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With contributions by:
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Mersa/Wadi Gawasis 2009-2010

Introduction

In December 2009-January 2010 the Archaeological Expedition of the University of Naples "l'Orientale" (UNO), Naples, and Italian Institute for Africa and Orient (IsIAO), Rome, in collaboration with Boston University (BU), Boston (USA) conducted the ninth field season at the site of Mersa/Wadi Gawasis, Red Sea, under the direction of Prof. Rodolfo Fattovich (UNO/IsIAO), and Prof. Kathryn A. Bard (BU). The team in the field included Italian, American, Egyptian, British, and German personnel with different areas of specialization (archaeology, nautical archaeology, epigraphy, geology, paleoethnobotany, topography).[1] Mr. Abdel Ghafar Abdelmoneim Mohamed represented the Supreme Council of Antiquities in the field, and greatly supported the work there.

The site is located 23 km to the south of the modern port of Safaga, on the top and along the slopes of a fossil coral terrace, to the west of which is the lower Wadi Gawasis (Figure 1).

Earlier excavations at the site along the western slope of the terrace provided good evidence of the use of Mersa/Wadi Gawasis as the pharaonic port for voyages to Punt in the Middle Kingdom and the early New Kingdom.

In 2009-2010 the fieldwork included geological and archaeological investigations, laser scanning of structures along the western wall of the coral terrace, and a conservation program.

Geological investigations were also conducted in the wadi bed and confirmed the hypothesis that ca. 4000 years ago the lower Wadi Gawasis was a large lagoon with an open channel to the sea.

Archaeological excavations were conducted along the western and southern slopes of the fossil coral terrace. Two areas were also investigated at the base of the western terrace slope. A 10 m x 4 m transect was excavated at the base of the southern slope of the terrace in the harbor area where only scattered 12th Dynasty potsherds were found, as well as some evidence of a burnt ship timber plank.

A new rock-cut chamber (Cave 8), 5.0 m x 4.8 m in area was found at top of the slope of the western terrace. An inscribed stela recording an expediton to Bia-Punt (the "Mine of Punt"), in Year 2 of the reign of Senusret II, was found outside the entrance to this chamber. The ceramics associated with this chamber and an outside living floor date to the early-mid 12th Dynasty.

At the base of the western slope, in an area below Cave 8, a dump area with ceramics dating to the 12th Dynasty and a Middle Kingdom activity area were recorded.

One test pit was also excavated inside Cave 2, which was discovered in 2004-2005, and confirmed that this gallery-cave was also used as a workshop for cleaning ship timbers.

Two huge blades of ship-rudder, ca. 4 m long, were also recorded ouside the entrance of Cave 6, which was discovered in 2006-2007.

Systematic mapping of the western wall of the coral terrace and Cave 8 was conducted with a laser scanner in order to generate a 3-D model of the area.

Conservation of several excavated ship timbers was also completed.

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[1] Members of the expedition were: Kathryn Bard, Rodolfo Fattovich, Andrea D'Andrea, Duncan FitzGerald, Rainer Gerisch, Christopher Hein, Giancarlo Iannone, Dixie Ledesma, Elsayed Mahfouz, Mohhamed Mustafa, Andrea Manzo, Pasquale Musella, John Wallace-Jones, Sally Wallace-Jones, Cheryl Ward, Howard Wellman, Stefano Tilia, and Chiara Zazzaro.

Coastal Geology

Christopher Hein and Duncan FitzGerald

Introduction

Previous geological field studies at Mersa/Wadi Gawasis (2006-2007; 2008) served to identify the existence of a paleo-lagoon at the site of Mersa/Wadi Gawasis, develop a mechanism for the filling of the paleo-lagoon, and stratigraphically approximate the chronological history of this paleo-lagoon (FitzGerald and Hein 2007, FitzGerald and Hein 2008). During these two previous field seasons: 1) a total of 39 auger and pulse auger cores was collected, primarily along the northern side of the wadi, adjacent to known occupation sites, 2) additional cores across the wadi served to further constrain the depth and geometry of the paleo-bay, 3) on-site malachological and foraminiferal analyses were performed on samples collected from core holes, providing information for paleo-environmental reconstructions, and 4) a site visit to the Roman/Islamic port of Quseir al-Qadim served as a comparative locale for studying the existence and closure of a paleo-lagoon used as an ancient harbor. Findings from these previous investigations include:

. A bay once existed in the area presently occupied by Wadi Gawasis.

. The occupation site is located south of the coralline cliffs containing the man-made caves, along the margin of the paleo-bay.

. A coralline/beach rock surface was mapped within the wadi sediments along the cliffs. This surface roughly parallels the cliff front and thins in a southerly direction.

. Cores across the paleo-lagoon determined that the lagoonal sediments extended at least 6 m below present mean sea level.

. The present wadi sediments are underlain by a very fine silty-sand containing both shell fragments and foraminiferal species associated with a brackish, warm to temperate shallow water, protected lagoon.

. A wave-cut notch and erosional terraces carved into Pleistocene coral bedrock at the modern mouth of the small embayment at Wadi Gawasis are located 1.5 m above modern mean sea level and are evidence of a possible higher stand of sea level in the past. This higher-than-present stand of sea level would provide for a lagoon deep enough at the time of occupation for the ancient Egyptian vessels to safely navigate.

. Quseir al-Qadim, a filled sabka similar to Wadi Gawasis, does indeed provide a comparison site in terms of straigraphy, sedimentology, and infilling history, though its archaeological history is of a much later period. The existence of this site does, however, support the idea that a Red Sea mid-Holocene highstand was wide-spread and the subsequent fall in sea level was, in combination with sediment delivery via wadi processes, a major driving process in the closure of these paleo-harbors.

Coastal geological studies were conducted at the Mersa/Wadi Gawasis archaeological site from 29 December, 2009 – 14 January, 2010. The purpose of this work was to address several questions:

1) What were the maximum dimensions of the paleo-lagoon?

2) What was the maximum depth of the paleo-lagoon?

3) What were the dimensions of the entrance channel? Was it wide and deep enough to permit access from the Red Sea to the harbor at the time of occupation? What controlled the dimensions of the paleo-channel opening?

4) Is there firm evidence of a mid-Holocene (~6 ka BP) highstand of sea level at Wadi Gawasis?

Geological Setting (see Fattovich and Bard 2007: 2-6)

Mersa/Wadi Gawasis is located 23 km south of the port of Safaga, at approximately 26°33'05" north, 34°02'08" east at the southern end of the Gulf of Suez. A small embayment exists at the present shoreline; a natural cut in the coral reef within this embayment produces deep water close to

shore. Sedimentological and geophysical studies were conducted along the western and southern slopes of a cliff located approximately 450 m from the present shoreline. This formation contains inter-bedded conglomerates, reef rock, and fossil coral and is overlain by fluvial sand and gravel. Reef rock capping the formation and its shallow eastward dip are evidence of a broad uplift, likely related to the cratonic rifting that began in the Eocene Epoch (54.5 ma – 33.7 ma) and accelerated during the Oligocene Epoch (33.7 – 23.8 ma; Sultan et al., 1993). Tectonic rifting split the Arabian–Nubian Shield and created the Red Sea. The Red Sea Basin is considered an active rift where seafloor spreading has occurred for the last 5 million years (Sultan et al. 1993). Occasionally during the Oligocene, the Bab el-Mandeb, which was a narrow strait between the Arabian Peninsula and African continent connecting the Red Sea to the Indian Ocean, closed. During closure, the Red Sea produced evaporite sequences, which are found throughout Wadi Gawasis and the surrounding region (Sultan et al. 1993).

Coastal Setting

Mersa/Wadi Gawasis is a microtidal coast having a mean tidal range of 0.25 to 0.5 m (Pugh 1996) with a spring tidal range of 0.5 to 0.6 m (Braithwaite 1987; Edwards 1987). Changes in wind regime produce a lower summer mean sea level (0.5 m) than in winter. The northern part of the Red Sea is dominated by northwest winds (the "shamal"), with velocities ranging between 7 and 12 km/hr (though empirically noted to be much stronger at times). The result of this northerly wind direction is that the fetch along the northern coast is limited. During summer months, persistent NW winds lower mean sea level and drive surface waters southward at velocities of 15-20 cm/sec. This current coupled with wave action is responsible for transporting sediment southward (Lindquist 1998).

Though located proximal to the tectonically active Red Sea rift system, the Egyptian Red Sea coast has experienced insignificant uplift or downwarping over the past several hundred millennia. Arvidson et al. (1994) radiometrically dated several coral terraces (6 and 8 m above MSL) along the Egyptian Red Sea to marine isotope stage (MIS) 5e, which is approximately 120 ka BP and a time when global sea levels are known to have been 6 to 8 m higher than present. Hoang and Taviani (1991) identified a fringing reef in southern Hurghada that dated to 150 ka BP. Finally, Plaziat et al. (1995) and Conchon et al. (2000) performed detailed studies on Pleistocene reef terraces at more than one dozen sites along much of the Red Sea coast; these sites included Sharm el-Naga (45 km north of Mersa/Wadi Gawasis) and Quseir al-Qadim (50 km south of Mersa/Wadi Gawasis). Of these locations, those authors found MIS 5e terraces 6 to 10 m above present MSL in all locations except at Gebel Zeit and Gebel Abu Shaar where MIS 5e terraces were found nearly 20 m above present MSL. These two sites are located in the very southern Gulf of Suez on a documented tilted and uplifted Zeit fault block (Plaziat et al. 1995). However, in general, these data constitute ample evidence that much of the Red Sea coast, including the region of Mersa/Wadi Gawasis, were not very active during the past 150,000 years. Furthermore, over the time period of the Holocene, there is no documented evidence of uplift and the coast can be considered tectonically stable.

Climatic Setting

The Red Sea is located between the Mediterranean and Afro-Southwest Asian monsoonal rainfall regimes. Though south of about 19°N (the northerly-most summertime extension of the Intertropical Convergence Zone, ITCZ) the rainfall regime is dominated by the Indian monsoon (Arz et al. 2006), the region of Mersa/Wadi Gawasis receives its rainfall predominantly from southeastward traveling cyclones originating in the southeast Mediterranean. Rainfall dominantly occurs in January and February, with mean (1925 – 1990) annual totals generally around 5 mm (Nicholson 2000), but occasionally as high as 10 to 25 mm/yr. However, at approximately 200 cm/yr, evaporation far exceeds precipitation (Arz et al. 2006).

The climate of the Mersa/Wadi Gawasis region of the Egyptian Red Sea coast has seen drastic climatic shifts during the Holocene. Following the end of the last ice age changes in orbital parameters (axial tilt and precession) forced a considerable amplification in the seasonal cycle of solar radiation (Berger 1978), amplifying the land-ocean temperature gradient and resulting in a strengthening and northward shift of the Indian monsoonal belt by as much as 700 km (Hoelzmann et al. 2000). The steep African precipitation gradient (from 100 to 440 mm/yr between 12° and 17° N latitude) was displaced 4-5° northward, resulting in greatly enhanced precipitation in the northern Red Sea coast of Egypt. By 9000 yrs BP these conditions had initiated a wet phase in northeast Africa's climate ("Green Sahara"), known as the African Humid Period (deMenocal et al. 2000; Arz et al. 2003), or, in the Sahara, the mid-Holocene Pluvial Phase (Hoelzmann et al. 2000), coinciding with the global warm period known as the Holocene Climatic Optimum. After reaching a maximum between 8000 and 5000 yrs BP, moisture reservoirs in northern Africa began a gradual drying phase (Damnati 2000). This was due to the gradual changing of orbital parameters, the warming of oceanic regions open to the Arctic, and generally reduced coastal upwelling (Geb 2000) coupled with vegetation – albedo and surface ocean temperature – moisture transport feedbacks (deMenocal et al. 2000). Following a pronounced dry event at 4.2 kya BP (Arz et al. 2006), the past 4000 years followed a generally drying trend marked by a series of transitions between relatively wetter and drier conditions (Issar 2003). These variations in sea level are crucial to our understanding of environmental conditions at Mersa/Wadi Gawasis during the Holocene. Particularly, during the time of occupation, this region experienced wetter conditions than today, but the warmer, wetter conditions of the mid-Holocene had long ended. Freshwater inputs from the wadi were likely of greater frequency and magnitude. Furthermore, additional precipitation would likely have served as a potential fresh water source for vegetation and human inhabitants of the site. Finally, as discussed below, the frequent freshwater inputs from the wadi during the late sea level transgression, highstand, and regression likely contributed substantially to the infilling of the paleo-bay.

Sea Level Variations

Raised Pleistocene (MIS 9, 7, & 5e) terraces are abundant throughout the Egyptian Red Sea coast and have been used to document the relative tectonic stability of the coast during the past 150,000 years (see discussion above). Therefore, it can be safely assumed that Holocene shoreline features in the Red Sea are evidence of past sea-level variations, and not tectonic activity.

A mid-Holocene highstand along equatorial and south hemisphere coastlines is well documented in the literature. It is suggested that this was caused by isostatically-induced equatorial siphoning of waters from far field oceans to coastal regions that underwent glaciation during the last ice age (i.e., Mitrovica and Milne 2002; Peltier 2002; Milne et al. 2005; Lambeck et al. 2003). Peltier (2002) cites a number of middle latitude northern hemisphere Pacific Ocean islands that also show evidence of this highstand.

Regionally, Lambeck et al. (2003) provide geological evidence supplemented with a rheological model for a similar highstand in the nearby Persian Gulf at the time of occupation of Mersa/Wadi Gawasis (4 kya). Taylor and Illing (1969) identified strandlines in Qatar 1.5 - 2.5 m above present MSL that date to 3930 to 4340 yrs BP; Al-Asfour (1982) documents excursions in Kuwait Bay in the northern Persian Gulf of anywhere from 5 to 15 m between 3560 and 4570 BP. However, the Persian Gulf represents a very different tectonic regime due to its active and diverse tectonic nature. Therefore, despite its proximity to the Red Sea, sea level in the Persian Gulf cannot be used as a direct proxy for sea level in the Red Sea.

Locally, along the Red Sea coast itself, no detailed Holocene sea level curve exists (Blue 2007). A poorly constrained sea level curve for the northern Red Sea is based on d18O foraminifera records from a sediment core taken south of the Sinai Peninsula (Figure 2; Siddall et al. 2003). The curve suggests several relative sea level excursions on the order of 10 m during the past 10 kya. However, little confidence is placed on the details of this curve due to the large error bars. The curve indicates that sea level has been rising slowly during the past 4 ka. However, Siddall (per.

comm. 2008) has suggested that a small (1 – 4 m) positive mid-Holocene sea level excursion could have existed in the Red Sea and fit within the uncertainties of his sea level curve.

Yet, despite the lack of a detailed sea level curve, there is ample documented evidence of a higher than present stand of sea level in the Red Sea during the mid-Holocene (Figure 3). These locales include two other important archaeological sites, Myos Hormos/Quseir al-Qadim (Blue 2007; Plaziat et al. 1995) and Berenike, Foul Bay (Harrell 1996, 1998). The most relevant of these highstand features are those identified just south of Hamata and at Wadi Gemal, both between 0.5 and 1.0 m above present MSL and radiocarbon dated at 6410 +/- 84 BP and 7670 +/- 206 BP, respectively (Plaziat et al. 1995). Locally, there is also evidence of a mid-Holocene highstand at Mersa/Wadi Gawasis itself, first identified during the 2007-2008 field season, and further investigated during the 2009-2010 field season. At the present mouth of Wadi Gawasis, several wave-cut notches have been identified; to the south of the wadi mouth, a 3 m wide erosional terrace exists. Investigation of these features reveals that their surfaces have not been exposed for 120,000 years (MIS 5e, the previously recorded sea level highstand for the region), but are rather much younger, suggesting a possible mid-Holocene age. Total station surveys (17 points; per. comm. S. Tilia), calibrated to tide charts, have placed the centerline of the notches at approximately 0.9 m above and the mean terrace surface 1.1 m above modern MSL, thereby confirming these erosional features approximately 1 m above present MSL.

In addition to these shoreline features, stratigraphic evidence from the wadi itself suggests a higher than present sea level at the time of occupation (see below for detailed stratigraphic descriptions). Finally, in cooperation with Dr. Glenn Milne of the University of Ottawa (Ottawa, ON, Canada), coupled ice / earth (viscosity) rheological models were run for the site of Mersa/Wadi Gawasis based on the "Sea Level Equation" (Milne et al. 2005; Lambeck et al. 2003); Mitrovica and Milne 2002). A number of model runs each varied several terms in the equation (the lithospheric thickness, LT; upper mantle viscosity, UMV; and lower mantle viscosity, LMV, of the Earth) to produce a modeled sea-level curve calibrated both to observational data along the Red Sea Coast (Plaziat et al. 1995) and documented Holocene sealevel variations in China and Thailand. All results of this modeling effort produced sea-level curves for the region that contained a highstand of sea level between 0.5 and 1.25 m above present MSL. The bestfit model (Figure 4) predicts a highstand of 1.0 m at 5 ky BP (G. Milne per. comm.). Together, these data provide clear evidence for a mid-Holocene eustatic highstand of approximately 1 m higher than present. If, as is likely, sea levels remained higher than present during the time of occupation, this discovery suggests that the water depth in the ancient Egyptian harbor may have been as much as 1 m deeper than previously thought.

Data Collection

During the 2009-2010 field season, a variety of methods were employed to address the questions described in the Introduction; these included auger cores, wash bores, and topographic and geomorphic surveys. To complement the 39 auger and pulse auger cores collected during 2006-2007 and 2007-2008 field seasons, an additional 44 auger cores were collected throughout the study area, for a total of 83 auger and pulse auger cores comprising 21 predetermined transects across the wadi (Figure 5). Cores ranged in depths from three to six meters. These transects were focused along the northern wall of the wadi, near occupation sites. Each transect was generally two to four cores long, with several longer transects that ran southward across the entire wadi. Additionally, an east-west transect (T-11) served to investigate changes in the wadi stratigraphy in a seaward direction and a transect to the south (T1-9) served to investigate the extent of the paleo-bay in a southerly direction. Finally, a transect of auger cores across the hypothesized opening to the paleo-bay (T-18) served to supplement deep wash borings across that same channel. All cores were topographically surveyed (S. Tilia per. comm.) and their elevations adjusted to present MSL.

A series of four deep (7 – 16 m) cores (wash borings) were collected throughout the study area to determine: (1) the maximum dimensions and nature of the opening to the paleo-bay, and (2)

the maximum depth of the paleo-bay. Three of these cores were placed along T-18; the fourth, the deepest, was collected in the southwest corner of the main wadi body, adjacent to the western (southward) road to study the maximum depth of the paleo-bay.

As described above (see Sea Level Variations), topographic and geomorphic surveys of wave-cut notches and erosional terraces along the coast and entrance to Wadi Gawasis were performed to further elucidate the possibility and nature of a mid-Holocene sea-level highstand that would have created a deeper lagoon at Mersa/Wadi Gawasis. Finally, visual geomorphic surveys of the coastal and upstream portions of both Wadi Gawasis and nearby Wadi Gasus were used to study wadi sediment transport processes and likely scenarios for the formation of upstream terraces during the Pleistocene.

Results

All cores were stratigraphically logged on site, with particular attention paid to fining upward sequences (Figure 7a; interpreted as event markers) and shell fragment abundances. These descriptions were used to divide core sections into a series of sedimentological facies based on environments of deposition. These facies included the following:

. Wadi: ubiquitious sediment (upper-most unit across all cores) composed of gravel, sand, silt, and multiple fining upward sequences; thickness is 2.5 – 4 m; thicker along the western and southern margins of the paleo-bay

. Tidal Flat: mottled clay, silt, and very fine sand with rootlets and multiple oxidized layers (Figure 7b); rootlets identified (R. Gerisch per. comm.) as Avicennia marina, i.e., mangrove; represent protected, quiet water environments

. Lagoon: subdivided into upper, middle, lower, and basal facies; composed of medium-fine silty sand to fine sandy silt; contains limited to abundant shells and shell fragments of various species (dominated by small, thin-walled bivalves); often capped by shell-rich shoreface sediment in more exposed regions where tidal flat sediments not found

. Coralline Bedrock / Beachrock: so-called “impenetrable surface” from previous field studies; hard, coral and shell surface found between -0.5 and +1 m of modern MSL

. Inlet Fill: shell hash-rich medium to coarse sand found only in T-18, in paleo-bay channel AB

A series of three deep wash borings supplemented nine auger cores collected along T-18, across the entrance to the paleo-bay. The three deep cores reached 8, 10, and 7 m, respectively. The 10 and 7 m cores bottomed in an impenetrable bedrock surface as did a number of the much shallower auger cores, providing for a well-controlled estimate of the dimensions of the channel (Figure 8). The bedrock at the base of the channel is smoothed (erosional upper surface) conglomerate. This is overlain by 4 - 6 m of lagoonal sediments, followed by an additional 4 - 6 m of shell hash-rich inlet fill sediments. The entire channel sequence is then topped by approximately 1 m of wadi sediments / anothropogenic fill.

Deep wash boring core T21-A1 penetrated 16 m in fine sands with ubiquitous (if occasionally rare) shell fragments. This result suggests that the lagoon may have once been quite deep, though it is more likely that as sea level rose the wadi infilled the lagoon relatively rapidly, limiting the maximum possible depth of the lagoon to much less than 16 m.

Discussion

The 2009-2010 field season at Mersa/Wadi Gawasis provided for the opportunity to accomplish all goals which were set out. An integrated discussion of the results from this field season is given below, with reference to information provided specifically by the 2009-2010 field season and the questions posed in the Introduction. For a discussion of evidence for the paleo-bay at Mersa/Wadi Gawasis as determined from previous field seasons, see FitzGerald and Hein (2007) and FitzGerald and Hein (2008). An integrated discussion from all coastal geological studies at this site will be presented in an upcoming article (Hein et al. Forthcoming).

Dimensions of Paleo-Bay and Entrance Channel

The paleo-bay at Mersa/Wadi Gawasis existed concurrently with the occupation of the site (FitzGerald and Hein 2007). A series of 88 cores has served to assist in the mapping of the extent of this bay. All but two of these cores penetrated into lagoonal sediments; the final two cores, both located in the northwest corner of the study area, each penetrated several meters below modern MSL, but no coralline rock or lagoonal, tidal flat, or shoreface sediments were identified from these cores. This suggests that these cores were collected in locations beyond the maximum extent of the bay. Furthermore, a thickening wedge of wadi sediments was discovered at the far western and southern extremities of the coring transects. In the two western-most cores on T-11 (Figures 10, 11; east-west transect), it is believed that the lagoonal sediments were fully penetrated, and basal wadi sediments identified. However, these data are in contrast to the deep core T21-A1 from which lagoonal sediments were identified 15 m below modern MSL. It is therefore suggested that the basal wadi sediments identified in T-11 result from a major flood event that delivered an extraordinary amount of sediment to the system; alternatively, due to the nature of the wash boring system employed for the deep core, the shell hash identified from further up in the section is not in situ, but was rather washed down from a shallower unit. Further investigation is required. Unfortunately, the exact maximum depth of the paleo-bay could not be identified; however, it is very likely that the bay never reached this depth. Rather, as sea levels rose in the early Holocene, a deep basin was flooded with water. Yet, continued sediment input from Wadi Gawasis likely infilled this bay as rising sea levels produced additional accommodation. The west- and south- ward thickening wedge of wadi sediments seen in cores suggests that the bay reached its maximum size prior to the highstand of sea level; input of wadi sediments forced the infilling of the extremities of this bay before it could reach its maximum size.

Based on the evidence described above, a map of the paleo-bay at Mersa / Wadi Gawasis has been constructed (Figure 9). The maximum possible dimensions of this bay is approximately 450,000 m², though as noted above, it likely never reached this size, but was likely close. Given a mean tidal range of 0.50 m, this suggests that the tidal prism (the volume of water filling or draining a bay during half a tidal cycle) was a maximum of 225,000 m³. O'Brien (1931) developed an empirical relationship between the tidal prism filling and draining a bay and the cross-sectional area of that bay's inlet channel. This relationship suggests that the paleo-bay at Mersa/Wadi Gawasis requires an inlet channel cross-sectional area of 32 m². By comparison, the channel identified at the mouth of Wadi Gawasis (Figure 8) has a cross-sectional area of 1300 m², nearly two orders of magnitude larger than required by O'Brien's relationship. Therefore, the channel, though narrow and deep, was never fully excavated to its maximum dimensions and, in the early stages, likely filled with lagoonal sediment simultaneously with the paleo-bay.

Infilling of the Paleo-bay and Closure of the Harbor of *Saww*

One of the major conclusions from the 2009-2010 field season at Mersa/Wadi Gawasis is that the paleobay that existed during the time of occupation closed as a result of two processes: falling sea level and wadi infilling. As discussed in the section Sea Level Variations, sea level along much of the Egyptian Red Sea Coast reached a maximum during the mid-Holocene, likely around 6000 yrs BP. This higher stand of sea level would not only have provided for a deeper bay to be used as a harbor, but would also have extended the boundaries of the paleo-bay, covering a considerable more area than had sea level been 1 - 2 m lower than present at that time. Conversely, falling sea levels between 5000 yrs BP and 2000 yrs BP were directly responsible for the contraction and eventual closure of the paleo-bay at Mersa/Wadi Gawasis.

As mentioned above, the paleo-bay at Mersa/Wadi Gawasis likely never reached its maximum dimensions due to the persistence of sediment inputs from the nearby wadi systems. In fact, various lines of evidence suggest that sediment delivery from nearby wadi systems was the dominant factor in the closure of the paleo-bay. Two core transects were collected that ran from the central region of the paleo-bay out toward the wadi-ward extremities. T-11 is oriented east-west; the

distal-most cores along this transect were collected at the western edge of the paleo-bay, heading into the primary channel of Wadi Gawasis. T-19 is oriented north-south; the distal-most cores along this transect were collected at the southern edge of the paleo-bay, heading up the smaller, secondary channel of Wadi Gawasis, which continues some distance to the southwest (Figure 10). These two transects show several very similar features: First, wadi and lagoonal sediments coarsen landward. Secondly, lagoonal sediments are more often interspersed with wadi sediments in a landward direction. Finally, wadi sequences thicken up-wadi from < 1 m near the center of the paleo-bay to > 2.5 m in the most distal cores. Notably in T-19, wadi sediments tend to overly tidal flat sediments; the depth of these tidal flat sediments increases in a landward direction. This indicates a dominance of sediment input in the evolution of this paleo-bay; even during sea-level rise, wadi inputs dominated the system and drove a shoreline regression, prior to the forced regression forced later by sea-level fall.

Paleo-climatic records can be used to explain these trends. The enhanced precipitation patterns of the mid-Holocene African Humid Period (see Climatic Setting above) would have delivered significantly more rainfall to the Wadi Gawasis watershed, thereby creating more frequent and larger flood events. These events, evidenced in the fining upward sequences of the wadi facies, delivered large quantities of sediment to the paleo-bay. Though some of this sediment was delivered directly into the bay to create the lagoonal facies, the coarser sediments were reworked along shore by the action of the fetch-limited waves of the paleo-bay. These sediments formed the shoreface and upper lagoonal sequences. Protected regions with limited wadi inputs received only the finest sediments, allowing for the formation of mangrove-rich tidal flats. Over time the paleo-bay closed due to the eustatic fall in sea level combined with wadi sediment input; however, simultaneous, the climate was becoming more arid, reducing the wadi sediment source, resulting in a thinning wadi sequence in a seaward direction. These combined forcings eventually closed the paleo-bay, leaving only the small embayment found today at Mersa/Wadi Gawasis.

Archaeology

Kathryn A. Bard, Rodolfo Fattovich, Dixie Ledesma, Andrea Manzo, Tracy Spurrier, Cheryl Ward and Chiara Zazzaro

Archaeological excavations were conducted along the western and southern slopes of the fossil coral terrace, and a test excavation was conducted in Cave 2. Two areas were also investigated at the base of the western terrace slope. A 10 m x 4 m transect was excavated at the base of the southern terrace slope in the harbor area.

Harbor Area

R. Fattovich, D. Ledesma

Three excavation trenches (WG 63, WG 66, WG 50) were opened at the base of the southern slope of the coral terrace in the harbour beach ("harbor area") of Wadi Gawasis.

WG 63/66[2]

Excavation Units WG 63 and WG 66 were delimited in the western sector of the "harbor area" between the southern slope of the coral terrace and the wadi bed to the south of WG 15 (2003-2004) and WG 18 (2003-2004) (see Bard and Fattovich 2007: 51-53).

WG 63 was a transect 10 m x 4 m in area; only 6 squares of this transect were excavated (D3, D4, D5, E3, E4, E5). Two stratigraphic units were recorded in this transect. The upper stratum (SU1) consisted of light windblown sand alternating with layers of gravel from recent wadi activity.

[2] Excavation was conducted by R. Fattovich and D. Ledesma.

Most of SU1 was sterile. Below a salt layer, ca. 30-50 cm thick, a stratum of dark, compact wet sand (SU2) was found. A much greater quantity of pottery was found in the salt layer and in SU2 than in SU1.

Excavations were suspended in SU2 due to the presence of red/orange streaks, which are the residue of ancient mangrove roots. These red/orange streaks occurred within the entire excavation unit. SU2 contained numerous ceramic sherds, large storage jars and the remains of large animal (donkey) bones. Within Squares D4, E4, D3, and E3 several layers of pebbles were interspersed between the layers of large storage jar fragments and bones.

The Stratigraphic Units were:

SU1: superficial stratum of sand (topsoil), with evidence of animal (donkey) bones and one mud-brick at the interface SU1/SU2 (stratum of dark red sand) in D4-E4, and a concentration of pebbles and potsherds in E4 NE.

SU2: dark red sand with evidence of ceramics on top of SU2 in D3 and concentrations of pebbles, along a SW-NW axis (path?); many scattered, horizontal fragments of jars; and three lower jaw bones of donkeys over the entire surface at the interface SU1/SU2 in D2, D3, E2, E3.

WG 66 was a transect, 10 m x 4 m in area, immediately to the south of WG 63. This excavation unit was opened to investigate the possible occurrence of a feature tentatively identified by Armando De Guio, University of Padua (Italy), on a satellite image of the site. Eight squares, 2 m x 2 m in area, were excavated (D1, D2, D3, D5, E1, E2, E3, E5). Excavations in this area, however, did not uncover the remains of any structure. Excavations were conducted in Squares D1, E1, D2, E2, D3, E3, D5 and E5.

Three stratigraphic units were recorded in this transect. The top strata (SU1) consisted of light windblown sand alternating with layers of gravel from wadi activity. A salt layer, ca. 20-30 cm thick, was recorded below SU1. Below the salt layer, a stratum of dark, compact wet sand (SU2) was recorded. Artifacts occurred mainly between the salt layer and SU2. They included pottery, large storage jars and the remains of animal (donkey) bones (Figure 12). Small pieces of copper were also found in SU2 Squares D5, E5, D3 and D3.

In order to further investigate the possibility of a feature within this transect, remains of large storage jars and animal bones were collected from D2 and E2 and excavation continued down approximately 5–10 cm below SU2. This stratum (SU3) consisted of a layer with a few small potsherds and pebbles.

The Stratigraphic Units were:

SU1: sterile, superficial stratum of sand, ca. 40 cm thick in D1-E1, and ca. 80-100 cm thick in D2, E2, above a salt crust. Very few potsherds at a depth of ca. 75 cm in D5-E5.

SU2: dark compact sand beneath the salt crust, with evidence of mangrove roots and scattered horizontal potsherds (as in WG 63, SU2). This SU was excavated through layers 5 cm thick in D1-E1, with some evidence of charcoal in D1. At the base of SU2, ca. 75 cm in depth, fragments of jars, a small concentration of pebbles and 1 animal bone were found in D3-E3.

SU3: stratum of compact red sand with a level of ceramics (horizontally laid fragments of jars) and evidence of mangrove roots.[3]

At the base of SU3 the red sand was mixed with pebbles (the lagoon shore) and very few potsherds.

WG 50[4]

[3] Interface SU2/SU3 – elevations from datum (144 cm), NW to SE: 1. 360 cm (- 2.16 m) / 2. 363 cm (- 2.19 m) / 3. 358 cm (- 2.14 m) / 4. 359 cm (- 2.15 m) / 5. 363 cm (- 2.19 m) / 6. 361 cm (- 2.17 m) / 7. 359 cm (- 2.15 m) / 8. 367 cm (- 2.23 m) / 9. 358 cm (- 2.14 m) / 10. 366 cm (- 2.22 m) / 11. 367 cm (- 2.23 m) / 12. 358 cm (- 2.14 m).

[4] Excavation was conducted by R. Fattovich. The excavation unit was delimited in 2007-2008.

This trench, 10 m x 4 m in area, was excavated immediately to the east of WG 48/49 in order to test the possible extension of the camp area and concentration of jars, which were identified in 2007-2008, into the central area of the harbor area beach.

The Stratigraphic Units were:

SU1: superficial, sterile stratum of sand, ca. 50-60 cm thick, with evidence of thin layers of sediments in the upper deposit from a small wadi draining from the coral terrace.

SU2: lower stratum of compact sand over a salt crust ca. 20 cm thick.

SU3: dark red compact sand beneath the salt crust, with a few ceramics and a large, burnt ship timber at the base (Figure 13).[5]

Western Terrace Slope

K. A. Bard, A. Manzo, D. Ledesma,T. Spurrier, Cheryl Ward, Chiara Zazzaro

WG 61/65[6]

T. Spurrier, K. A. Bard, D. Ledesma

WG 61/65 is located on the western slope of the coral terrace northwest of Cave 1 (Figure 14). This area was chosen in order to locate an additional man-made cave. In previous field seasons, potsherds and lithic debris were observed scattered on the slope below this area – indicative of occupation. There was also an unnatural, flat terrace in the middle of the slope. WG 61 and WG 65 were oriented along a north-south axis and each consisted of a 10 m x 10 m trench, which was divided into 25 2 m x 2 m squares.

Potsherds, lithics, and wood pieces were collected from the slope surface for analysis. As the surface layer began to be removed, it was determined that a very large piece of coral terrace, which had previously fallen, was unstable and was partly held up by the sand. Thus, it was a danger to the excavators and work in Squares A1-A2-A3-A4-A5 was abandoned. Work was concentrated there in the 4-6 meters extending from the coral terrace wall in order to focus on locating the cave entrance (Squares B2-B3, C1-C2-C3, D1-D2-D3, and E1-E2-E3). The surface layer of WG 61 (SU1) was very thick and consisted of colluvium with very few cultural remains. There were a handful of potsherds that had fallen down the slope from the top of the terrace.

At approximately 1.5 m below the top of the colluvium layer, after removing more than 24 sq. m of sand, the top edge of the entrance to Cave 8 along the coral terrace wall, in Squares D and E, was located. The opening in the coral terrace was square, indicating that it had been worked by humans, and measured approximately 1.2 m across (Figure 15). Continued excavation in SU2 (below the colluvium) revealed the top of the remains of a mud-brick wall. The mud-brick wall began near the wall of coral terrace and extended downslope, where it formed a right angle running parallel to the terrace wall. There were also many collapsed mud-bricks in association with the wall, which was only preserved 2-3 courses high (Figure 16). The base of the mud-brick wall was not far below the top of the cave entrance, indicating a period of use much later than that of Cave 8. It is probable that the entrance to the cave was not known or used when the mud-brick structure was built.

The top of an unfinished limestone anchor was uncovered adjacent to the Cave 8 entrance, placed perpendicular to the terrace wall. There was mud residue on the top and sides of the anchor and terrace wall, which could be the remains of mud plaster used to seal the entrance. The mud still had impressions of human fingerprints in it. Mud plaster also continued to the bottom of the anchor. The entrances to other man-made caves at Wadi Gawasis were also marked by stone anchors and this one could have been used as a door at some point (Figure 17).

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[5] Elevations of the surface with timber and ceramics from datum (137 cm): 1. 284 (- 1.47 m) / 2. 287 (- 1.5 m) / 3. 280 (- 1.43 m) / 4. 285 (- 1.48 m). Upper surface of the timber: 288 cm (- 1.51 m).

[6] Excavation was conducted by T. Spurrier, K. A. Bard, A. Manzo and D. Ledesma.

As excavations continued, a new 10 m x 10 m trench, WG 65, was opened adjacent to WG 61 in order to be able to view the entire occupation area in front of Cave 8. As the surface layer of colluvium was removed, it began to fall into WG 61, exposing a limestone block in the balk of WG 61, E3 and WG 65, A3. This turned out to be a stela lying face down, with its rounded top lying downward toward the bottom of the slope as if it had slid down from above. The stela measured 72 cm x 10 cm x 46.5 cm and its hieroglyphic inscription was well preserved.[7] Nearby, in the balk of WG 61, E and WG 65, A, on the border of Squares 2 and 3, was a carved, oblong stone ca. 60 cm x 23 cm x 13 cm. The function of this stone is unclear, but it had been worked into its round shape.

There was a small timber in WG 65, B2, SU2 in association with many mud-bricks and large potsherds. These mud-bricks turned out to be another wall of the structure found in WG 61. This wall runs perpendicular to the coral terrace wall and parallel to the first wall, creating a small room. Like the first wall, there were also many collapsed mud-bricks next to this one. Also, two round post-holes in the coral terrace wall above the cave were noted. These post-holes could have been used to support roof beams, although it is not known whether such a roof would have been contemporaneous with Cave 8, or with the mud-brick structure. There was at least one part of the mud-brick wall that had an additional outlier of mud-brick, which could indicate a base where a post may have been placed. It was decided to continue excavating only inside the structure in order to find the living floor(s) associated with it.

Two parallel ash deposits were discovered to either side of the entrance to Cave 8, on top of SU19 in WG 61, D2-E2. It was probably easier to start fires in this area next to the terrace wall, which was sheltered from the wind. Near the threshold of the cave entrance, three broad, flat timbers (T82, T83, T84) were found lying next to each other (Figure 15). There were also remains of mud-bricks on top of the timbers (from the mud-brick structure?). The nautical archaeologist noted plaster and small potsherds on the bottom side of T82, which suggests that the timbers were not used as a ramp leading into the cave, as found at the entrance to two other caves at the site, but were used as roof beams that later fell during a period of abandonment. The northern border of the timbers lines up with the northern horizontal post-hole in the coral terrace wall and the timbers were found slightly overlapping. The mud-brick on top of the timbers were probably from a roof structure above the Cave 8 entrance, which collapsed before the walled structure was built.

Underneath the timbers, there was a thin layer of leaves and twigs. There was also a layer of leaves and twigs underneath the mud-brick walls of the structure. These layers of leaves and twigs were not created by natural phenomena, such as wind or water, and were laid down on purpose to create a more stable surface to build the mud-brick structure and to add stability to the floor of the occupation areas.

At the base of the cave entrance, there was an 85 cm x 90 cm slab (or mud-bricks incrusted with salt). This slab created a type of threshold at the entrance, which was also incrusted with salt. At first, it was thought Cave 8 was still sealed with mud-bricks, but this turned out to be a salt layer, 0.5-1.0 cm thick, that had formed on top of aeolian sand in the entranceway. Inside the entrance to Cave 8, there was a large sand dune that had accumulated over many years, indicating that the sealed entrance to the cave had been breached for a long time. There were also large pieces of collapsed rock from the ceiling just inside the entrance. Upon entering the cave, no artifacts were immediately visible though there were linear depressions in the sand leading to the corners of the cave, and rodent bones and botanical remains. Supports were built to strengthen the doorway and the weaker areas of the ceiling inside the cave so that excavations could continue with a new trench, WG 67.[8]

Outside of the cave, once the stratum of sediment inside the structure was excavated below the bottom of the mud-brick walls, it was decided to continue excavating outside of the structure on all sides down to the same level as in the interior, at which point the structure could be removed. In WG 65, B2, B3 on the south outside the structure (SU20), there were the remains of a highly

[7] See epigraphic report of Stela 29 by E. Mahfouz below.
[8] Excavation of WG 67 inside Cave 8 was conducted by A. Manzo.

deteriorated limestone block with a hole in it, which may have at one time been a stone anchor. In this square, there was also a well preserved wood plank, T96, directly under a fire-pit. Once the walls of the mud-brick structure were removed, excavation continued into the sediment stratum contemporary with the entrance to the cave (SU45). In some areas, the sand was relatively shallow and the coral terrace was reached relatively quickly, whereas in other areas there was still a deep deposit of sand. It appears that the terrace here had been worked to create a type of walkway into the cave. In this layer, two wooden posts were exposed outside of the cave entrance in WG 61, D3. The sand stratum the posts were in, on top of the coral terrace floor, was sterile and had no cultural remain and excavations were discontinued.

While excavations were going on outside of the cave, it was also decided to excavate in the area to the south of the structure in WG 65, C-D-E. At the bottom of SU1 (the colluvium layer) the remains of mud-bricks were found. These could be contemporary with the mud-brick structure in WG 61 and WG 65, A-B. There were also many hearths and fire pits on and around the mud-bricks, some of which were burnt. The bricks were irregular in size and shape, and in some areas they had been placed into circles or half circles. One fire pit had the remains of thousands of burnt barley seeds (Figure 18), and it was decided to stop excavations in WG 65, C-D-E in order to preserve the remains for the paleoethnobotanist to examine in a future field season.

There were many other artifacts of interest throughout most of the sediment strata in WG61/65. SU19, the layer of sand within the mud-brick structure (Structure 1), contained the debris from the end of an expedition: copper strips ca. 2 cm wide, a blackened linen bag with a small square clay sealing still attached to it, fragments of plastered cargo boxes, impressed clay sealings, many pieces of small rope (probably made into matting or possibly a rope bag), wooden pegs, a lump of resinous material (wax?), and many potsherds, mainly from storage jars.

Also excavated in strata just outside the cave entrance were an obsidian bladelet; pieces of linen; pieces of small, thin rope; fragments of matting; many broken clay sealings and raw clay for sealings. A scarab seal was found in association with the sealings in one of the lowest levels. There was also a small piece of a wooden furniture leg found in this area, which could have been part of a (scribe's?) stool. Pieces of papyri with black hieratic letters painted on them and a few ostraca were also found. This evidence suggests that economic activities were concentrated in the area outside of Cave 8.

A fish jaw bone was found with a string tied around the posterior end. It is unclear what the purpose of this was (a kind of amulet?), though it looked as if the string had been tied around the bone after it had been de-fleshed and thus it is doubtful this was a way of drying the fish. In WG 65, A2-A3, B2-B3 (SU2), there was a large piece of basalt rock ca. 41 cm x 15 cm in area, which was probably not naturally deposited from the wadi. Near the southeast corner of the structure in WG 65, B2, there was a badly deteriorated wooden mallet, which the conservator removed.

The pottery assemblage dates mostly to the early 12th Dynasty and, according to the ceramicist, there was an abundance of domestic pottery vessels. In WG 61, B2, there was a large fire-pit with at least 10 pieces of a broken bread mold, which were near the remains of a platter. In association with this type of pottery in WG 61/65 there was also a large wooden spoon and wooden vessel stoppers, as well as a decorated wooden jar lid with a flower carved on the top. A jar lid(?) made of reeds was also excavated here. Sherds of incised, Middle Nubian pottery were also excavated outside Cave 8.

There were many fire-pits and hearths of various sizes throughout all strata in WG 61/65: 24 in total were excavated this field season. The fire-pits appear to be independent of one another. In WG 65, A3, a large fragment of a carved stone artifact that had probably been used as a pedestal for turning/making ceramic pots was found. The walls and bottom of this artifact were very thick, with a depression in the center on which the pivot would have fitted. Along the bottom rim of the stone

artifact, there was a smaller depression/track ca. 1 cm wide. This artifact had evidence of burning, mainly within the central (pivot) depression, but also along the broken edges.[9]

The Stratigraphic Units were:

SU1: sediment stratum (in WG 61/65). Surface layer consisted of alternating layers of colluvium (large-grain aeolian sand, large pebbles, rocks of coral terrace) with some leaves. There was a handful of potsherds and wood fragments, which probably fell down the slope from the top of the terrace.

SU2: sediment stratum (in WG 61/65). This layer began at the top of the Cave 8 entrance and consisted of aeolian sand with many mud-brick fragments, potsherds and wood fragments. This layer also coincided with the top of the remains of a mud-brick wall structure.

SU3: sediment stratum. Inside the northern and western mud-brick walls of the structure, in approximately WG 61, D2-3, E2-3, excavating downward in order to reach the floor of the structure. This layer consisted of more compact, finer sand with leaves and wood fragments.

SU4: Feature/Structure 1, a mud-brick wall.

SU5: feature, Stela 29.

SU6: feature, an unfinished anchor used at part of entranceway to Cave 8.

SU7: sediment stratum, entrance area to Cave 8, south of anchor, in WG 61, E1-2

SU8: feature, Fire-pit 1. Hearth in the balk of WG 61, E.

SU9: sediment stratum, salt layer in WG 61, B2-3,C2-3.

SU10: sediment stratum of medium/fine sand below SU9 (salt layer), in WG 61 B2-3, C2-3. This layer contained many fire pits/hearths.

SU11: feature, Fire-pit 2. Hearth in WG 61, C2, SU10.

SU12: feature, Fire-pit 3. Hearth in WG 61, B2, SU10.

SU13: feature, Fire-pit 4. Hearth in WG 61, B3, SU10.

SU14: feature, Fire-pit 5. Fire-pit with large burnt pot sherds, in WG 61, D4, SU10.

SU15: feature, Fire-pit 6. This was a fairly large fire-pit, with an abundance of ash on and around the top and northwest sides of the anchor up against the coral terrace wall, in WG 61, D2.

SU16: feature, southern part of Structure 1, the mud-brick wall in WG 65, A2.

SU17: feature, small timber (T29) in WG 65, B2.

SU18: feature, Fire-pit 7, under stela in WG 61, E3.

SU19: sediment stratum located inside Structure 1, in WG 61, D2-3, E2-3, and WG 65, A2-3, B2-3, living floor layers. Medium/fine grain sand with deposits of leaves. This SU contained much debris from the end of an expedition.

SU20: sediment stratum of medium/fine sand in area outside of Structure 1, to the south in WG 65, B2-3.

SU21: sediment stratum of medium/fine sand in area outside of Structure 1, to the north in WG 61, D3-4.

SU22: feature, 3 large, flat, broad timbers (T82, T83, T84). T83 and T84 quite deteriorated, lying in a row in front of the entrance to Cave 8, in WG 61, E.

SU23: feature, Fire-pit 8, in WG 61, D3, SU19.

SU24: feature, Fire-pit 9, in the corner of WG 61, D4, SU19.

SU25: feature, salt incrusted, mud-brick surface outside of Cave 8, at the threshold leading into the entrance. Possibly a platform.

SU26: feature, Fire-pit 10, with round, cylinder-shaped wood fragment, in WG 65, A2-3, SU19.

SU27: sediment stratum under SU19 of medium/fine grain sand inside Structure 1, in WG 61, D2-3, E2-3, and WG 65, A2-3 (this layer is the same as SU45).

SU28: sediment stratum of fill and aeolian sand in the doorway and entrance of Cave 8, in WG 61, D1, E1.

SU29: feature, Fire-pit 11 in WG 65, in the middle of A2-3, B2-3, SU27.

[9] See small finds section for more details on artifacts from WG 61/65.

SU30: feature, Fire-pit 12, with large piece of a burnt platter, in WG 65, B2 and part of C2, SU20.
SU31: sediment stratum inside Cave 8. Aeolian sand and fill in WG 67, B3-4, C3-4, D3-4, E3-4.
SU32: sediment stratum of medium/fine sand outside of Structure 1 to the west, in WG 61, D4, E4, C3-4 and WG 65, A4.
SU33: feature, Fire-pit 13 in WG 65, A3, B3, on eastern edge of square.
SU34: feature, botanical deposit of rope, wood, fibers, and leaves, in WG 65, E3, SU20.
SU35: feature, Fire-pit 14. Hearth against the coral terrace wall in WG 65, C3, at the bottom of SU1.
SU36: feature, Fire-pit 15, a large fire-pit with deposits of charcoal and thousands of charred barley seeds, in WG 65, C3. This fire-pit was at the bottom of SU1 and on top of SU2, on top of a mud-brick feature.
SU37: feature, Fire-pit 16, a very large fire pit in WG 61, E4, on western edge in SU32 and so deep that it reaches into SU46.
SU38: feature of mud-brick, in WG 65, B3-4, C3-4, D3-4, with several hearths.
SU39: feature, Fire-pit 17 in WG 65, C3, D3, SU2, against the coral terrace wall.
SU40: sediment stratum of medium/fine sand with leaves and sticks, in WG 65, C3-4, D3-4, E3-4, under the mud-brick feature of SU38.
SU41: feature, Fire-pit 18 in WG 65, C3, D3, SU2, on western edge of square.
SU42: feature, Fire-pit 19, a very large fire pit with salt incrustation on the top, in WG 65, D3, SU40.
SU43: feature, Fire-pit 20 in WG 65, A5, on eastern edge at the bottom of SU32 in SU 46.
SU44: sediment stratum of medium/fine sand in WG 65, B2-3 under SU20.
SU45: sediment stratum (same as in WG 61, D2-3, E2-3,SU27) of medium/fine sand in WG65, A2-3, outside of Cave 8.
SU46: sediment stratum of medium/fine sand, from cave entrance down to terrace in WG 61, D4-5, E4-5 and WG 65 A4-5.
SU47: feature, Fire-pit 21 in WG 61, D3, SU45.
SU48: feature, Fire-pit 22 in WG 61, E5, SU45.
SU49: sediment stratum of medium/fine sand in WG 61, C23, under SU21. Contemporary with SU27/45 and SU32.
SU50: feature, Fire-pit 23, a large fire pit containing at least 10 fragments of burnt bread mold, in WG 61, C2 against the coral terrace wall.
SU51: feature, Fire-pit 24 in WG 65, A4, SU46.
SU52: feature of two wooden posts in WG 61, D3, SU45.
SU53: sediment stratum of medium/fine sand in WG 61, D3, E3, under SU45. This is the layer in which the bottom of the posts were located.
SU54: sediment stratum of medium/fine sand in WG 61, C2-3, under SU49 and SU50.

Their relationships are shown in a stratigraphic matrix (Figure 19).

WG 67/Cave 8[10]

Cave 8 consists of a single chamber, ca. 5 m x 6 m in area. The chamber has a rectangular shape, with a SW-NE axis and a 0.8 m wide entrance on the SW side. The floor consists of the horizontally carved fossil coral rock into which the chamber was excavated, while the roof consists of a curved vault. The maximum height inside is ca. 1.7 m.

A wall of sandstone blocks was constructed on the southwestern side of the cave entrance. The edges of three of these blocks in the western part of the wall can be clearly distinguished, while the eastern part is completely covered by salt incrustation. Some of these blocks may have been anchors or parts of anchors. Since this wall consists of sandstone blocks, the rectangular cave

[10] Excavation was conducted by A. Manzo.

chamber was probably excavated in the coral terrace starting at a natural rock shelter, whose shape was carved into a rectangular area, while its opening was reinforced to prevent bedrock collapse. The wall of sandstone blocks was also built to delimit the entrance to the cave in order to protect the materials inside, provide privacy and guarantee a more controlled access to the inner space.

The rock façade of the terrace wall at the entrance to Cave 8 seems to have been smoothed, as it is very straight, and a kind of step may have been created immediately outside the original rock shelter. A rectangular sandstone block was lying vertically on this step, perpendicular to the edge of the terrace wall and west of the entrance to the cave. This block may have been intended to protect the entrance from the prevailing winds and the transported sand. Two holes ca. 0.2 m in diameter were carved symmetrically to the east and west of the entrance in the vertical terrace wall, possibly for a canopy (of perishable materials), which would have shaded and protected the area immediately outside the cave. The post-holes and the mud-brick walls discovered in the area outside of the cave may also have been intended to sustain the horizontal beams of this canopy.

A thick salt incrustation had sealed the entrance of the cave and covered part of the collapsed and dismantled mud-brick wall, which had been built at the entrance after one of the last phases of use. After excavating the mud-brick remains, it became clear that the mud-brick wall had been broken into sometime in antiquity. This was demonstrated by the fact that while excavating the sediments covering the entrance there was no evidence of any recent human activity. The fill of the cave also looks quite undisturbed from recent disturbances. After the partial dismantling of the mud-brick wall, the cave may have been used again and was left open, allowing windblown sand to fill the cave. The inner space of the cave was covered by a mound of windblown sand that was higher close to the entrance than in the inner part of the cave.

After consolidating the cave ceiling close to the entrance with wooden frames and beams, a 5 m x 1 m excavation unit consisting of a east-west row of 1 m x 1 m squares was delimited inside Cave 8 to find the original floor and to collect artifacts which could give insights into its use and chronology. This excavation unit was named WG 67. The poor preservation of the ceiling near the cave entrance, which was clearly demonstrated by large pieces of collapsed bedrock from the ceiling lying on the sand stratum which filled the cave, prevented extending the excavations inside the whole cave.

Unfortunately, the only stratigraphic unit which was excavated in WG 67 before finding the surface of the original floor of the cave, a thick sediment stratum of soft aeolian sand ca. 20-40 cm thick, resulted in a paucity of finds. Only a few potsherds were collected, mainly in the squares close to the walls of the cave. These included sherds of an atypical brownish-grey handled pitcher found along the western edge of the excavation unit in the northwestern corner of the cave. A fragment of ostrich eggshell was also found.

According to Duncan FitzGerald, large-grained sand was intentionally brought into Cave 8 to make a smooth floor in the excavated cobble layer. The windblown sand at the entrance of the cave is much finer grained, and thus the large-grained sand on the cave floor could not have been carried there by the wind.

WG 31

K. A. Bard

In the last two days of field work, Bard started excavating again in WG 31, an area next to the coral terrace wall that had been excavated by Bard and Fattovich in 2005-2006. In this very short excavation in 2010, finds in WG 31, SU1 (a deep deposit of windblown sand) included: small pieces of wood and charcoal, potsherds (including 2 Middle Nubian ones), some fish vertebrae, animal bones, clay sealings, fragments of linen and (mat) ropes, and a few lithics.

This is a very promising area for investigation, and excavations will continue here next field season.

Base of the Western Terrace Slope

Two excavation units (WG 69, WG 70) were opened at the base of the western slope of the coral terrace, to the west and north of the activity area excavated in 2003-2004 to 2006-2007 (Bard and Fattovich 2007: 73-76; 2007b).

WG 69[11]
K. A. Bard, R. Fattovich

This excavation unit was delimited at the base of the western slope of the terrace, in front of Cave 8, and included the geological pit T10A, where many fragments of pottery were recorded. The excavation unit was oriented in alignment to the terrace.

An excavation trench, 6 m x 4 m in area, corresponding to Squares A1, A2, B1, B2, C1, C2, was opened in this unit. Test pit T10A was included into Square B2.[12]

The Stratigraphic Units were:

SU1: superficial, sterile stratum of lagoon sediment, ca. 15-20 cm thick, with evidence of potsherds at the base of the SU.[13]

SU2: sterile stratum of compact clay, ca. 0.15-0.2 m thick, in T10A, with evidence of ceramics at the base. This was a stratum of wadi sediment covering potsherds in a matrix of sand.[14]

SU3: stratum with a great quantity of large and small potsherds (dump) in A1-A2, in a sand matrix between clay strata SU2 and SU4. In A1 there was also a concentration of small potsherds (see C1).[15]

SU4: Stratum of clay from the wadi, with big fragments of pottery at the SU3/SU4 interface and within SU4.[16]

SU5: stratum of sand with potsherds at the interface SU4/SU5, with evidence of a lagoon shore and shells at the base of SU5. Evidence of a dump with small potsherds and animal bones in A1.[17]

The profile on the northern side of WG 69 showed the following stratigraphy from bottom to top (Figure 20):

1) At the lowest level there is coral rock and many bivalve shells, some still together (i.e., they were not used for food) – the lagoon.

2) A deep layer of mangrove roots, ca. 32-40 cm, from tidal flat deposits.

3 SU4 with Middle Kingdom pottery, above which are wadi sediments with few/some mangrove roots, ca. 15-22 cm.

4) SU3 with Middle Kingdom pottery, above which are wadi deposits and no mangrove roots. Thus, through time and use of harbor mangrove trees were cut down, used in fires and for construction, and eventually disappeared.

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[11] Excavation was conducted by R. Fattovich and K. A. Bard.

[12] Elevations of the surface WG 69 from datum (115 cm) were: 1) 205 cm (- 0.90 m) / 2) 204 cm (- 0.89 m) / 3) 203 cm (- 0.88 m) / 4) 205 cm (- 0.90 m) / 5) 214 cm (- 0.99 m) / 6) 218 cm (- 1.03 m) / 7) 215 cm (- 1.0 m) / 8) 218 cm (-1.03 cm) / 9) 217 cm (- 1.02 m) / 10) 214 cm (- 0.99 m).

[13] Elevations of the interface SU1/SU2 with potsherds from datum (130 cm) from East to West: 1) 241 cm (- 1.11 m) / 2) 252 cm (- 1.22 m) / 3) 246 (- 1.16 m).

[14] Elevations of the base SU2 from datum (119 cm): 1) 247 cm (- 1.28 m) / 2) 250 cm (- 1.31 m) / 3) 253 cm (- 1.34 m) / 4) 252 (- 1.33 m). Elevation of the top of concentration of big potsherds in A1, A2: 5) 246 (- 1.27 m). Elevation of the top of concentration of small potsherds in C1, C2: 6) 245 cm (-1.26 m).

[15] Elevations of the top of SU3 from datum (112 cm): 1) 263 cm (- 1.51 m) / 2) 271 cm (- 1.59 m) / 3) 275 cm (- 1.63 m). In B1-B2 stratum of sand mixed with remains of small crabs (lagoon sediment), ca. 15 cm thick, with a few fragments of ceramics, including large fragments of jars. Elevations of the top of ceramics from datum (115 cm): 1) 267 cm (- 1.52 m) / 2) 264 cm (- 1.49 m) / 3) 263 cm (- 1.48 m). In C1-C2, beneath a stratum of clay, there was a great quantity of small fragments of ceramics at the base of the SU. Elevations of the top of ceramics in SU3 from datum (119 cm): 7) 255 (- 1.36 m) / 8) 261 (- 1.42 m).

[16] Elevations of SU3/SU4 interface from datum (142 cm): 1) 299 (- 1.57 m) / 2) 300 cm (- 1.58 m) / 3) 301 cm (- 1.59 m).

[17] Elevations of SU4/SU5 interface from datum (138 cm): 1) 287 cm (- 1.49 m) / 2) 295 cm (- 1.57 m) / 3) 290 cm (- 1.52 m).

5) Final episode (SU1) with no more mangrove stands and the bay completely filled in by wadi sediments, ca. 35 cm, i.e., a combination of man-made and natural destruction of the environment beginning ca. 4,000 years ago.

On the whole, the stratigraphic sequence of WG 69 consisted of: 1) ca. 95 cm of deposits from the present wadi top to the ancient lagoon; 2) ca. 50 cm of wadi deposits from the dump deposit (SU4, ca. 2,000 BC?) to the top of the wadi; 3) ca. 35 cm of wadi deposits above the last Middle Kingdom dump (ca. 1,800 BC?). According to Hein, this sequence also represents climatic change, with less rain and less wadi activity than earlier in the Holocene.

WG 70[18]

This excavation unit was a test pit, 4 m x 4 m in area, about 50 m to the NE of WG 69, in an area where scattered fragments of ceramics together with pebbles and stone from the coral terrace were visible on the surface. Four squares, 2 m x 2 m in area, were excavated.

The Stratigraphic Units were:

SU1: stratum of windblown sand with pebbles and stones from the terrace, as well as scattered fragments of ceramics, ca. 40 cm thick. Ash, burnt sand and charcoal, as well as a few traces of wood were recorded over the whole excavated area, and were partially included in a salt crust at the base of SU1, with a major concentration in E1, E2. A fire pit ca. 40 cm deep was also recorded in E2.[19]

SU2: stratum of windblown sand beneath the salt crust (see SU1) with evidence of a large clay fire pit (burnt clay) associated with large fragments of pottery in the northeastern corner of E1, as well as other fire pits and fragments of ropes associated with Middle Kingdom potsherds across the excavated area.[20]

Another large fire pit was recorded on a stratum of windblown sand in E1-E2 beneath the salt crust. Beneath this fire pit there was some evidence of another hearth, most likely from the same phase as the former one.[21]

SU3: windblown sand beneath the fire pits, with evidence of a large mud-brick feature with a concave bottom and traces of fire in the center (most likely a kiln), in the northwestern corner of D1. The feature extends eastwards, out of the test pit and will be excavated in 2010-2011 field season.

Top of the Coral Terrace at Wadi Gawasis[22]

An Excavation Unit, 10 m x 10 m in area, was delimited on the top of the corral terrace, to the northeast of the Ankhu shrine that A. M. Sayed excavated in 1976, in the central sector of the site. This excavation was designed to test the occurrence of a possible quadrangular structure, ca. 20 m x 20 m in area, that A. De Guio had identified on a satellite image of the site.

The excavation demonstrated that a superficial, sterile stratum of sand, ca. 5-10 cm thick, directly covered the bedrock without any evidence of a feature or artifacts. Therefore, this excavation was suspended.

Pottery

Sally Wallace-Jones

[18] Excavation was conducted by R. Fattovich.

[19] Surface elevation from datum (138 cm): 1) 131 cm (+ 0.07 m) / 2) 68 cm (+ 0.7 m) / 3) 109 cm (+ 0.29 m) / 4) 160 cm (- 0.22 m).

[20] Elevation of the large fire place from datum (134 cm): 125 cm (+ 0.9 m). Elelvations of the top of SU2 in E1, E2 from datum (134 cm): 1) 152 cm (- 0.18 m) / 2) 160 cm (- 0.26 m) / 3) 155 cm (- 0.21 m).

[21] Elevation of the upper fire place from datum (135 cm): 184 cm (- 0.49 m).

[22] Excavation was conducted by R. Fattovich.

Ceramic material from all the main areas of excavation was examined during the season. The Vienna system was used to classify fabrics and all the sherd material from the site was examined using a x10 hand lens in natural light. The dating across the site continues to be distinctively Middle Kingdom with a definite bias toward the 12th Dynasty, especially in the areas WG 61/65, and WG 63 on the coral terrace outside Cave 8. Across the wider site, material covers the 12th Dynasty with some evidence for continuation into the 13th Dynasty.

Pottery: WG 61/65

These areas are very interesting from a ceramic point of view as they have a surprisingly rich assemblage of vessel types and fabrics which one would expect to find in normal domestic context in the Nile Valley (Figure 21 A and B). The range of fabrics includes Nile A, B1 B2 and C fabrics, as well as Marl A3 and Marl C. There is also a small quantity of Nile E cooker present and this always shows evidence of heavy smoking. Vessel types cover a full range of open and closed forms, including many fragments of medium and large storage jars. What is interesting is that whilst these are certainly present in the Marl C fabric, which occurs so commonly elsewhere at the site, a significant proportion of jar body sherds (up to 50%) are of Nile fabrics. There is also always a small proportion of large storage jars on Marl A3 fabric. Nile fabrics are also commonly represented by large flat-profiled dishes with an everted lip and an average diameter of 30-40+ cm. In the majority of cases the fabric is Nile B2, although some closed forms and fragments of larger open forms may be classified as Nile C. Both open and closed forms show evidence that red wash was present and also that rope or string was used as a support whilst vessels were drying. It is clear from their bag-shaped profiles and thinner walls that some Marl C jars were smaller than the large storage jars identified at other areas of the site and these were almost certainly used as cooking pots, as they are often heavily smoked. There are also some thinner sherds of Marl C which may be from open forms.

In addition to the large dishes and jars, a wide range of smaller vessels is also present; common amongst these are many fragments of B1 hemispherical cups and small Marl A3 cups of similar size and form, the dating of which is discussed below. Vessels used in food preparation and for storing and transporting liquids are common and these include fragments of Marl C cooking pots, and also Nile B2 material, including large and small open forms and jars in a variety of sizes. Vessels for storing beer, water and wine are present in Nile B2 and Marl A3 in a range of sizes and forms common to the Middle Kingdom. Small plates with an average diameter of about 17 cm are also commonly found. These are usually of Marl A3 fabric with a wheel-turned rim and scraped base. They are of a very uniform size and it has been suggested that they may have been used as a standard sized ration plate. A stack of this kind of material was discovered at Mersa/Wadi Gawasis in 2006-2007 (Perlingieri 2007b); there are also many fragments of similar sized plates up to 20 cm in diameter of Nile B2. Marl A3 is less frequently represented than Marl C, but is used for some deeper bowls with wheel-turned rims and scraped bases. Sherds of many deep, basin-shaped vessels occur frequently in this area and were probably used in food preparation. They are much less common in other areas of the site. They have a distinctive rounded, deep profile and molded rim; they are almost always of Nile B2 fabric, although some of the smaller ones are of a finer fabric almost like B1. They vary in size between about 16 and 30 cm in diameter. There is evidence that the smaller vessels B1 were often red-washed and burnished inside and out, whilst larger examples are uncoated or have traces of red wash inside and out without any burnishing. WG 61, D2-3, E2-3 alone produced fragments from at least five different vessels of this type, all of which were heavily smoked stained. They resemble material from Kahun (Petrie 1890: Pl.XII No. 9), but are less familiar from other sites where parallels are scarce; however, they are present at Dahshur in tomb groups dated between Senusret III and Amenemhat III (Susan Allen pers. comm.) There is also a significant amount of bread mold from the area. These are always of the typical tubular Middle Kingdom form. Much of the material shows signs of exposure to heat, being smoked and blackened to a greater of lesser degree.

It is very clear from x10 magnification examination of the pastes that the Nile silt vessels were made from clays typical of the Nile Valley. The clay types and inclusions as well as the vessel forms and technology are exactly what would be expected in the Nile Valley. The marl clay items are also likely to have been brought into the site of Mersa/Wadi Gawasis, and in the case of the Marl A3 vessels the clay must have come from somewhere in Upper Egypt, whilst the Marl C clay was probably collected somewhere in the Memphis Faiyum region. The vast majority of the pottery was, therefore, made elsewhere and brought to the site either as a means of transporting supplies or for domestic purposes such as food preparation. There is no evidence at present that any pottery, with the possible exception of bread molds and platters, was manufactured on any great scale at the site. On the contrary the pastes, technology and vessel types indicate that it was all brought from the Nile Valley and its environs. Some of the bread molds may have been manufactured locally (Perlingieri 2007a), but a number of them do appear consistent with material known from the Nile Valley.

The area of WG 61/65 has a number of indications which suggest a date of early to middle 12th Dynasty. These include the presence of many fine sandy Nile B1 and Marl A3 cups with thin walls and flat rather shallow profiles. The Nile material is almost always plain and uncoated, and some of the fabric is extremely fine and could be classified as Nile A. An exceptionally thin, fine and hard Marl A3 fabric is also used for a number of small cups, which have walls that narrow to as little as 1 mm at the rim. There are almost no occurrences of red rim bands. However, there is a small amount of fine sandy B1 material from several vessels, including one carinated cup, which have a red-slipped and burnished finish inside and out, again supporting an earlier date.

There is evidence of wheel technology being used in combination with hand making techniques and this is especially obvious in both open and closed vessels of Nile and of marl fabrics where rilling marks can be seen on the interior surfaces of the vessel, but clear scraping has taken place in order to shape the outer surface. In the case of large jars made in Marl A3, Marl C, Nile B2 and Nile C clays, there is also clear evidence of finger smoothing of coils used in the lower section of the vessels.

There are some ring bases present, which illustrate a transitional stage between those which were hand-pinched and those which were wheel-made separately and applied to the vessel at a later stage. Some have a pinched base and one Marl A3 vessel has a ring foot, which was wheel-made and added to the vessel, the join being clear at the base of the vessel (Arnold and Bourriau 1993).

The wheel technique used to form vessels bodies is not always secure. Many vessels which have a flat or rounded base that has been cut to shape also show wide, rather clumsy and often irregular rilling lines, suggesting that wheel technology was still developing. In the case of a case of a Marl A3 vessel from WG 65, D5, SU2, the rilling lines can clearly be seen inside and the vessel has a rather off center, oval shape that has been very clumsily trimmed to shape outside. The vessel is further mis-shapen where the potter has lifted it carelessly and pushed part of the vessel wall inwards. However, the vessel was fired and used, suggesting that the time and effort expended in its making accorded it some value in spite of being mis-shapen (Figures. 22 A and B).

Further indications of a date for this area come from a range of vessel types which have parallels in the 12th Dynasty. Material from El-Kab and especially Kahun provide some especially good comparison material for this (and other) areas of the site. For example, a carinated cup in Nile B2 fabric with red wash inside and out, found in WG 65, A2-3, B2-3, SU2, can be compared very closely to UC66212 in the Petrie Museum, the profile being very similar although the Petrie Museum is listed as having a wavy rim. (Having examined the Petrie Museum vessel, I believe the wavy rim to be an accidental bulge rather than deliberate design feature.) (Petrie 1890: Pl. XII No. 4.)

Another vessel form which occurs in this area is the Marl C zir of Bader type 46/47 (Bader 2002: 34). In this area they tend toward the fatter, more rounded profile of type 47 than those of type 46 found in the later Middle Kingdom. They have a characteristic ridged neck and again are found in the 12th Dynasty at Kahun as well as other Middle Kingdom sites. Material from this area

compares well to examples in the Petrie Museum (Petrie 1890: Pl. XII No.11). It should be noted that these vessels are not uncommon at Mersa/Wadi Gawasis and that at other areas of the site they show a development of style into the later vessel form.

A further group of vessels from this area suggestive of a 12th Dynasty date is the extensive collection of jars, which probably held beer water or possibly wine. These seem to divide into two main types: 1) larger vessels made from Nile B2 clay in some cases with red slip on the exterior, (some also show traces of red on the interior and a few examples have interior or exterior burnishing or both); and 2) smaller vessels of Marl A3 clay without any exterior treatment. Some of the marl vessels are quite small, having diameters of around 8 cm, although larger examples do occur with diameters in the range 16-18 cm.

Larger Nile clay jars have flared necks or longer necks with a rolled rim. Parallels for both of these types may be seen in the 12th Dynasty; for example, the flared neck type is similar to those found at El-Kab (Quibell 1987: Pl. XVI Nos. 58, 60, 72); and also Petrie 1890: Pl. XII No. 33). The Kahun example also shows a base with rope marks, and this type of jar base of Nile B2 and Nile C is found in this and other areas of the site. Type 60 in particular is well known in the 12th Dynasty. They are often found in Nile C material and some of the examples from Mersa/Wadi Gawasis are coarse enough in fabric and temper to be assigned to Nile C, although some are finer and may be assigned to Nile B2.

The longer necked vessels more closely resemble those shown in Kahun (Petrie 1890: Pl. XII No. 22) and there are also some longer necked examples similar to one in the Petrie Museum which is from Hawara and is dated to the 12th Dynasty (UC18488[23]).

The marl clay jars are dated by Bourriau to the early 12th Dynasty, between the reigns of Senusret I and Amenemhat II (Bourriau 1981: 70). Typically, they have a thrown upper section and a hand-finished base. The neck is short and slightly tapering with a small, neat roll of clay at the rim. They are described as water jars and are found with some frequency in this area and also at other areas of the site. UC18363 from El-Kab also provides a very close parallel dated to the 12th Dynasty. The clay used for these vessels is normally very fine and the small size of some of them suggested that they may have been personal possessions rather than large jars in which rations were transported and stored.

Many examples of both the Marl A3 and the Nile B2 vessel types have been identified from this area and such vessels are also found with considerable frequency in other areas of the site. Some of the rim forms, especially of B2 jars, in other areas of the site do begin to show characteristic forms of the later 12th to 13th Dynasties, although this is not the case in WG 61/65.

WG 61, A2-3, WG 65,A2-3, SU19 produced a Marl A3 sherd with incised decoration on the exterior of a carinated bowl, similar to material from El-Kab (Quibell 1897: Pl. XV). The single line of wavy decoration was made in the clay whilst it was still damp. Similar material was also found in WG 61, E4-5, SU46, which produced three incised sherds, one rim sherd of a carinated bowl with a single line of wavy incised decoration on the exterior between the rim and the carination as well as a rim from a bowl with a more rounded profile, which was decorated with an incised lozenge design and small beads of clay applied along the rim and is obviously a very special item. A third sherd from this area also had traces on incised wavy designs, but the sherd and one other piece without decoration had been re-worked into a pointed scraper type tool. However traces of the incised decoration remained visible on the exterior surface.

The clay, decoration, technology and form of these vessels all suggest a date earlier rather than later in the 12th Dynasty. Material from El-Kab provides a good comparison for the carinated bowls (Quibell 1897: Pl. XV No. 26). The lozenge design also has a parallel from Armant currently in the Manchester Museum (10614)[24], which is also dated to the 12th Dynasty. These are not the

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[23] http://www.digitalegypt.ucl.ac.uk/

[24] View an image at the Virtual Kahun pages :
http://emu.man.ac.uk/webmmtest/pages/common/imagedisplay.php?irn=69069&reftable=ecatalogue&refirn=104159

only incised sherds to be identified at the site and further incised material will be discussed below (Figure 23 A, B).

A small number of sherds from WG61/65 were coated on the inside with the remains of a viscous material which is now hard, but in the past has clearly been soft, allowing it to be scraped from the inner surfaces of a large Marl C jar, leaving tracks in the remaining material. Clearly, a large Marl C storage jar or jars were used to contain some kind of thick liquid material, which was precious enough to have been scraped out of the interior so that none was wasted. This is the first evidence from the site for the contents of a jar and it is worth noting that it was a jar of Egyptian material and manufacture, which was brought to the site from its place of manufacture somewhere in the environs of the Nile Valley. Whatever the contents prove to be (wax?), their presence at the site raises many questions about how and why the material was brought to Mersa/Wadi Gawasis.

Pottery: WG 63/66, WG 69

A Marl C cooking pot from WG 63, D3, SU2 has close parallels with 12th Dynasty material from other sites. A complete profile was preserved showing that the vessel was a bag-shaped jar with a scraped rounded bottom. It closely resembles UC18636 from Kahun and is of similar size. The Kahun example was heavily smoked stained and used for cooking, which is interesting as the area in which this vessel was found seems to have been important in food production. Bourriau dates the vessel to the reign of Senusret II (Bourriau 1981: 66) and this is again of significance for the dating of the site, especially as it was found in an area which also contained Stela 29, dated to Year 2 of the reign of Senusret II (Figure 24).

This area is distinct from the coral terrace area, being much closer to the bed of the wadi and in an area associated with the harbor. Here the ceramics show a much more mixed date range as well as a whole range of fabrics and vessel types, from large, flat-bottomed Marl C zirs with a base diameter of more than 30 cm to many fragments of Nile B1 and B2 cups. In WG 69, C1-2, SU3 almost 60% of the sherds recovered were fragments of B1 cups (115/198 sherds). The date range represented here is much wider than in WG 61-65 and covers all of the 12th and probably the early 13th Dynasty, based on the typology of Marl C jar rims present and the forms of beer jar rims (Bader 2002; Aston 2004: 82-3). Many of the ceramics from this area are very worn and seem to show old breaks; they often appear to be domestic debris. It seems that there may have been a layer of much smaller sherds overlying sherds of large jars sherds, often from substantial Marl C jars of which there are many in this area. There is also a large amount of bread mold debris. This may confirm the excavator's idea that the site area was a dumping ground for broken pottery which was put down in deliberate layers to form a compact surface. WG 69, SU1 also produced sherds which have been identified as a Middle Bronze Age Canaanite amphora[25] that seems to have been broken and discarded in antiquity, as some of the breaks were very worn.

As ever, there is evidence of the presence of a huge quantity of Marl C storage jars at the site. It seems probable that these were brought to Mersa/Wadi Gawasis containing provisions which were needed for the personnel stationed there, that they were re-used as necessary and that they were discarded once broken. A number of Marl C jars have pre-firing or inked pot marks and of those noted in recent field seasons some, in the form of strokes on the body or notches on the rim, were probably intended to be tally marks. Others have more obscure meanings, although many of them appear to carry information about the jars, possibly being an indication contents, origin or ownership. A few also show definite hieroglyphic signs. The range of pre-firing pot marks at Mersa/Wadi Gawasis shows many similarities to those from Kahun (Gallorini 1998). There is also a range of post-firing marks. One from WG 61/65 was incised post-firing on a Marl C jar and clearly shows the sun, whilst another, on a fragment of red-coated B1 cup, also made post-firing may represent a fish. In both these cases it seems probable that the sherds were used as a medium on which to draw. The breaks are old and show evidence of ware, whilst the shape and scale of the

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[25] I am grateful to Prof. Timothy Harrison of the University of Toronto for his help in confirming the MBA material.

drawing is suggested or perhaps constrained by the size and shape of the sherd; this is especially clear with the fish and also on an ink sketch which re-uses a piece of Marl C jar and which may represent a lotus flower. Whilst it is clear that the majority of pre- and post-firing pot marks had a significant linguistic symbolism, it also appears that some broken sherds were used for artistic purposes, perhaps in a similar way to later examples of ostraca. At Mersa/Wadi Gawasis the overwhelming majority of marks are found on closed forms of Marl C fabric, suggesting that a system of codifying information about the jars was in place.

WG 69, B1-2, SU4 contained one broken section of what may be an Old Kingdom bell-shaped bread mold. The breaks were old and no other material of comparable date has been found in the area. It was found in a context filled with broken Middle Kingdom pottery, including a large number of sherds from Marl C jars and fragments of tubular bread molds.

As yet, no evidence of any incised fish dish material has been found at any location on the site. This pottery occurs in domestic contexts at Kahun, Memphis Kom Rabia and Tell el-Daba and it is beginning to be better known from ritual contexts, for example, from debris in the South Temple area of the Pyramid Complex of Senusret III (Susan Allen pers. comm.) It seems somewhat odd that although evidence of ritual material and a full range of domestic material is found at Mersa/Wadi Gawasis, and that there is evidence of 13th Dynasty use of the site, that as yet there is no trace of this style of pottery. It may be that as this type of vessel had a very specific use and that as occupation of the site was sporadic and temporary, they were not considered necessary items, especially as nothing could be transported in them, and they are often large and heavy making them awkward and impractical to transport. However, the material is very characteristic of the period and it is clear that the transport of many types of vessels was undertaken for the harbor site, thus it remains to be seen whether or not this type of ceramic will be found at the site in the future.

Pottery: Geological Test Pits

During the process of making geological test pits, Christopher Hein recovered a number of potsherds from locations across the wadi. In all cases, these were of Middle Kingdom date, comprising the usual range of material, especially bread molds, a piece of an uncoated B1 hemispherical cup, and large fragments of Marl C and Marl A3 jars. Notable amongst the finds from these test pits are in T10, A1: a piece of Nile E cooker rim of a rolled type well know at Tell el-Daba and a body sherd of Nile D fabric, the only one from the site so far. In T10, A2 a large, mostly complete pot stand was found (Figure 25). It was made of uncoated Nile C fabric with a diameter of 28 cm. This is one of the very few definitive examples of pot stands from the site. It would have been suitable for supporting a large jar of the types which occur so commonly. The uniformity of material from these pits and of their dating to the Middle Kingdom is worthy of note, as they cover a wide area of the site and would therefore seem to confirm the uniformity of a site date within the Middle Kingdom.

Pottery: Incised Material

WG 55, C2, SU2 produced three incised sherds, one rim from a carinated bowl on which the decoration is quite extensive, possibly resembling the decor on an 11th Dynasty bowl from Denderah (Petrie 1898: No. 134/305). There was also one body sherd from an open form with only small traces of incision and one, the most interesting, a body sherd from an open form which was incised on the inner surface. The incision is deep enough to have meant that the sherd fractured on the interior along the line of the incision when the bowl was broken. Each of these sherds is of Marl A3; however, the final sherd mentioned is of an unusually fine hard paste, and it is well made with very fine rilling lines. Incised decoration on the interior of such vessels is much more unusual than finding it on the exterior, so this may well be a special vessel of some kind. It is especially interesting that these three incised sherds, which are very rare at Mersa/Wadi Gawasis, come from WG 55, the area adjacent to a possible shrine (in WG 56) and in which Minoan pottery and significant finds of ebony were made. If an 11th or early 12th Dynasty date can be assigned to the

carinated bowl, it may suggest that it was a kind of heirloom, a special vessel brought to a special area of the site for a special purpose, perhaps in a similar way to the Minoan pottery, although it is impossible to speculate what this might have been.

Three further incised sherds have been also been identified, one in WG 32, one in WG 38, and one in WG 66. The one from WG 32 came from a vessel with a wavy rim and has wavy decoration incised on the outer surface, whilst the piece from WG 38 is from an open carinated form and has incised line decoration and small decorative clay whirls applied on the point of the carination. It would seem to have a very close parallel in UC18422[26], originating from El-Kab and dating to the early 12th Dynasty. The sherd form WG 66 comes from the shoulder of a small closed form of Marl A3 and consists of parallel curved lines running around the base of the neck with groups of shorter, diagonally arranged, curved lines grouped underneath in eights. There is a close parallel for the design in Quibell 1897, Pl. XVI No. 70, dated to the 12th Dynasty. The breaks were worn and this sherd may have been at the site for some time before being thrown away.

In all cases, these sherds with incised designs point to occupation of the site from an earlier rather than later 12th Dynasty date, and also indicate that not all the pottery at the site was purely utilitarian. Some more decorative material was present, although how and why it was brought to the site remain open to question.

Pottery: Discovery and Identification of Canaanite Material

In the 2007-2008 field season a number of sherds of small jars with distinctive flat, ridged rims were discovered. They all had flat bases and thin walls with a finely raised, ridged pattern, probably made during production. The paste was full of mineral inclusions. WG33, SU3 contained 24 sherds from at least 5 different vessels. During the 2009-2010 field season some further examples were recognised in WG 32, B4, SU5. These have been identified as Canaanite by Manfred Bietak.[27]

A number of pieces of Canaanite amphora have also been identified, the most complete being from WG 69, SU1, which was identified amongst sherds that appear to have been broken in antiquity and dumped. The fragments of Canaanite amphora which included a handle and part of the rim were found in association with a large number of Middle Kingdom bread mold fragments, body sherds form large jars of Marl C and Nile B2 fabrics and a complete beer jar rim of a type dated to the early 13th Dynasty at Tell el-Daba (Aston 2004: type 7a). The amphora is clearly of a Middle Bronze Age type and fabric and has parallel at Tell el-Daba (Aston 2004: 296, Fig. 33e, group 33).

Other pieces of similar fabric, form and technology have also been identified. WG 33 produced a dark brown, very gritty handle stump and in WG 47 a collar-shaped rim of the same fabric was also identified. WG 54, SU2 also appears to have a vessel of similar fabric and with a distinctive handle. This evidence would suggest that there were at least three amphora type vessels present at the site along with a number of smaller jars.

Pottery: Discovery and Identification of Minoan Material

In 2007-2008 a tiny sherd of Minoan pottery was identified from WG 55, C2, SU2. It has since been closely identified as being characteristic of Proto-palatial pottery.[28] The pattern belongs to the White-banded Style of MMIB Kamares pottery. The section of pottery, the color and small angular inclusions (calcareous or quartz) are very distinctive elements of Kamares wheel-made pottery produced in the area around Knossos. The form is likely to be a shallow, rounded cup and the date is Middle Minoan IB, making it rather old for the Middle Kingdom date of the site. However, there is evidence that this area had special status and it is possible that the pottery is another example of a precious item of heirloom which was brought to the site for reasons which are yet unclear.

In the 2009-2010 field season a further Minoan sherd was identified, again from WG 55, C2, SU2 . It is a very distinctive class of Minoan wheel-made pottery, first appearing in Crete in Middle

[26] Search for an image by catalogue number at http://www.digitalegypt.ucl.ac.uk/

[27] Manfred Bietak pers. comm. to K. Bard.

[28] I am grateful to Massimo Cultraro of the Italian CNR for his help in identifying the Minoan material.

Minoan IIIA about 1700 BC and therefore suggestive about the date range of the site as a whole, coming as it does in the mid-13th Dynasty. It is usually known as Fine Buff Crude Ware (meaning rough and hastily made), but there are finer varieties. It appears to be from a shallow bowl with a distinctive, slightly rounded profile. Such bowls do occur with a plain finish like this example and are also known to have been sprayed with dark paint, partly dipped in dark paint or monochrome coated (Figure 26).

One further sherd, a base of fine fabric from WG 69, C1-2, SU3 remains to be examined and confirmed as Minoan, although the paste and finish are suggestive that it may also be from Crete.

Pottery: WG 67

This context represents the area inside Cave 8. The pottery is largely but not entirely unremarkable and consists of the usual range of types and fabrics representative of an early to mid-12th Dynasty date. In this way it fits broadly with the remarks made about WG 61/65. Material retrieved includes 5 sherds of Marl C from the bodies of two large jars showing typical turned technology in combination with hand forming and scraping; 2 body sherds of a large, uncoated B2 jar; 9 pieces of B1 hemispherical bowl representing one or two vessels; also one B1 bowl base, which had been scraped to shape, along with a piece of red-burnished inside and out B1 cup body; the almost complete rim of a B2 plate of about 18 cm in diameter, with an everted red-washed lip; 3 sherds of a Marl A3 plate with smoke blackening outside, which joined to a sherd found outside the cave in WG 61, B2-3, C2-3, SU10; and 2 rim fragments of a very fine and hard Marl A3 water jar of the type mentioned above and dated by Bourriau to the early 12th Dynasty (Bourriau 1981: 70).

The most interesting vessel found in the cave was in a completely broken state, but enough sherds were recovered to reconstruct a full profile and to allow drawing and photography to take place. The vessel is extremely unusual. It is about 14 cm in height with a diameter at the mouth of about 10 cm. It has rounded shoulders tapering to a flat ring base of about 6 cm in diameter. The rim is direct and flares out from the shoulder. There is a handle stub about half way down the handle on one side of the body, but no evidence of a handle on the other side. The surface of the pot is a uniform black and there are traces of fine burnishing on the outer surface. The fracture is a deep reddish-brown, although the black surface is uniform and very well finished. The pot has fine rilling lines and a well made ring foot, which was clearly wheel-made and is beyond anything that could have been achieved with the technology available in Egypt in the Middle Kingdom. It has a pre-firing potter's mark incised in the base, in the form of two crossed lines. The fabric is unusual and not like other pastes in use in Egypt at the time. The form, clay, color, burnish and technology all suggest that the pot is not Egyptian in origin; however, as yet it has proved impossible to find a parallel for it elsewhere in the world. It has been ruled out as coming from Crete or Cyprus, nor does it seem to belong in the Levant. Andrea Manzo[29] feels that it is unlikely to be of southern origin and the paste and form are also unlikely to be Canaanite.

Irmgard Hein[30] has suggested that it may be similar in style to a group of pots from Karnak North from the Middle Kingdom layers. These occur infrequently, but also have a ring base, are fine and thin-walled, are well made with excellent wheel production resulting in good quality, attractive pots. Pottery of this Karnak type is not known not in the Delta, Palestine, Nubia, Cyprus or the Aegean. It has been named "Karnak Grey Ware" and it also has a burnished outer surface. The similarities make it possible that this is a pot of the same type, but the origins of such material both at Karnak and at Mersa/Wadi Gawasis still remain mysterious. The clay is not of any mainstream Egyptian type and the technology is also indicative of a non-Egyptian origin.

Susan Allen[31] has also suggested that the form may relate to Canaanite forms, especially as it appears to be a single-handled jug and that it may be a Middle Bronze Age shape made in Egyptian clay, possibly even by a Canaanite potter working in Egypt. This is possible, although the

[29] Andrea Manzo per. comm.
[30] Irmgard Hein per. comm.
[31] Susan Allen per. comm. to K. Bard.

clay is unlikely to be Egyptian in origin unless it is from a very unusual and little known source. The blackening on the surface is definitely deliberate and although the burnishing is difficult to detect because of the much damaged state of the vessel, it is clearly present on the neck and rim.

One other parallel may also be suggested here. UC21651 is a black juglet form vessel of Middle Kingdom date from Buhen.[32] Although the shape and technology differ from that of the pot from Mersa/Wadi Gawasis, the surface color and especially the color and appearance of the fracture are very similar to those of the Mersa/Wadi Gawasis pot. There is also a significant amount of pottery from Nubia at Mersa/Wadi Gawasis. However, the technology used for the Mersa/Wadi Gawasis pot looks to be well in advance of that seen in the Nubian material. As yet, only photographic comparisons to the Petrie Museum vessel have been possible. Further comparison and study are, therefore, vital in order to determine where the vessel originated, as it clearly has great significance in the study of foreign relations at the site.

The site of Mersa/Wadi Gawasis continues to produce a fascinating range of pottery of Middle Kingdom date, illustrating that a whole range of domestic and storage vessels were brought to the site to support the sea-going expeditions that were the reason for the site's existence. This poses questions about the nature of each expedition and how it was organised, as the logistics of transporting so much material must have been very daunting. The range of foreign pottery discovered at the site also continues to grow and this also raises many questions about relations between Egypt and the surrounding lands. A continued and detailed study of the ceramic material may help to answer these questions in the future.

Nubian Pottery and Ceramics from Southern Regions of the Red Sea

Andrea Manzo

Twenty-one potsherds of Nubian type and from the southern regions of the Red Sea were collected in the 2009-2010 field season. In addition, a more complete assessment of some Nubian sherds discovered in 2007-2008 was conducted as well.

Nubian sherds included:

1. Seven fragments of one small closed bowl with slightly everted rim from, from WG 61, D2, E2, SU45 (Figure 27). These fragments have a reddish-brown paste and are decorated with incised horizontal lines on the body and small impressed lines on the rim. This type of bowl occurs very frequently in Pan-grave cemeteries in Lower Nubia, and in C-Group domestic assemblages. Fragments of similar bowls were already collected at Mersa/Wadi Gawasis.[33]
2. Two body-sherds of open or slightly closed bowls, from WG 55, E3, SU4, and WG 66, D3-E3, SU3. These fragments are of a dark brown or grey organic- and mineral-tempered ware, and are decorated with oblique, often crossing, bands of incised lines on the upper part of the body. They are of a class of possible cooking-pots, which occur frequently in Middle Nubian assemblages. Similar fragments were already recorded at Mersa/Wadi Gawasis.[34]
3. A rim-sherd of a bowl or cup, with a grey, mineral-tempered paste, a smooth grey external surface with red spots, and wiped internal surface, from WG 55, D3, SU2. The fragment is decorated with panels of horizontal, vertical, and oblique bands of incised lines on the outside surface, and a motif of criss-cross notches on the top of the lip. This potsherd is similar to Pan-grave and C-Group II types.[35]

[32] Search for an image by catalogue number at http://www.digitalegypt.ucl.ac.uk/
[33] Manzo 2007, 2010.
[34] Manzo 2007, 2010.
[35] Säve-Söderbergh 1989, pp. 166-174, Pl. 20, type PI a5 47/65:3; pp. 261-262, Pl. 163, 4.

4. A body-sherd of a bottle with a grey-to-brown micaceous and mineral-tempered paste, with a polished grey external surface and smooth grey internal surface, from WG 68, SU1 (Figure 28). This fragment is similar to Middle Kerma or Classic Kerma types.[36]
5. Five hand-made potsherds WG 31, SU1; WG 61, C2-3, SU49; WG 61/65, SU32; WG 61-65, SU45; WG 65, A2-3, B2-3, SU2. These fragments are most likely Nubian in origin, but they are too small to be ascribed to specific classes.

Sherds from regions of the southern Red Sea included:

1. A body-sherd of a brown micaceous and mineral-tempered ware and smooth surfaces, from WG 65, A4-5, SU46 (Figure 29). The outside surface is decorated with a band of combed lines, most likely obtained with the edge of a shell. Both the type of paste and decoration are comparable to specimens from sites dated to the first half of the 2nd millennium BC in the region of Djibuti as well as at Adulis in Eritrea.[37]
2. Three potsherds decorated with burnished lines, from WG 33, SU3, Hearth 3. These fragments are similar to types from the Yemeni coastal region,[38] but unfortunately they are too small to be ascribed to specific types.

Preliminary remarks

These finds confirm the conclusions based on the collections of previous field seasons at Mersa/Wadi Gawasis.[39]

The Nubian fragments are consistent with those collected in previous field seasons and provide further support for the hypothesis that Nubians were participating in pharaonic expeditions to Punt. Some vessels, however, might have been made by local groups of the Eastern Desert with a material culture related to the Nubian one. Other vessels ascribable to Upper Nubian types, such as the Kerma sherd from WG 68, might have arrived to to Mersa/Wadi Gawsis from the Sudanese coast *via* the Red Sea.

The fragments from regions of the southern Red Sea confirm that both sides of the Red Sea were involved in the Egyptian trade with Punt. The finds from the 2009-2010 field season also suggest that this trade included the Eritrean coast and/or Djibuti.

Sealings and Seal

Andrea Manzo

In the 2009-2010 field season sealings were collected in Excavation Units WG 61/65, SU19, SU21, SU32, SU44, SU45, SU46, and WG 31, SU1. More sealings were also collected in WG 32 when the ramp to the entrance of Cave 6 was completely cleared, in addition to ones excavated in WG 32 in previous field seasons. Finally, a well preserved faïence scarab seal was collected in WG 61, E4, SU45. On its flat side, the scarab has a pattern of spiralling lines with symmetrical *nfr* signs aligned obliquely, and can be generically ascribed to the Middle Kingdom (Figure 30).

Some sealings only had a complex pattern of spirals (e.g., one from WG 61, SU45). Other seal impressions contained protective signs, such as *nb*, *nfr*, *ḥnḫ*, *ḏd* and *nbw,* and were found in WG 61-65, SU45 and SU46, and WG 32, SU 46 (entrance of Cave 6). Among the seal impressions with protective signs, noteworthy is the occurrence of ones of the same seal with *wꜣḏ* and (possibly)

[36] Privati 1999, p. 47, Fig. 13, 7 for Middle Kerma; Reisner 1923, pp. 374-381, Figs. 255-258 for Classic Kerma.

[37] For the Djbuti region see Gutherz, Joussaume, Amblard, and Guedda Mohammed 1996, pp. 273-279, Fig. 9; Poisblaud 2002, pp. 209-210, Fig. 16; Poisblaud 2004-2005, p. 119; the comparisons with the materials from Adulis were conducted on the basis of drawings and unpublished notes by Andrea Manzo and Chiara Zazzaro.

[38] See Buffa 2007, pp. 34-35.

[39] See Manzo 2007, 2010.

nfr signs forming a kind of cross, with four possible *mi* signs aligned obliquely between the arms of the cross, in WG 32, SU46 (entrance of Cave 6) and WG 61/65, SU46.

Among the sealings with inscriptions, one complete and other fragmentary impressions of a seal with the name of the scribe Amenemhat (*sš ỉmnmḥ3t*) were found in WG 61/65, SU45 and SU46 (Figure 31). A fragmentary impression of an institutional seal (shield-shaped) mentioning the *niwt rsy* ("the Southern Town", i.e., Thebes) and surrounded by a border of spirals was collected in WG 32, SU 46 (entrance of Cave 6). This sealing was also impressed with a smaller seal with spirals and the *ꜥnḫ* sign on a chunk of clay sealing a wooden box. Moreover, the same assemblage included a fragmentary sealing possibly also used to seal a wooden box. This sealing included a border of spirals and the name and title *imy-r pr ḥḏ* [*sn*]*wsrt*, "the overseer of the Treasury Senwsert" (Figure 32). The *pr* sign ("house, palace") and possibly the *niwt* sign ("city") occur on a fragmentary sealing discovered in WG 31, SU1.

Some of these sealings also provide important chronological insights. The scarab seals bearing names and titles of officials are not attested in assemblages earlier than the late 12th Dynasty, and their use may be connected to the administrative changes attested during the reigns of Senusert III and Amenemhat III.[40] This dating is also confirmed by sealings with impressions of two different seals, from WG 32, SU46 (entrance of Cave 6) and WG 61/65, SU46, which probably resulted from more complex administrative controls that were used beginning in the second part of the 12th Dynasty,

On the back of the sealings, the impressions of pegs, wood and ropes suggests that most likely some of them were intended to close wooden boxes (WG 32, SU46; WG 61/65, SU19 and SU46). Other sealings possibly have the impressions of bags (WG 32, SU46; WG 61/65, SU45) and baskets (WG 61/65, SU46). Fragments of clay stoppers with impressions of straw disks intended to close jars containing wet materials, such as cheese or fish, were collected in WG 61/65, SU32, SU45 and SU46. Several sealings from WG 61/65 SU19, SU45 and SU46 had impressions of papyrus on their back sides, as was also the case for the only sealing from WG 31, SU1.

WG 61/65, SU32 and SU44 also contained fragments of chunks of pure raw clay, suggesting that containers were not only opened but also sealed in that area of the site.

Preliminary remarks

The sealings discovered in 2009-2010 considerably enlarge the number of institutions and officers that were involved in the organization, administration, and management of the seafaring expeditions. A previously unknown administrative area was also discovered in front of Cave 8. If the area in front of Cave 6 was mainly used for the opening of the wooden boxes containing the products of Punt,[41] as was also confirmed by the finds there from the 2009-2010 field season, the sealings from the administrative area in front of Cave 8 were used to control access to different types of containers.

Moreover, a number of papyrus sealings were noted in the assemblage collected in front of Cave 8. In this area containers and possibly letters were also sealed, as is demonstrated by the chunks of pure raw clay excavated there, and by the discovery of a scarab seal and several fragments of papyrus. The large number of sealings for papyrus together with the fragments of papyrus discovered at WG 61/65 also suggests that letters and despatches were regularly sent to Mersa/Gawasis when the seafaring expeditions were staying at the harbor, and that replies were sent back to the Nile Valley. At these times, a kind of regular delivery service similar to the one between Egypt and the Nubian fortresses may have existed.

Epigraphic Report/Rapport épigraphique

[40] Johnson 1977, p. 142, Martin 1971, pp. 175-187, Pl. XII, Williams 1977, pp. 136-137, see also Ben-Tor 2004, pp. 26-27.

[41] Manzo and Pirelli 2006.

Elsayed Mahfouz

Stèle WG 29

Une grande stèle en grès mesure 72 cm de hauteur, 74 cm de largeur et 10 cm d'épaisseur a été mise au jour le 28 décembre 2009 (Figure 33). Kathryn Bard et Tracy Spurrier l'ont découverte intact dans la nouvelle zone de fouilles (WG 61), carré 22 tombée sur la surface sableuse. L'objet est sans doute tombé d'un emplacement plus haut. Heureusement, son surface inscrit était face au sable, l'effet qui a permis de sauvegarder la plupart du texte hiéroglyphique.

En 2 janvier 2010 Howard Wellman, le restaurateur de la mission, et l'épigraphiste ont commencé à nettoyer la surface inscrite de la stèle couverte par une couche épaisse du sel mélangé avec le sable. Celle-ci était relativement dans un état de conservation raisonnable si l'on compare avec les autres stèles découvertes au sites souvent très endommagées par l'effet négatifs du sel et de l'humidité. La conséquence de cette dernière apparaît dans la partie centrale de la stèle étudiée en détruisant quelques parties importantes du texte surtout dans la quatrième et cinquième lignes. La scène supérieure porte quelques traces de couleurs à l'intérieur de ses éléments notamment la couleur rouge dans disque solaire à la lunette de la stèle et la couleur bleue dans le signe de *nb* du titre *nb t3wy* à la gauche du registre supérieur.

La stèle est divisée en deux registres : un officiel occupant la partie supérieure concernant le souverain et son protocole et un inférieur concernant le fonctionnaire responsable aux activités exercées au site.

Le décor de la stèle est surmonté du soleil ailé dont les traces de la couleur rouge dans le disque solaire sont encore claires. Cette couleur, l'uræus et les plumes bien détaillées montrent un travail artistique bien soigné.

Le registre supérieur occupé par les noms et les épithètes royaux sont en caractères plus grandes que le texte inférieur. Le nom d'Horus du roi Sésostris II occupe la partie centrale du registre dont l'image du faucon porté la double couronne surmonté la façade du palais. Sechemoutaouy, le nom royal, en est inscrit à l'intérieur avec un martelage dans la partie droite de double signe de la terre (Taouy) qui signifie l'Egypte.

Ḥr sšmw-t3wy
Celui qui gouverne le double pays.

À gauche se trouve l'épithète royale liant l'institution monarchique au culte du dieu Min de Coptos, patron du désert Oriental et protecteur de navigateurs égyptiens au pays de Pount. L'épithète est inscrit sur deux colonnes:

di.f ꜥnḫ nb mry Mnw Gbtyw
doué de toute la vie, aimé de Min Coptos.

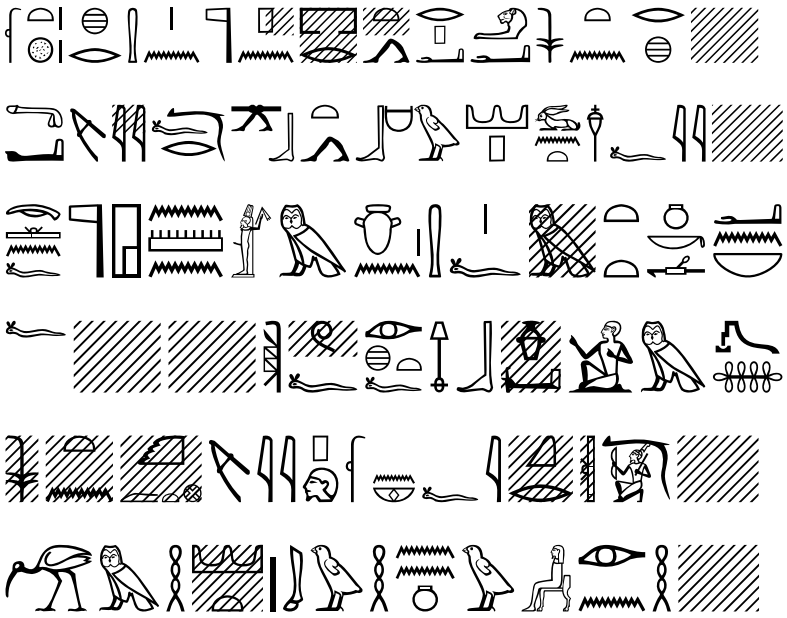
A droite se trouve le nom du couronnement suivie par une épithète royale. Ceci est également inscrit sur deux colonnes :

nṯr nfr Ḥꜥ-ḫpr-Rꜥ
nb T3wy di ꜥnḫ

Le dieu parfait Khâkheperrê,
Maître du Double pays, doué de vie.

Il paraît intéressant de remarquer que le titre *nṯr nfr* a remplacé le nom *nsw-bity* qui représente une tradition protocolaire apparue déja dans des autres documents de la XIIe dynastie au site comme la stèle WG 06[42].

Le registre inférieur est chargé par un texte hiéroglyphique de six lignes inscrit avec des caractères plus petits que les signes du protocole royal d'une orientation générale de droite à gauche. La partie gauche de la dernière ligne est totalement endommagée. En outre, des autres parties dans le texte même sont aussi effacées surtout le début et la fin de chaque ligne ainsi que quelques zones centrales. L'effet que cause une difficulté à donner une lecture complète du texte :



1) *rnpt-sp 2 ḫr ḥm n nṯr pn* [*prt*] *iry-pˁt ḥ3ty-ˁ rḫ nsw* […]
2) *mty mry.f imy-r3 sbt* (*n*) *bi3w Pwnt ḫsfy* […]
3) *sprn.f ḥwt-nṯr Mnw m ib n ḥm.f mitt ink wˁ n nb*
4) *.f* […] *šmsw.f ir ḫt.f wb3 m stp-s3*
5) *mry* [*nsw kmnt*] *tp rnpt n ḥb* […]*.f iḳr imy-r3 mšˁ* […]
6) *gmi ḫ3st wḥmw Ḥnnw irw Ḥ*[…]

1) L'an 2 sous la majesté de ce dieu, le prince héréditaire, gouverneur, connu du roi […]
2) Le précis, aimé, directeur de la mission (aux) mines de Pount est sortie et a navigué […]
3) Il a approché du sanctuaire de Min, … dans le cœur de sa majesté pareil ?. je suis suis l'unique de son maître.
4) […], son agent qui accomplit ses affaires, l'échanson auprès du palais
5) aimé du roi d'Egypte dans le festival calendaire d'offrandes, l'excellent, directeur de la mission […]
6) le prospecteur du désert, l'héraut Hénénou, né de […]

Sous le texte se trouve deux signes séparés qui ont apparemment été postérieurement inscrits. Il s'agit du signe d'une maison et au autre qui ressemble à un oiseau.

[42] Mahfouz 2008a, p. 257.

Lors la stèle donne des rensignements très importants sur la présence d'un haut fonctionnaire portant le titre de héraut qui est nommé Hénenou, un nom répandu au Moyen Empire au site durant l'an 2 du règne de Sésostris II, quatrième souverain de la XIIe dynastie. Le fonctionnaire a porté non seulement des titres honorifique comme le prince héréditaire, gouverneur et le connu du roi mais également un titre d'une nature exécutive claire. Il s'agit du titre « le directeur de la mission aux de Pount » qui montre une activité maritime claire et une responsabilité éblouissante envers les relations entre l'Égypte et le pays de Pount durant le règne de Sésostris II.

D'ailleurs, Hénénou était attaché au palais royal par le titre de « échanson auprès du palais ». Enfin, le titre « celui qui prospecte (litt. Regarde) le désert » indique ses responsabilités dans les zones montagnes et la possibilité d'avoir une institution spécialisée de cette sorte d'administration.

Le texte de cette stèle représente la première témoignages dur une occasion de présence en l'an deux du règne de Sésostris II. Sir Gardner Wilkinson a mis au jour une autre stèle datée de l'an 1 du même règne mais nous avons suggéré dans un article recent que le texte de cette stèle lie les activités maritimes excercées au site du Ouadi Gaouasis aux sites miniers du Sud Sinaï[43].

En conclusion, une expédition aux mines de Pount a été envoyée au pays de Pount sous la direction de héraut Henenou au règne de Sésostris II. La mission est rentrée en l'an 2 et a approché au sanctuaire de Min. la question qui se pose maintenant où se trouve ce lieu sacré et la stèle nous permet de proposer que le port de Mersa Gaouasis avait une chapelle pour le dieu Min. Dans ce cas, nous aurions une évidence écrite confirmant les données archéologiques découvertes par la mission italo-américaine au site.

Papyri

PWG 02

Un fragment de papyrus découverte dans la nouvelle zone de fouilles (WG 61) et plus précisément dans le carré de fouilles numéro C2 au niveau stratigraphique 21, le 4 janvier 2010. Celui-ci mesure 3.5 cm de longueur, 7 cm de largeur et porte une partie de trois colonnes du texte écit en ocre noir :

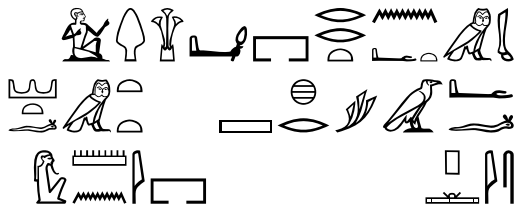
1) …comme Thot …
2) …le magistrat de la place …
3) …vie, prospérité et santé [roi ?]…

PWG 03

Quelques fragments du papyrus ont été découverts par Tracy Spurrier dans le secteur de fouilles WG 61, carré D4-E4 au niveau stratigraphique SU 82, le 6 Janvier 2010. Parmi ces fragments, deux principaux avec une colonne du texte hiératique illisible en ocre noir.

PWG 05

Un fragment du papyrus portant une texte hiératique écrit en ocre noir a été découvert à la fin de la mission. Le texte qui se constitue de trois lignes est incomplet avec une lacune au milieu et une partie manquante à la fin de la deuxième et la troisième ligne.



L'héraut Djerserha
A paquet de trèfle Bundle … dans son désert
…. Contrôle … le temple d'Amon

[43] Mahfouz 2008b, pp. 48-55.

Selon le style paléographique, ce texte pourrait être daté de la fin du Moyen Empire.

Ostraca

OWG 113

Un ostracon a été découverte par Tracy Spurrier le 6 Janvier 2010 dans la nouveau secteur de fouilles (WG 61) au carré D4-E4. Son niveau stratigraphique est SU82.

Le tesson porte une partie d'un texte composé d'une seule colonne écrit en ocre noir sur un surface blanchâtre. L'ostracon mesure 13 cm de longueur, 7 cm de largeur et 1.5 d'épaisseur.

… de la terre, 30 poissons nettoyés de la ville.

OWG 114

Un fragment a été mis au jour par Tracy Spurrier entre WG 61, carré D2-3, E2-3, et WG 65, carré A2-3 au niveau stratigraphique 45, le 10 janvier 2010.

Il s'agit d'un ostracon portant un texte hiératique se constituant de quatre lignes incomplètes écrites en ocre noires sur une surface rouge. Les dimensions de l'ostracon sont 9.5 cm de longueur, 5.5 cm largeur et 1.0 cm d'épaisseur.

1) L'an 6, premier mois de la saison Chemou …
2) Le gouverneur a apporté …
3) 5 tr…
4) du poisson nettoyé.

Ship Timbers and Maritime Artifacts

Cheryl Ward and Chiara Zazzaro

During the 2009-2010 season, Mohamed Abd el-Maguid, Chiara Zazzaro, and Cheryl Ward excavated and examined new ship components and debitage from ship breaking. Timbers excavated in earlier field seasons were re-evaluated and recorded as they were processed for storage in Cave 2. Major discoveries include a deposit of substantial ship timbers outside the entrance to a gallery (Cave 6) and the identification of comparable features on a segment of a ship's plank (T64) in Cave 3. In addition, two cedar hull planks (T80 and T93), three cedar deck planks (T82, T84, T94), and five small boat planks (T81, T83, T86, T95, T97) were recorded along with timbers in WG 32 (the ship timber deposit), tool handles (T101 and debitage including probable oar fragments from WG 64 (W960-W964). Excavation of WG 64 in Cave 2 also provided additional information about the use of space in this gallery.

WG 64

WG 64 is located within Cave 2, one of the group of five galleries discovered in 2004-2005 after removing a deposit of ca. 2 m of aeolian sand along the western edge of the fossil coral terrace (Bard and Fattovich 2007: 61). It consists of a 4 m x 2 m trench, divided into 2 m x 2 m squares (Figures 34 and 35).

Cave 2 is 24 m long and ca. 4-5 m wide. Oriented southwest-northeast, this gallery consists of a large natural rock shelter that was extended by the ancient Egyptians. It is divided into three sectors: the Entrance Corridor; Room 1, which were excavated during the 2004-2005 and 2005-2006 field seasons; and Room 2, surveyed in 2005-2006, where WG 64 was opened during this field season. Previous excavations in the Entrance Corridor and Room 1 revealed two occupation phases consisting of ceramics, wood debitage and ship timbers incorporated as features in the gallery, and food production artifacts (Bard and Fattovich 2007: 65).

Two 50 cm x 50 cm test pits placed ca. 10.20 m from the entrance revealed evidence of intensive woodworking activities, so WG64 was laid out to incorporate both test pits. WG 64 also

allowed documentation of the relationship between the Entrance area, Room 1 and Room 2 and investigation of the arrangement and use of different spaces within the gallery.

Access from Room 1 to Room 2 was obstructed by rock fall from the ceiling; much of that deposit was removed during the 2005-2006 field season. Room 2 has a nearly rectangular plan, ca. 17.5 m x 4-5 m in area. The ceiling is vaulted and the present maximum height is about 2 m in the center, but is as low as 1 m near the walls where rock fall has accumulated. Much of the ceiling retains mud plaster that likely served to prevent tiny fragments of the fossil coral terrace from continually falling onto work and living surfaces.

On the long southeastern wall, the wall/division between Cave 2 and Cave 5 collapsed, giving access to Cave 5 where 26 or more coils of line were stored. At least one coil of rope seems to have fallen into Cave 2. The surface of Room 2 in Cave 2 is characterized by aeolian sand, concentrations of wood and rope fragments, and rock fall from the ceiling.

WG 64 was laid out nearly parallel to the gallery walls. The surface was characterized by a thin stratum of aeolian sand, with a high concentration of wood debitage and scattered fragments of rope along the center of the trench and in the westernmost part. The northwestern corner of the trench (square B1) had an accumulation of rock from degradation of the gallery wall.

In WG 64, wood debitage was mixed in a compact sandy layer (SU2) 10 to 20 cm thick. Approximately 47 liters were recovered from WG 64, including 10 liters of small debitage fragments (thin splinters and pieces up to 5 cm long), 12 liters of medium-sized fragments up to about 10 cm long, and 16 liters of larger fragments (up to 15 cm long). Two liters of cedar-type debitage with shipworm damage and a few fragments with insect damage, 1 liter of acacia-type fastener fragments (tenons), 3 liters of cedar-type timber fragments, 1 liter of *Ficus sycomore*-type fragments, and 1 liter of box fragments also were recovered. The condition of the debitage was, in general, good, but most surfaces were moist and soft, lacking detail due to degradation.

The wood debitage is likely the result of dismantling, cleaning and modification of ship timbers. Only a few fragments retained adze marks and less than ten fragments displayed the red paint marks that we associate with cleaning activities, possibly because of the surface degradation. The debitage is consistent with the size and types of wood debitage excavated in the gallery Entrance in 2005-2006 (Ward and Zazzaro 2010: 30-31).

Trench WG 64 includes hearths, concentrations of organic materials, ship components, stone tools and debitage, pottery, and food remains. In the southeastern section below a thin stratum of aeolian sand, burned sandy soil (SU5) extends over an area 2 m x 1 m, suggesting at least one hearth was here. A ca. 2-liter concentration of reeds and leaves is morphologically similar to the giant reed *Arundo donax*. Located along the northwestern and northern limit of the trench (SU3), the deposit may be the remains of a pallet for sleeping or sitting, or even of rope-making activities (Figure 36). A concentration of gypsum and wood debitage was noted in the north corner of square A1 (SU7).

A tool handle for an adze (W962, Figure 37) discovered beside a collapsed block on the north side of the trench was fashioned on the spot from a bit of local mangrove-type wood and a shipworm-damaged cedar fragment. The handle was found in association with two type 4 fragments of rope (the thicker type of rope found at the site). Barley seeds, insects and a few pottery fragments were also found in WG 64, especially along the southern limit of the trench.

In the southwestern corner, W960, a probable oar loom segment 75 cm long and 5 cm in diameter, was found beneath a layer of rock fall in association with a rope fragment, a retouched stone, and a fragment of a bread mold. W961, a probable oar loom segment 53 cm long and 6 cm in diameter and W963 and W965, probable blade fragments, were found in the center of the trench (Figures 34 and 38).

Discussion

The composition of wood debitage in WG 64 and in the entrance of this gallery differs significantly from wood debitage collected in the contiguous gallery, Cave 3. The surface and upper layer of Cave 3 is characterized by fastener fragments that are larger than those of Cave 2 and include different types, including dovetail tenons. Cave 2 is the source of most of the fragments of oars, found in the disturbed area in Room 1 as well as throughout WG 64. The two galleries likely were in use at different times.

In addition to the gypsum deposit in WG 64, a spill of gypsum plaster has been found in Cave 3 and there are gypsum traces on the outer face and filling gaps in disused mortises in some ship planks found at the site. Ethnographic studies in the southern Red Sea indicate that gypsum mixed with animal lard is used to protect exterior hull planking even today. The gypsum on planks and in the galleries may reflect similar use, but additional testing to identify a binder such as animal fat is required.

Trench WG 64 represents a single human occupation phase. Wood debitage, fragmentary oars, gypsum remains and the adze handle attest to woodworking as the primary activity in this area, almost certainly ship dismantling and the subsequent modification of ship components. The discovery of a thick layer of leaves, reeds and seeds suggests that Room 2 was also a living area where food processing and/or food storage occurred, supported by the burned area we believe indicates at least one hearth.

The finds in WG 64 demonstrate continuity with the early 12th Dynasty occupation level previously identified in the gallery's Entrance Corridor. As there is a single occupation phase, we suggest that the collapse of large sections of the gallery's walls and ceiling probably isolated the entrance of the gallery from the rest of the space in antiquity and that WG 64 dates to the early 12th Dynasty.

The Stratigraphic Units were:

SU1: surface layer including collapsed blocks and aeolian sand. SU1 covered SU2, SU3 and SU7.

SU2: wood debitage layer concentrated in the center of the trench and extending below gallery collapse. SU2 finds included an adze handle, five probable oar loom and paddle fragments, and cordage. This stratum was under SU1, above SU4, and it was contemporary with SU3 and SU7.

SU3: concentration of reeds and leaves with a few ceramic sherds, wood debitage and rope fragments extending along the western and northwestern limit of the trench. SU3 was under SU1, above SU4 and contemporary with SU2, SU3 and SU7.

SU4: sterile sandy soil extending all along the trench. SU4 covered SU6 and was under SU2, SU3 and SU7.

SU5: sterile sandy soil with traces of burning extending ca. 2 m by 1 m in the southern part of square B1, probably a hearth area. SU5 was beneath SU1, above SU6 and contemporary with SU4.

SU6: gallery floor, characterized by bedrock, small rocks and pebbles. This stratum was below SU4.

SU7: concentration of gypsum. SU7 was below SU1, above SU6, and contemporary with SU2 and SU3.

WG 32: the ship timber deposit

Excavation unit WG 32 was first opened south of the entrance to Cave 2 in 2005-2006. Investigations were resumed in a 6 m x 12 m area of the excavation unit in 2006-2007 (Calcagno and Zazzaro 2007). In 2007-2008, the aim of excavation in WG 32 was to better define the three different occupation phases identified by Andrea Manzo in 2006-2007 (Fattovich and Bard 2007: 18-19; Calcagno and Zazzaro 2008). The latest occupation layer was characterized by scant archaeological material and represented a period of abandonment at the site during which windblown sand and leaves accumulated. This phase may date to the early New Kingdom, on the basis of an associated potsherd found in WG 53.

The latest phase overlies an earlier level characterized by artifacts including complete hull plank T34, inscribed stelae, clay sealings, about 40 complete or fragmentary wooden boxes (two of

which had painted inscriptions), ceramics, and about 50 shallow ration bowls (complete and fragmentary). Texts painted on the small wood boxes date this level to the reign of Amenemhat IV (ca. 1797-1790 BC) (Fattovich and Bard 2007: 47-48). The entrance to a gallery (Cave 6) in the southern section of WG 32 represents the earliest level attested in this area to date (see Bard and Fattovich 2007: 60-61). Plank T34 (3.29 m long, excavated in 2005-2006) almost certainly belongs to the timber deposit as its tip was in the gallery entrance, and its longitudinal axis was precisely aligned with those of the ship components below it (Ward 2009; Ward and Zazzaro 2010).

The 2007-2008 field season noted the components beneath a heavy layer of salt concretion (SU38) at the entrance to Cave 6 in association with two walls in squares B5 and C5 (Bard and Fattovich 2008). Recognizable among these timbers was the upper portion of a steering oar blade (T72) similar in form and wood type to blades T1 and T2 recovered from Cave 2 in 2004-2005 (Zazzaro 2009: 3-8). Excavation was postponed until timber conditions could be further assessed.

In 2009-2010, this area was re-investigated with the assistance of project conservator Howard Wellman. The excavation focused on a timber deposit beneath the salt encrustation (T86, T87, T88, T89, T90, T91, T92 and T93) and two steering oar blades (T72 and T85) from a single steering oar (Figure 39). The blades are remarkable for their size, measuring ca. 3.25 m and 4.20 m in length. They are in a context of reuse, and lie parallel to one another at the bottom of the timber deposit.

The lower ends of blades T72 and T85 lie under T9 below cedar hull plank T93, 1.0 m below the ceiling of the entry to Cave 6. T93, fragmentary and in extremely poor condition now, was laid across the entry, perpendicular to the axis of the timbers in the deposit. Each end of the plank lay beneath a mud-brick wall on either side of the entrance, about 80 cm below its ceiling.

The blades are extremely fragile. Heavy salt encrustation covered the upper portion of the blades while the wide, lower ends show significant damage from shipworms and later, insects. They are almost triangular in shape, with rounded edges and external surfaces. A recess around each upper blade probably was for material used to bind the blades to the loom. Both blades have holes passing through the upper portion, probably for cordage that secured the steering oar to the hull.

T72 and T85 are approximately twice the size of steering oar blades T1 and T2 found in Cave 2 (Zazzaro 2009: 3-8). Mortise-and-tenon joints along the inner edge of each blade originally fastened each blade to a central loom of a single oar. The two blades appear to have been dismantled by cutting the tenons. The longer blade, T85, has paired mortise-and-tenon joints along the edge where it was connected to the loom and two holes for the rope that attached it to the hull.

The oar's original fastenings also included copper strips, since copper traces remain in some mortises cut through the thickness of the lower blade. The pattern of copper corrosion products suggests that strips were used as ligatures protecting or reinforcing mortise-and-tenon fastenings and to fasten the blades to each other and to the loom.

T86, a reworked Type 4 plank, lay on the south side of T72. T87, T88, T91 and T92 lie between the two blades. T89 lies beside T72 while T90 lies beneath T72, and both are parallel to T72. The parallel arrangement of all these timbers suggests that they were placed there at the same time. Several of the timbers have a half-round cross section, but identification and detailed recording awaits removal of the salt encrustation that obscures them.

In addition to ship timbers, a few sherds and clay sealings were found along the south side of the deposit and near the gallery entrance and await further study. Ship components were recorded and consolidated, and most were left in situ for further conservation.

Discussion

Because most of the timbers described in this deposit remain obscured by heavy salt encrustation or in situ, it is not possible to provide a firm interpretation of its context. The alignment of the steering oar with its 4.2-m-long blade at the opening to Cave 6 may indicate that it functioned as a ramp like smaller timbers outside Caves 3, 4 and 7. The oar's lower end is lower at the gallery entrance, yet the function of T93 in its position of reuse is unclear. Although the steering oar blades quite clearly

angle down beneath it, anyone approaching the open gallery would have to step up and across this c. 14-cm-thick and 30 cm wide plank. If T93 is part of the entrance closure, its position makes more sense, but additional recording is needed to determine how the ancient Egyptians laid out this area. An additional problem with the interpretation of the oar as a ramp is the large number of smaller pieces piled on top of it, and carefully aligned with it, including the complete plank T34 and approximately 40 boxes excavated in 2005-2006.

Tenons in the steering oar blade are the same size as those in WG 39, next to plank segment T64 in Cave 3, and suggest that the two are related.

Re-evaluation of T64[44]

At Mersa/Wadi Gawasis, the remains of large ships in the form of hull planks 14-22.5 cm thick exhibit classic Egyptian hull construction techniques documented on rivercraft (Ward 2000, Ward and Zazzaro 2010). Planks for smaller vessels utilized a previously unrecorded system of hull fastening relying on small mortise-and-tenon joints augmented by a sewing system that is the oldest example of construction techniques more frequently associated with the Indian Ocean and Persian Gulf.

Because all the Mersa/Wadi Gawasis timbers show a degree of consistency across fastening dimensions, spacing, and proportions, and are in the context of reuse or storage, it is particularly difficult to assign individual timbers to an individual ship. T64 and the deposit of steering gear outside Cave 6 offer a significant exception to that problem.

Excavated and briefly examined in 2006-2007 (Calcagno and Zazzaro 2007), T64 is a segment of a strake fastened to the keel and positioned at the waterline substantially reduced from the original Type 2 hull plank and now 106 cm long, 50.5 cm wide and 22.5 cm thick (Figure 40). This massive plank segment in good condition was placed into mud plaster along the edge of Cave 3. Sediment around T64 included a short rope noose with a frayed knot, a sandal sole, and part of a tenon.

Fastenings on T64 include deep mortise-and-tenon joints, some of which are locked, dovetail fastenings, and ligatures for copper strips. The size of the mortise-and-tenon joints (tenons 45 cm long) corresponds to loose tenon fragments on the surface of Cave 3, but is twice that recorded for any other Egyptian example.

A 9.5-cm-wide ligature channel for copper strip bindings is cut from the IF to the OF between two pairs of mortise-and-tenon joints along the inboard edge. A recess on the outer face extends about 8.5 cm from the inboard edge and copper stains indicate five 2.2-cm-wide strips passed through the 1.3-cm-thick channel. A second channel intersects the IF-OF channel. Aligned with M8 and M10 on the inboard edge, the channel angles from approximately 13 cm on the IB edge to about 16 cm above the OF within the channel. Unlike the IF-OF channel, this channel was roughly cut with a blade 1 cm long, possibly cut later to provide access to the ligature or for a wooden chock as no copper corrosion products are present on its surfaces.

Discussion

Plank curvature, water staining, distribution of damage from shipworm, and fastening patterns place this piece near the end of a planking strake at the waterline. It is the most robust timber yet recorded from an Egyptian hull in terms of its overall characteristics. Its minimum width is 55 cm, based on projected dimensions.

Additional finds

In addition to the ship timber deposit of WG 32, the recording of T64, and the excavation of WG 64, archaeologists throughout the site identified T80 (the remains of a type-2 hull timber used in a hearth on the edge of the ancient lagoon); and T81 (type 4), T82 (type 3), T83 (type 4), and T84

[44] Much of this section was first published as C. Ward, C. Zazzaro and M. Abd el-Maguid, "Super-sized Egyptian ships," *International Journal of Nautical Archaeology* 39.2 (2010) 387-389.

(type 3, recut from type 2) from WG 65, B2, SU 2: all short segments of flat planks reused as part of the floor in this structure outside Cave 8. T94, a very small deck plank, was found in WG 65 A2/3-B2/3, SU27, the hearth outside Cave 8. T95, another deck plank, was found outside the entrance to Cave 8 in WG 61, C4, SU27. T96 is a fragment 30.5 cm long or a stanchion or stake from WG 61, D2, SU45, and T97 is a small piece of a deck plank from WG 39 in Cave 3. Tool handles T98-101 provide an intriguing look into technology and making do with available materials. Fragments of oars from WG 64 (W960-W965) will provide continuing data for research into auxiliary equipment for the ships of Mersa/Wadi Gawasis. Each of these finds is described in detail in the following catalog.

Conclusion

The 2009-2010 field season provided significant new information about gigantism in Egyptian ships, the chronological links between different parts of the site, and fragments of auxiliary pieces poorly represented in earlier seasons. Continuing study of timbers previously excavated, and the documentation of those found in 2009-2010, helps to refine our understanding of the site and the ships it supported.

Catalog of Hull Timbers

T61 (re-examined)
WG 39, Cave 3, A9-B9, SU18
Type 2 hull plank, reworked
L 230 cm (exposed length)
Max W 24 cm
Max Th 8.5 cm
Cedrus libani

Description: This plank was fixed across the width of Cave 3 along the northeast boundary of the entrance to Cave 3 from Cave 2. I61 was connected to plank segment T64 by mud plaster and likely was part of the permanent structure of the gallery. Its ends extend beneath two mounds of wall and ceiling fall and have not been recorded. T61 lies over a level of fall from the ceiling in antiquity and a human occupation level characterized by the remains of hulled barley with insect damage, wood debitage, marine shell fragments, shipworm tunnel lining fragments, cordage, sherds, and textile fragments, including one partially attached to Edge 2. Salt encrustation is present on the plank edges, and the western end of the plank shows severe teredo damage.

The exposed portion of the plank is in good condition although the upper surface, as found, deteriorated quickly when exposed. A knot about 10 cm in diameter is present on the upper surface. Only the eastern end of T61 was uncovered; it tapers from 7.5 to 2 cm wide at its tip, much like hull plank T34. The plank has been reworked, split longitudinally to remove the outer face and trimmed to remove its original edges almost entirely before it was installed in Cave 3. It remains in situ.

Fastenings: A mortise, a rectangular cavity, and two pegs are the only fastenings remaining on the exposed portion of T61. Mortise 1 (17 cm long, 10.5 cm wide and about 1 cm deep) is on the plank's lower surface as found. A 2-cm-deep rectangular cavity measuring 5 cm by 6.5 cm on the upper surface at the west end near the south edge of the plank resembles holes for stanchions on the inner face of Dashur boat planks.

Two pegs pass through the thickness of the plank and measure 1.7 cm and 2.4 cm in diameter. They are not associated with other fastenings.

Toolmarks: The rectangular hole has chisel marks surrounding it. A number of adze marks (2, 4 and 5 cm long) are present on the plank surface, and two triangular tool marks (c. 2 cm long) were also noted.

T64

WG 39, Cave 3
Type 2 hull plank segment
L rem 106 cm
W rem 50.5 cm
Th 22.5 cm
Cedrus libani

Description: This massive plank segment in good condition was near the wall of Cave 3 and its south end was attached to plank T61 by mud plaster. Clearing dirt around the segment to prepare it for moving exposed a short rope noose with a frayed knot, a sandal sole, and part of a tenon. On the OF (the lower surface as found) on the IB plank edge, a shipworm-damaged fragment of about 30 cm spalled off (T64.2). Bits of rope and string abound near the plank; it was set into a 1-cm-deep layer of mud plaster.

T64 is roughly trapezoidal in shape, and the ends were sawn, chiseled and adzed apart from adjacent plank segments at an angle of approximately 60 degrees to the wide faces. Angles of dovetail mortises to adjacent plank positions and patterns of shipworm damage and staining indicate that this likely is part of a ship's plank in the area of the waterline. The size of the mortise-and-tenon joints corresponds to loose tenon fragments on the surface of Cave 3; complete tenons likely measured 45 cm in length.

The OF is identified by the presence of shallow shipworm tunnels and holes at End 1 and along the IB edge. It exhibits a gentle curve from edge to edge. This surface is now brittle with insect damage and termite tunnels visible all along it and on the plastered IB edge. The relatively limited amount of shipworm damage on the OF suggests it was either out of the water or that damage was trimmed off prior to placement as a work bench. A 12-cm diameter knot preserves the original surface near End 1.

The IF is smoothly finished, but has the remains of use as a work area in the form of many long marks across its surface, as well as the remains of original dubbing marks.

The OB edge shows dubbing marks across its surface, and has a series of adze marks at about 45 degrees to the wide faces near the IF. These probably represent removal of a damaged surface during disassembly and reworking.

The IB edge has gribble and teredo-type damage visible to 4.5 cm from the OF near End 2 and less than 2 cm from the OF at End 1. A dark stain crosses this edge at an angle of 22-24 degrees from the OF to the IF. It appears to be indicating the waterline as it corresponds to the degree of teredo damage, permitting an identification of End 1 as that part of the plank closest to the end of the ship, though it is not possible to tell if it is the forward or aft end. A modern 2.2-cm-diameter hole has been drilled through this edge for dendrochronological sampling.

End 1 (furthest from midships) is relatively evenly cut, while End 2 (closest to midships) changes angles sharply near the IF and has heavy chisel, saw and adze marks over its surface. Both ends seem to have been cut from the OF toward the IF at an angle and then sawn at approximately 90 degrees from the IF to meet the saw cut, which in each case was approximately 15 cm long.

Fastenings: Deep mortise-and-tenon joints, locked deep mortise-and-tenon joints, a ligature for copper strips, and dovetail tenon mortises are present on T64. On the IB edge, two pairs of mortise-and-tenon joints (M7 & M8, M9 and M10) are spaced approximately 33 cm center-to-center at 7.5 and 9 cm from the OF. The mortises measure approximately 10.5 cm wide, 2.25 cm thick, and 28-29 cm deep. On the OB edge, two pairs of mortise-and-tenon joints (M3 and M4, M5 and M6) are locked by 2-cm-diameter pegs 9.5 cm from the OB edge that were driven from the IF. The pegs pass through both tenons in each pair. Tenons 3 and 5 were extracted to discover whether the peg passed through both tenons. The tenons were cleanly sawn at their midpoint on the plank edge. About 25 % of Tenon 3 was insect frass, but the rest was very hard and fit so tightly in the mortise that the tenon had to be broken to remove it. Tenon 5 was about 50% frass on its outer edges, but still close fitting in the central portion. Mortise dimensions are comparable to those on the IB edge.

A ligature for copper strip lashings is located between the tenon pairs on the IB edge. The 9.5-cm-wide ligature channel is cut straight through the plank thickness. It is located in a recess on the OF that extends about 8.5 cm from the IB edge. It is about 1.3 cm thick and copper corrosion products indicate five 2.2-cm-wide strips passed through it. A second channel intersects it. This channel is in line with M8 and M10 on the IB edge. It is angled from approximately 13 cm to about 16 cm above the OF within the channel. It is roughly cut with a blade 1 cm long, and may have been for access to the ligature or for a wooden chock, as no copper corrosion products are present on its surfaces.

The dovetail mortises are original features of this plank, as suggested by the original evaluation of the plank in 2007. On the IB edge, the bottom of the mortise is at 89 degrees to the edge, indicating a relatively flat transition to the adjacent plank, almost certainly the keel. The OB dovetail mortise angle is 98 degrees to the edge, indicating a rising hull curvature at that point. The mortises each have pry marks.

Toolmarks: On the OF, some dubbing is visible, but no individual marks are identifiable. A few gouges from a chisel are present near End 1. Deep and extensive saw, adze and chisel marks are present on End 2 and End 1. Where the IB edge meets End 1, three gouges surrounded by tearing along the grain contribute to understanding the reduction process.

T66
WG 39, A10, SU 20
Type 1 beam, reworked
Exposed L 120 cm
W rem 20.5 cm
Th rem XX cm
Cedrus libani

Description: Beam T66 was uncovered in 2006-2007 and reported then as a plank. It lies about 2 m from and parallel to T61, near the front of Cave 3. Review of the timber in 2009-2010 shows that it is a heavily reworked beam. Edge 2 and the pedestal between the ledges were almost entirely removed, probably to make a smooth walking surface. The remaining ledge is approximately 5 cm wide, and the original pedestal width was 13-13.3 cm, suggesting an original width of approximately 23 cm.

Beam end 1 is curved more sharply on one edge than the other, like beam T32, and it has a 4 x 4 cm hole centered in its width to permit it to be attached to the hull. A groove from beam end to the edge of the hole was made during disassembly, as it is torn along the edges. A hole with two levels is centered at the beginning of the pedestal area. It has a recess 4.5 cm deep (5 x 4 cm) and passes entirely through the beam in the adjacent hole (5 x 5 cm). On Edge 1, a mortise 3 x 2.2 cm extends about 7 cm into the beam edge.

Deep adze marks, 4.2 cm long, are present across the surface and along the ledge. The lower surface and End 2 are inaccessible, as the beam remains in situ.

T72
WG 32, B4-B5, SU33 (2009-2010)
Type 5, steering oar blade
L 325 cm
W ca. 65 cm (exposed width)
Th 20.5 cm
Faidherbia albida

Description: Steering oar blade T72 has an almost triangular shape, with rounded external edges and corners, a 9-cm-diameter hole through it for a rope line to attach it to the ship, and a slight

groove around the upper end. The blade is fragile, as the upper part was covered by salt encrustation, while the remaining lower part is heavily eroded, ruined by shipworms and insect damage.

Only the upper face as found and the two edges were recorded. The inner edge is concave in shape in order to receive a central loom. A single mortise-and-tenon fastening has been located on the inner edge; it joined the blade to the loom but likely was not the only joint to do so. The blade appears to have been dismantled by cutting the tenon that originally connected the blade to the loom.

Fastening: Only one mortise and tenon fastening was recorded. M1 measures 18.7 cm deep, 9 cm wide and 1.7 cm thick.

Four ligatures in the lower portion of the blade and the remains of copper strips in them fastened the blades to each other and to the loom and may have reinforced the mortise-and-tenon joints. The channels are approximately 10 cm wide and 2 cm thick. They pass completely through the blade.

Toolmarks: Saw marks are visible on the outside of the upper end of the blade.

The blade is in situ.

T79 [formerly W294]
WG 32, C5, SU25
Type 2 hull plank fragment reused as a wedge
L rem 56.5 cm
Max W rem 3.5 cm
Max Th rem 9.4 cm [in original orientation]
Cedrus libani

Description: This plank fragment is split out of a type 2 hull plank. As drawn, the only face is the original plank edge; most of this face has OS, and a small area of OS remains on Edge B. A charred mark and several adze marks from blades 2.5 cm long are present. In good condition other than insect damage on Edge B, T79 has polish on its rounded and narrowest end from wear, suggesting its use as a wedge. A single mortise of minimum width 6 cm is present.

T80
WG 50, SU3
L 330 cm
Max W 47 cm
Th rem 2 cm

Description: Probable Type 2 hull plank, knife-shaped, burned and calcined. Almost no wood remains, but hardened sand preserves the shape of the plank in a layer a few mm to 10 mm thick. Several areas of more solid wood remain, and a tenon (T84) was recorded, but no wood identification was possible.

The shape of the find and the presence of a tenon suggests this is a hull plank. Two other patches of burned wood (W900 and W901) within less than a meter may be part of T80. Grains of a cereal, probably barley, are present in the center of the plank where the thickest wood remains were recorded.

Several other fused deposits of charred wood and sand (W903) are recorded from other parts of the site, and it seems likely this feature was created by an entire plank being lit on fire and used, at least in part, to prepare food or dispose of rubbish. This feature remains in situ.

T81

WG 65, B2, SU2 (top) upper interface with SU1
Type 4 plank reworked from Type 2 plank
Max L rem 42.5
Max W 8 cm
Max Th 4.3 cm
Cedar-type

Description: A small mortise, a peg hole, and two patches of the black pitch-like material on its outer face identify this timber in good condition as a fragment of a Type 4 plank. It is salt stained and bleached, with some post-depositional insect damage. The ends of shipworm tunnels and a 4.3-cm-long adze mark beside them indicate that it is constructed from a reworked Type 2 plank. There is a 1.3-cm knot hole at End 2, which is eroded. Edge B is torn and broken, with no original surface remaining. The grain runs parallel to plank edges in End 1; End 2 is virtually non-existent.
Fastenings: A mortise 5 cm wide narrowing to 2 cm at its base and 4 cm deep is present on Edge B. On Edge A, half a drilled hole 1.4 cm in diameter remains.
Tool marks: The surface is adzed but not smooth; dub marks are present on Edge A and on the OF.

T82
WG 61, D2-3, E 2-3, SU19
Type 3 deck plank found beside T84
L 80.5 cm
W 26 cm
Th 6 cm
Cedrus libani

Description: The deck plank is heavily eroded on its upper face, but the remaining wood is in good condition except as noted. Its roughly sawn ends are in poor condition, with large cracks and eroded areas running along grain lines in the length of the plank. Thirty cm of Edge A crumbled upon exposure, but the beveled angle typical of deck planks is present on both edges. Edge B is poorly preserved.

The surface of the plank is heavily eroded on its upper face, which is preserved to 0.5 cm in a few areas with significant series of blade marks in various directions covering the surface. In its in situ position, it lay flat and had mud plaster remains on its upper surface. About one-third of its original upper surface remains. Its lower face was covered by fine pebbles, straw, and other plant materials in a salt encrustation matrix.

Portions of this plank were cut away to permit it to be fit around obstructions such as rigging lines. Symmetrical curves are present at each end. Each end has an angle of about 105-110 degrees transitioning to a ca. 70-degree arc.
Tool marks: Copper traces are present near End 2 in torn grain, likely from a tool. Heavy adze marks 2-4.5 cm long cover much of the preserved area of the lower face; heavy dubbing around a spike knot preserved adze marks of a blade 3 cm wide.

T83
WG 61, D2-3, E2-3 SU19, found on north side of T84
Probable Type 4 plank
L 67 cm
W 31 cm
Th 3 cm

Description: Extremely poor condition and heavily damaged by termites, the plank was almost entirely converted to frass. It fell apart upon excavation except for about 3-4 cm along its NE edge,

where part of the lower surface as found had been protected by a black substance up to 15 mm wide. The black substance has only been found on Type 4 planks, suggesting T83 was probably one as well.

T84
WG 61, D2-3, E2-3, SU19, found between T82 and T83, LF uppermost
Type 3 deck plank, recut from Type 2
L 69.5 cm
W 29.5 cm
Th 4.5 cm
Cedrus libani

Description: T84 is in good condition with a light salt encrustation over most of the surface, except at Edge 2, which is insect damaged. The beveled ends are clear, and begin about 7-8 cm from each end. A central spike knot on the UF is more than 20 cm long.

The UF/Edge A boundary is rubbed and worn down at grain along the upper face, suggesting a tight fit.

Tool marks: Saw marks over a spike knot are visible across the plank surface and are overlaid by dubbing marks and larger adze bites from a blade 4.3 cm long, especially over two knots on LF near Edge A.

A central panel of incised marks is present on the LF about 8-10 mm above the torn Edge B around the knot at 30-40 cm from End 1. The marks were cut for efficacy rather than beauty. The marks of the cross are 4.3 cm long and may be the adze documented on this and other planks, as there are no chisel marks inside the lines and the cross bar tapers toward each end, as it is deepest toward the center. A U-shape and two additional lines have four parallel bars.

The original UF was placed down into a layer that became hard concretion with pebbles about 1 cm in diameter and had bits of desert debris and straw stuck to both faces. No plaster was recorded on the wide surfaces, but is noted at both ends and edges.

T85
WG 32, B5, SU33
Type 5, steering oar blade
L 420 cm
W ca. 85 cm (exposed)
Th 12 cm
Faidherbia albida with *Acacia nilotica* fasteners

Description: This steering oar blade has an almost triangular shape, with rounded external edges and corners, and a slight groove on the top like T72. The blade is fragile: the upper part was covered by salt encrustation, which penetrated the entire surface and created fine cracks throughout the timber, while the lower part is heavily eroded, ruined by shipworms and insect damage.

Only the upper face as found and the two edges were recorded. The inner edge is concave in shape in order to receive a central loom. Paired mortise-and-tenon fastenings in the edge of the blade were originally used to connect it to the loom. Tenons were cut to separate the blade and loom in antiquity.

The original fastenings also included the use of copper strips in at least seven ligatures to protect or reinforce the mortise-and-tenon joints and to fasten the blades to each other and to the loom. The blade has two holes through its upper end to provide passage for lines to secure the steering oar to the hull.

Fastenings: Four paired mortise-and-tenon joints, approximately 10 cm wide and 1 cm thick, were recorded: M1 is 19.5 cm deep; M2/1 and M2/2 are 15 cm deep; M3/1 is 16.5 cm deep; M3/2 and

M4/1 could not be probed for depth; and M4/2 is 10 cm deep. All tenons are ca. 0.8-0.9 cm thick. One fragmentary tenon was also recorded in the lower portion of the blade, exposed to the surface in an open or eroded mortise. The fragmentary tenon measures 10 cm x 6 cm. A peg, 0.8 cm in diameter, was recorded in mortise-and-tenon joint M3.

Two holes in the upper blade measure 10.2 cm in diameter on the upper face of the blade, as found. Hole 1 measures 7 cm in diameter and Hole 2 measures 8 cm on the opposite face.

The seven ligature channels with remains of copper strips are each 10 cm wide and vary in thickness from 2-4.5 cm. They pass through the blade and all have remains of the standard 2.2-cm-wide copper strips for binding.

Toolmarks: Surfaces are very eroded, but some tool marks, probably of an adze, are visible on the inner edge.

T86
WG 32, SU46, found between rudder blades T72 and T85 and above T87
Type 3 deck plank, reworked from Type 2 hull plank
L rem 38 cm
Max W 11 cm
Max th 3.6 cm
Cedrus libani

Description: The plank is in generally good condition, but has an extremely soft surface. End 1 is finished and slightly curved and worn on its wide face. End 2 is broken at the fastenings. Edge B is roughly trimmed; a torn strip left rough edges. Edge A has good original surface preserved, with grain lines running along it. The original orientation of the plank as a hull plank is indicated by the mortise passing through the wide faces of this deck plank, but formerly along a plank edge.

Fastenings: About half of a mortise-and-tenon joint is present in Edge B at End 2; the plank is broken here. Part of a 0.6-cm-thick tenon remains in the 9-cm-deep mortise and the chisel marks that made this mortise are visible in the second mortise. A second mortise 9 cm long and 2.2 cm thick passes through the plank's wide faces. There is a small bit of copper corrosion on this mortise edge that is tool related, not part of the fastening.

T87
WG 32, B5, SU33
L 87 cm
W 11 cm
Th 2.3 cm
Cedrus libani

Description: Plank lying between the upper portions of the two steering oars blades (T72 and T85). The plank was covered by the salt encrustation and the wood condition is poor. Only the upper face as found and part of the edges were recorded. Both ends and edges are eroded. Several small knots are visible on the wood surface. One edge of the plank is beveled.

Fastening: one peg measuring 1 cm in diameter was recorded on the upper face, as found.

Toolmarks: no tool marks are visible on the surface.

It remains in situ.

T88
WG 32, B5, SU33
Type 5, unknown
L rem 52 cm
Max W 5 cm

Max Th 2.3 cm

Description: T88 is a half-round timber lying between the upper portions of steering oar blades T72 and T85. It was covered by heavy salt encrustation, and the wood is in poor condition. Only the upper face as found, and a portion of the edges were recorded. Both ends and edges are finished surfaces. No fastenings or tool marks were recorded.

T89
WG 39, SU33
Type 5, unknown
L rem 85 cm
W rem 7 cm
Th 5 cm
Cedrus libani

Description: This half-round timber lay across the mound near the entrance of Cave 6, beside and parallel to the lower part of steering oar blade T72. The wood is in poor condition and covered by a heavy salt encrustation. Only the upper face, as found, and part of its edges and the ends were recorded. One end is broken, the other end is unfinished, and the upper face had no OS remaining. A large knot was present at one end.
Fastenings: Four mortises were recorded along the timber length; the poor condition of the timber did not permit accurate measurements of the depth, but each was 5-7 cm deep. M1: 8.5 cm x 2.4 cm; M2: 9.6 cm x 1.6 cm; M3: 9.5 cm x 2 cm; M4: 10.5 cm (fragmentary)

T90
WG 32, SU33, beneath T72
Obscured features
Cedrus libani

T90 lies beneath blade T72 and is almost entirely obscured by it. It remains in situ.

T91
WG 32, SU33, between blade T72 and blade T85
Type 5

Description: Found beside T85, T91 is 5 cm above the flat surface of T85 and separated from it by a thin line of salt encrustation. This piece has a flattened, oval-shaped section and lies tilted with its north edge angled down below the IB edge of T72. Its maximum diameter is about 12 cm. It is too small to be a loom, but may be a tiller fragment. It remains in situ.

T92
WG 32, SU33, between blade T72 and blade T85
Obscured features

T92 is almost entirely obscured by salt encrustation and the blades. It remains in situ.

T93
WG 32, C5, SU33 (threshold at the entrance of Cave 6)
Type 2 hull plank
L rem 120 cm
W rem 20 cm

Th rem 6.5 cm
Cedrus libani

Description: This plank is in extremely poor condition, in part because it has been heavily impacted by excavation activities. It lies across the entrance to Cave 6. The west end of the 120-cm-long plank segment extends 23 cm beneath the west mud-brick wall, and the first 15 cm of its east end is set into mud plaster beneath the east wall. Both edges are finished. End to edge angles at the preserved end are 125° and 95°.
Fastenings: Three mortises (M1, M2, M3) pass through the plank, but M4 does not. M1: 12 cm x 3.5 cm; M2: 10 cm x 2 cm; M3: 9 cm x 2.5 cm; M4: 6.5 cm x 1.7 cm and 2.5 cm in depth.
Toolmarks: Some adze marks are visible at one end.

T94
WG 65, A2-3, B2-3, SU27, hearth outside Cave 8
Type 3 deck plank, small size
Max L 47 cm
Max W 14.7 cm
Max th 3.3 cm
Cedrus libani

Description: This small plank in good condition is about 60% of the length of most deck planks. Like other deck planks, its beveled ends are about 12 cm long. End 1, Edge B and part of the lower face are charred for 20 cm near End 1. The grain runs along the plank, but is nearly vertical at the ends. Light dubbing and saw marks are present on the ends and edges.

T95
WG 61, C4, SU27
Type 3 deck plank
L 49.4 cm
W 27 cm
Th. 5.1 cm

Description: Complete Type 3 deck plank found in front of the entrance to Cave 8. The wood condition is good, but the plank is split near one edge along its length. Both ends are beveled. The upper face is heavily adzed with sharp bites near two knots.
Toolmarks: Face A is heavily adzed, especially at the upper and lower corners. Adze marks are 4.5 – 5 cm wide. Straight knife-type marks are also visible on Face A, in an area 27 cm x 16 cm. Shallow adze marks are visible on Edge 2. Both ends have saw marks.

T96
WG 61, D2, SU45
Type 5 stanchion or stake
L 30.5 cm
W 6 cm
Th 5.7 cm

Description: Square-sectioned timber found outside the entrance to Cave 8. The wood condition is good, but salt concretion obscures much of the surface. The timber appears reworked and there is no original surface. Both ends are finished.
Toolmarks: One face has adze dubbing marks, max 3.4 cm in width, and other toolmarks are present.

T97
WG 39, Cave 3
Type 3 deck plank, probably reworked Type 2 hull plank
L 81 cm
W 13.4 cm
Th 5.7 cm

Description: The deck plank is in very poor condition: the plank is completely eroded and eaten by termites. Evidence of reworking is visible at one end. The other end is broken.
Fastening: A single mortise 7.5 cm wide, 1 cm thick and 7-7.5 cm deep is present on one edge. A peg passes through the thickness of the plank; it measures 1.4 cm in diameter.
Toolmarks: Saw marks are visible at one end.

T98
WG 60, D5
Tool handle, Type 5
L 42 cm
W 3.2 cm
Th 3 cm
Avicenna sp.

Description: The handle is in good condition, tapering at one end with a curve following the grain at the opposite end. The handle is shaved, making its shape roughly octagonal. It was found with T99 and T 100.

T99
WG 60, D5
Tool handle, Type 5
L 45 cm
W 3.4 cm
Th 3.2 cm
Avicenna sp.

Description: The handle is in good condition, tapering at one end to 3.0 x 2.2 cm and a curve following the grain at the opposite end. The handle is shaved, making its shape roughly octagonal. It was found with T98 and T 100. Tool marks suggest the larger end was chopped off; it has a small amount of the black pitch-like substance on it.

T100
WG 60, D5
Tool handle, Type 5
L 50 cm
W 3.5 cm
Th 3 cm
Avicenna sp.

Description: The handle is in good condition, tapering evenly to 3 cm at one end with a curve following the grain at the opposite end. The handle is shaved, making its shape roughly octagonal. The tapered end has a series of indentations over the final 6 cm, suggesting the handle had been used. It was found with T98 and T 99.

T101
WG 64, B2, SU2
Adze handle, Type 5
L 55 cm
D 3 cm
Avicennia marina and cedar-type

Description: This crude adze handle was found in association with the wood debitage in Cave 2. It is the first tool found at the site that can be directly related to ship dismantling activities. Made with opportunistic material, it is not as well finished as contemporary adze handles recorded elsewhere in Egypt (Killen 1994: 21 Fig. 22, and 43 Fig. 50) or three other tool handles from this site. The shape and the characteristic inclination of the blade toward the handle are consistent with other adze handles.

The handle consists of two parts: one is a mangrove branch, a shaved oval/octagon in section, 55 cm long and 3 cm in diameter. The other piece (19.5 cm long and 9 cm wide) is a reworked fragment of a cedar-type ship plank heavily damaged by shipworm. Leather thongs or cordage in a groove originally bound the two parts together. The blade, which was not present, was attached to the shorter piece at a point 5.5 cm wide, suggesting that the adze blade measured roughly the same (Figure 37).

Wood Debitage
W960
WG 64, A1, SU2
Type 5
Round-sectioned fragment, possible oar loom. One end is broken, and the other is finished. It is 75 cm long and 5 cm in diameter (Figure 39).

W961
WG 64, A1, SU2
Type 5
Round-sectioned fragment, possible oar loom, partially eroded with one finished end. It is 53 cm long and 6 cm in diameter (Figure 39).

W963
WG 64, A1, SU2
Type 5
A slightly convex fragment of Nile acacia-type wood measuring 43 cm long, 9 cm wide and 1.7 cm thick. The dimensions and convex shape of this piece suggest that it was an oar blade (Figure 39).

W964
WG 64, A1, SU4
Type 5
Wood fragment with pointed end, pentagonal in section, 23 cm long and 7 cm wide (Figure 39).

W965 (2 pieces)
WG 64, SU2
Type 5
Possible oar loom segment with a round section 5 cm in diameter and 6.8 cm long. Both ends are damaged.

A second element is slightly convex and measures 23 cm long, 6 cm wide and 3.5 cm thick. The shape of this piece suggests that it may be an oar blade fragment (Figure 39).

Archaeobotany

Ksenija Borojevic and Rainer Gerisch

Plant Remains

Ksenija Borojevic

Methods

During 2009-2010 field season, the author spent two weeks at the Mersa/Wadi Gawasis site. In total, 57 archaeobotanical samples were analyzed, equaling 8980 ml (ca. 9 liters) of soil. Thirty-eight samples (1200 ml of soil) had been collected during previous field seasons from Excavation Units WG 32 (in 2006), and WG 33, WG 46/47, WG 55 and WG 56 (in 2008), when plant material was mostly hand-picked where visible. During the 2009-2010 field season, 17 samples were collected (5650 ml) from WG 61/65 and WG 67. Soil samples (mostly sand) were dry sieved using four geological sieves (mesh aperture 0.25 mm–2.00 mm). The volume of soil samples ranged in size from 40 ml to 1500 ml (1.5 liters). Plant remains were preserved as desiccated and charred (carbonized). Wood and wood charcoal was studied separately by Rainer Gerisch.

The identification was based on the morphological characteristics of plant remains using a microscope at the site and later from photographs taken during the analysis. Victoria Sheridan, undergraduate student of Archeology at Boston University (financed by the Undergraduate Research Opportunity Program 2010) helped with the data entry and writing of this report.

The results of archaebotanical analysis are presented in Table 1 and are discussed below by the Excavation Units from which samples were taken.

Results

N=number of samples taken and analyzed
vol (volume of soil/sand dry screened) ml

WG 32, A4
N = 1, vol = 1200 ml
A sample (1200 ml) collected in WG 32 in 2006 was analyzed in 2010. This sample consisted of burnt sand. It contained only two charred *Hordeum vulgare* grains and three pieces of cereal kasha made of barley. A single burnt 1-cm rope fiber was also found. Other fibers included two small linen strings. Two fish vertebrae were also in the sample.

WG 33
N = 4, vol = 550 ml
This Excavation Unit included Fire-pits 1, 2, and 3 and Hearth 3. One sample was collected from each fire-pit during the 2007-2008 field season. One tenth of the volume of each sample was further analyzed in 2009-2010 (Fire-pit 1 = 50 ml; Fire-pit 2 = 250 ml; Fire-pit 3 = 250 ml). In sum, the samples were dominated by small wood charcoal pieces (440 ml) and by charred barley grains (90 grains of hulled *H. vulgare.* Fire-pit 1 (ca. 20 cm in diameter?), like WG 32, contained barley kasha (three pieces), a large, salt-sand incrusted piece (ca. 10 cm), incorporated wood charcoal remains, twigs, charred barley grains, and a snail. Another single plant fiber and one internode stalk also were found in the same trench.

WG 46, E3, D2, D4
N = 4, vol = 180 ml

From WG 46 (Fire-pits 4, 5, 6, and 7), four samples were collected (180 ml) and contained only wood and charcoal pieces and some unidentifiable small animal remains (e.g., skin with scales).

WG 47, A2-3
N = 3, vol = 400 ml
WG 47 contained mostly wood charcoal (100 ml) and sand. A few fish bones were found in Fire-pit 2.

WG 55, C1, 2, 3; C1-2-3; D1-2, 3; E1-2-3
N = 24, hand-picked
Twenty-four hand-picked samples were collected from WG 55 in January, 2008. They were the most prolific and diverse samples of plant material. The most common plants in WG 55 were desiccated figs (*Ficus sycomoros*). Sycomore fig fruits (84) were rather small (1–2 cm) and immature (Figure 41 A). There were fragments of *Acacia nilotica* fruits (6) and a single specimen of *Balanites aegyptiaca*. A single possible capsule with no internal divisions (similar to a poppy capsule from the outside but hollow on the inside) was found in Square C2 (Figure 41 B). Three as yet unidentified seeds/achenes, ca. 7 mm × 4 mm large, with three discrete ridges (similar to *Carthamus* in shape and size but without pappus attachment scar) were recovered from different squares of the excavation unit. One of these seeds was found within the capsule (above) along with some sand, but it is likely a secondary intrusion in the capsule. There were many leaves of *Avicennia marina* (over 350 ml). In Square E2 "brushes," sheaths of monocotyledon plant likely of *Desmostachya bipinnata* (ca. 20 cm long) were found in SU5. A 5 cm long chip of Lebanese cedar (*Cedrus libani*) was also found in Square E2. From Square E3 a base of garlic with rootles was recovered.

There were many animal remains in this excavation unit. Several kinds of insect remains, including a wasp cocoon, the head of a Tenebroid type, and elytra (part of the wing), were found. Mammal excrements (coprolites) of cf. mice, ovocarpine herbivores, and of a larger herbivore (possibly a donkey) were found as well. The large coprolite was full of desiccated barley chaff.

WG 56**,** A3, E2
N = 2, handpicked
WG 56 is adjacent to WG 55. Two fruits of doum palm (*Hyphaene thebaica*) were collected from this trench (Figure 41 C). Fruits were desiccated and partially preserved, including a decomposing woody endocarp, which is otherwise hard. No white hardy seed was found inside. One fruit was almost whole (ca. 6 cm long and 4 cm in diameter); the other was eaten by insects. (A similar but hard woody endocarp of doum palm bearing rodent tooth marks was found in Cave 3.) In addition, two pieces of *Ficus sycomoros* fruit and one piece of *Acacia nilotica* fruit were collected.

WG 61
N = 9, vol =4350 ml
WG 61 in front of Cave 8 mostly contained remains of charred barley grains and some emmer grains. It is interesting that from WG 61, B2-3, Fire-pit 12/SU30 located in SU20; and WG 61, D2-3, E 2-3/WG 65, A2-3, SU19, Fire-pit 10/SU26, both desiccated and charred remains were recovered. Charred *Hordeum* grains (6) were accompanied by desiccated spikelets (23) and rachises (2). Two charred *Triticum dicoccum*, two desiccated spikelets, and one piece of chaff were also found. Nine fine fibers and a small piece of linen rope were found in WG 61, B2-3, Fire-pit 12/SU30. One of the fibers was woven; eight fibers were burnt. Monocot leaves from a reed were found in Square B2-3. Two small pieces of desiccated cedar were also found.

From B2-3, C2-3 SU21, a single fully developed fruit of desiccated fig (*Ficus sycomoros*), ca. 2 cm, was recovered together with four *Avicennia* fruits, leaves, and fragments of *Balanites aegyptiaca* fruits. Two desiccated garlic bases were found in the same unit, still with the skin and

rootlets (Figure 41 D). Additionally, two garlic rootlets were recovered from WG 61, D2-3, E2-3/WG 65, A2-3, SU19 and three more from WG 61, D4, E4/WG 65, A4, SU32. In total, seven garlic rootlets were recovered from this trench. An unknown seed/achene was found on the border of WG 61, D2-3, E2–3/WG 65, A2-3. Three seeds of the same type were found in WG 55 (see above).

A sample from WG 61, D1, E1, SU28, debris from Cave 8 (750ml), contained no charred or typical plant remains except for desiccated aquatic plant specimens that are identical to the ones washed from the Red Sea on the present-day beach (e.g., five dry, empty, round fruit-like skins and plant seeds that were three-sided and spongy like leaves). Similar aquatic plants and *Avicennia* leaves were found from WG 61, D2-3, E2-3. It seems that this unit contains much eolian sand together with mangrove leaves and sea plants. Twenty seeds of the salt tolerant shrub (*Nitraria retusa*) were found near a fire-pit in WG 61, D2-3, E2-3, SU7. Seeds of the salt tree were also found in Cave 3 in previous field seasons, but they lacked the nutritious endosperm, which had been consumed by pests (Borojevic et al. 2010). From WG 61, D2-3, E2-3, SU19, a "lump of resin" ca. 2 cm wide and 4 cm long, was collected (Figure 41 E)

In the entrance of Cave 8, WG 61, E1, SU28, a piece of a woven linen fabric (ca. 6 × 3 cm) with a grey "coating" (possibly mud) was found. The coating (0.5-mm thick) adheres very closely to the fabric and does not seem to be very brittle, but more like glue.

Animal remains from the trench included a piece of animal long bone, several other smaller fragments, and a crab-like claw. Snail shells were also present.

WG 65, A2-3; WG 61, D2-3, E2-3; C3-4, D3-4, E3-4, E4
N = 8, vol = 1300 ml
WG 65 is adjacent to WG 61. This trench had the most overall plant remains. Only a few samples were analyzed, but a large number of samples were collected that contained a large quantity of charred barley seeds and were left at the site in Fire-pit 15, SU2 (located in WG 65, C3, SU36; Figure 42). From eight analyzed samples, there were six whole charred *Hordeum vulgare* and six charred *Triticum dicoccum* grains. *Hordeum* was by far the better represented. In addition to the whole grains, there were 35 fragments and three bulgar-like (cut for porridge) pieces. In addition, there were seven desiccated *Hordeum* spikelets and approximately 28 desiccated rachises. Three rachises were found charred.

Fruit and other samples from trees were present mostly in Squares A2-3, consisting of one *Ficus sycomorous* fruit and one whole and 19 fragmented *Ficus* seeds. The genus *Avicennia* was also well represented with six fruits and a large quantity (ca. 500 ml) of leaves. Other tree fragments included one *Balanites aegyptiaca* fruit. Two pieces of fruit-type thin shell could not be identified any further. Other plant materials included one desiccated garlic base with rootlets.

Monocots were attested to by 23 plant fragments. From WG 65, A3, SU27, a piece of woven mat, which was made of monocotyledon plant fibers and tied with a rope made of flax, was found together with two long desiccated brush-like sheathes of *Desmostachya bipinnata* (5 cm and 8 cm long). These "brushes" were very similar to the ones recovered from Cave 3. In WG 65, E4, SU27 material from SU33 included several types of plant fibers: a piece of rope ca. 80 cm long, a smaller piece of the same type of rope with a knot, two long stalks probably of papyrus, and two strips of a narrow linen cloth tied in a knot (Figure 43 A). Also in E4 were fibers from the interior of mats made of *Imperata cylindrica* (Figure 43 B).

In the fire-pit, fragments of a clay platter and mud-bricks were found. One piece of a platter (33 cm long) made of unbaked clay had some plants secondarily attached to it. The pieces of mud-brick were made without plant temper. A potsherd made of crude clay was burnt from inside was also found here (WG 65, A3-4, SU2).

Four insect remains were found from WG 65, A2-3.

Summary and conclusions

Due to the extraordinary preservation by desiccation, a variety of plant macro remains were preserved, including seeds, entire fruits, plant fibers, and products made from plant material, e.g., ropes, mats, and linen cloth fragments. The analysis of plant macro remains confirmed that the principle cereals were barley and emmer, as indicated in the reports from previous field seasons (see Borojevic 2007). Charred barley grains are found outside the caves in much larger quantities than emmer, e.g., from fire-pits in WG 33 and WG 65. The charring may represent accidents that happened during the heating of the grains, indicating that those cereals were processed in front of caves. On the other hand, uncharred plant material was recovered from the same units (e.g., WG 65, A2-3, SU19), including hollow emmer spikelets and barley rachises. Numerous fiber plants, pieces of rope, and linen fragments were found in the same trench in addition to seven desiccated garlic base plates with rootlets. Such a diverse composition of charred and uncharred plants indicates different depositional histories (cf. Van der Veen 2006).

Newly opened Cave 8 did not yield any plant material. From the entrance of the cave, some desiccated sea plants were found mixed with mangrove plants, indicting that they were likely blown in when the sea was much closer to the cave entrances.

The plant assemblage collected from WG 55 and WG 56 in the previous field season is dominated by immature sycomore figs and others types of fruits, including two doum palm fruits, one Balanites fruit, Nile acacia fruits, and mangrove fruits. Wood of Nile acacia was commonly found at the site as well as the wood of sycomore fig and mangrove trees (see report below by Gerisch). One garlic base was also found in the same trench.

Particularly intriguing is the discovery from WG 55 of an unidentified hollow capsule resembling a poppy capsule (but without internal divisions) and three unidentified seeds that await further analysis. The capsule, unidentified seeds, and garlic are new taxa at Mersa/Wadi Gawasis.

Although various types of onions were consumed and depicted by the ancient Egyptians, the first archaeobotanical evidence dates to the Second Intermediate Period, according to Cappers (2006) and to the 18th Dynasty, according to Murray (2000). At the Roman site of Beranike, a number of bulb scales and bases were found in trash dumps and, according to Cappers (2006), were cultivated locally. Similarly, at the Roman site of Mons Porphyrites (2nd century AD), desiccated base plates with clove fragments of garlic and skin fragments of onion (*Allium cepa*) were recovered (Van der Veen 2006). It is possible that garlic could have been cultivated locally at Mersa/Wadi Gawasis; the local SCA guard at the site has grown several rows of onions which require water only in the first weeks after planting.

The bases of garlic (*Allium sativum*) from Mersa/Wadi Gawasis are identical to the ones found at Beranike and Mons Porphyrites, but two millennia older. If the Mersa/Wadi Gawasis garlic remains indeed date to the Middle Kingdom, then this garlic is the oldest found in Egypt so far. The new finds of garlic could fill the gap in evidence between the Predynastic clay models of garlic and archaeobotanical evidence from the New Kingdom reported by Murray (2000).

Table 1

WG E.U.	32 Total	33 Total	46 Total	47 Total	55 Total	56 Total	61 Total	65 Total	Grand Total
Volume ml	1200	550	180	400	0	0	4350	1300	8980
Number of samples	1	4	4	3	24	2	9	8	57
Wood charcoal ml	150	441	120	100	0	0	12	20.02	843.02
Hordeum vulgare charred grains	2	90	0	0	0	0	16	6	114
Hordeum vulgare desiccated spikelets	0	0	0	0	0	0	23	7	30
Hordeum vulgare rachis	0	0	0	0	0	0	2	31	33
Barley (cereal kasha) pieces	3	3	0	0	0	0	2	0	8
Hordeum (bulgar)	0	0	0	0	0	0	0	3	3
Triticum dicoccum spikelets desiccated	0	0	0	0	0	0	2	6	8
Triticum dicoccum grains charred	0	0	0	0	0	0	2	0	2
Hordeum fragments	0	0	0	0	0	0	0	35	35
Cerealia fragments	0	0	0	0	0	0	6	0	6

Cereal internodes	0	0	0	0	0	0	2	0	2
Cereals	5	93	0	0	0	0	55	88	241
Ficus sycomoros fruits	0	0	0	0	84	2	1	1	88
Ficus seeds charred	0	0	0	0	0	0	0	20	20
Avicennia fruit	0	0	0	0	1	0	4	6	10
Avicennia marina leaves and branches (volume)	0	0	0	0	3	0	3	5	11
Acacia nilotica fruit fragments	0	0	0	0	6	1	0	0	7
Hyphaene thebaica	0	0	0	0	0	2	0	0	2
Balanites aegyptiaca	0	0	0	0	1	0	4	1	5
fruit skin	0	0	0	0	0	0	0	2	2
Fruit and trees	0	0	0	0	95	5	12	35	147
Allium sativum (garlic) base	0	0	0	0	1	0	7	1	9
Unknown seed (similar to *Carthamus*)	0	0	0	0	2	0	1	0	3
cf. Capsule similar to poppy	0	0	0	0	1	0	0	0	1
Plant mono brushes	0	0	0	0	1	0	0	2	3
Plant fiber fine	1	1	0	0	0	0	9	2	13
Reed	0	0	0	0	0	0	1	2	3
Reeds and grasses	1	1	0	0	1	0	10	6	19
Dry rounded fruit skins (perhaps from sea)	0	0	0	0	0	0	5	0	5
Sea plant like cone like individual	0	0	0	0	0	0	3	0	3
Spongy leaves from sea	0	0	0	0	0	0	0	0	0
Oceanic specimens	0	0	0	0	0	0	8	0	8
Unknown seed	0	0	0	0	0	0	4	3	7
Ancient plant (monocot)	0	0	0	0	0	0	0	23	23
Varia indeterminata	0	0	0	0	0	0	4	26	30
Animal excrement	0	0	0	0	1	0	2	1	4
Insect remains	0	0	0	0	0	0	5	4	9
bone/shell/snail	0	0	0	0	0	0	0	0.01	0.01
stone/soil	0	0	0	0	0	0	0	30.22	30.22
Total	6	94	0	0	99	5	94	156	453

Charcoal and Wood Remains

Rainer Gerisch

In a fourth field season, microscopic analysis of charcoal and wood was conducted December 28, 2009 to January 11, 2010, to continue the studies on the ancient coastal and wadi vegetation, the use of wood as fuel and in ship building, and for documentation of the excavated material. Identifications were carried out using a binocular and a high power reflected light microscope with used magnifications of 40× to 500×.

The examined charcoal material comprises almost as much as from the previous three field seasons of analysis (2005-2006, 2006-2007, and 2007-2008). During the stay, 61 samples of wood charcoal were analyzed comprising 4,592 pieces with a total volume of 4,058.6 ml. The material includes samples that were left unexamined during the 2007-2008 excavations and were recovered after the author's departure (and stored in a box in Cave 3), and charcoal from the current excavations in 2009-2010: season 2007-2008 (36 spls/1,697 pcs/1,556.9 ml), season 2009-2010 (25 spls/2,895 pcs/2,501.7 ml). The most recent excavations revealed a large amount of wood charcoal from trenches WG 61/65 in front of the newly discovered Cave 8. The remaining material from 2007-2008 consisted of a larger portion in WG 54 and WG 55. Two additionally found wood taxa supplement the 17 taxa identified from charcoal in previous field seasons: the toothbrush tree (*Salvadora persica*) and a member the palm family (Palmae).

An extraordinary discovery has been made with the possibly first substantial finds of rod-like structures of ebony from the land of Punt (preserved as charred fragments in WG 55), which

may have been offerings left at the shrine in WG 56, near the entrance to Cave 7. These finds give remarkable insight into the timber trade with the southern Red Sea region (see "Ebony at Mersa/Wadi Gawasis" below). The source of the deciduous oak charcoal in Cave 3 has also been identified with the charred block of wood T78 (see "Wood finds" below).

Because of the relatively large amount of charcoal, several samples had to be left unexamined for the following field season. At the day of departure, there were 10 samples remaining from these contexts: WG 61, SU21 (1 sample); WG 61, Fire-pit 12/SU30 located in SU20 (1 sample); WG 61/65, SU32 (3 samples); WG 61/65, SU45 (1 sample); WG 65, SU20 (1 sample); WG 65, SU40 (1 sample); WG 65, SU44 (1 sample); and no label (1 sample).

Parallel to the charcoal identification, finds of desiccated wood, recovered objects, samples taken from objects that were still lying in situ on the excavation site, and selected wood debris, were analyzed by their anatomical structure. They comprised 39 objects/samples of those and 4 samples with 53 pieces of wood debris.

Results of charcoal identification by field season, excavation unit and stratigraphical unit

The charcoal assemblages are similar to those identified in previous field seasons. The samples of Mersa/Wadi Gawasis are heterogenous in character and dominated by wood of the Nile acacia (*Acacia nilotica*), the grey mangrove (*Avicennia marina*) and cedar of Lebanon (*Cedrus libani*). They consist of a mixture of wood debris from ship timbers and woods from the Red Sea region and are derived from domestic and industrial fire-pits. Stratigraphical units with more than a few charcoal pieces contain between 4 and 13, mostly between 5 and 8 wood taxa. SUs with the largest charcoal portions contain 327 pieces, 274.9 ml for 2007-2008 (WG 54, SU1/SU2) and 1,871 pieces, 1,404.9 ml for 2009-2010 (WG 61/65, SU 19). Oak charcoal was found in small numbers in WG 55 (deciduous oak), WG 54, WG 61 and WG 65 (evergreen oak). From previous field seaons, it was identified in excavation units WG 19, WG 39 (deciduous oak), WG 19, WG 30, WG 32, WG 54 (evergreen oak); deciduous oak was mainly in WG 39. Christ's thorn (*Ziziphus spina-christi*) has only been identified as desiccated wood so far (planks from boxes, wood debris).

A large number of hearths was excavated in WG 61 and WG 65 throughout all strata, 24 in total. WG 61, SU10 contained many hearths. In WG 65, a hearth was found next to the coral terrace wall in SU2, and a very large one with salt incrustation on the top of it (SU 42) was found in SU40.

Field season 2007-2008:

WG 33**:**

SU4: (1 sample) / *Acacia nilotica*: 19 pcs, 50 ml, 22.9 g (S), *Avicennia marina*: 50 pcs, 96 ml, 51.9 g (S), *Cedrus libani*: 24 pcs, 49 ml, 14 g (S) (1-xx), *Faidherbia albida*: 1 pc, 4.5 ml, 2.2 g (S), *Ficus sycomorus*: 5 pcs, 7.5 ml, 1.7 g, *Rhizophora/Bruguiera*: 27 pcs, 43 ml, 21.4 g (S), *Salix* sp.: 2 pcs, 1.5 ml, 0.4 g (S), *Suaeda* sp.: 1 pc, 2.5 ml, 1 g, *Tamarix* sp.: 1 pc, 1.2 ml, 0.3 g (S), total: 130 pcs, 255.2 ml, 115.8 g

WG 46**:**

SU1: (1 sample) / *Avicennia marina*: 4 pcs, 2 ml, 1 g, *Rhizophora/Bruguiera*: 2 pcs, 1.7 ml, 0.9 g, total: 6 pcs, 3.7 ml, 1.9 g

WG 52**:**

SU2: (1 sample) / *Avicennia marina*: 10 pcs, 8.4 ml, 11.2 g (S)

WG 54**:**

Interface SU1/SU2 (2 samples) / *Acacia nilotica*: 172 pcs, 128.5 ml, 56.3 g (S), *Avicennia marina*: 1 pc, 1.3 ml, 0.7 g, *Cedrus libani*: 150 pcs, 144 ml, 36.5 g (S), *Ficus sycomorus*: 4 pcs, 1.1 ml, 0.2 g, total: 327 pcs, 274.9 ml, 93.7 g / uncharred, slightly charred: *Cedrus libani*: 1 pc, 23 ml, 11.2 g (o), 1 pc, 7.5 ml, 2.3 g (x)

SU2 (3 samples) / *Acacia nilotica*: 109 pcs, 85.6 ml, 38.1 g (S), *Avicennia marina*: 62 pcs, 83 ml, 42.3 g (S), *Cedrus libani*: 109 pcs, 85 ml, 22.2 g (S), *Ficus sycomorus*: 1 pc, 0.1 ml, 0.1 g, Palmae: 1 pc, 0.4 ml, 0.2 g, *Quercus* sp., evergreen: 1 pc, 3.8 ml, 1.9 g, *Rhizophora/ Bruguiera*: 1 pc, 0.4 ml, 0.2 g, total: 284 pcs, 258.3 ml, 105 g / uncharred, slightly charred: *Cedrus libani*: 9 pcs, 8.5 ml, 4 g (S) (o)

WG 55:
Interface SU1/SU2 (1 sample) / *Acacia nilotica*: 6 pcs, 5.5 ml, 4 g (S), *Avicennia marina*: 11 pcs, 5 ml, 2.4 g, *Cedrus libani*: 3 pcs, 1.5 ml, 0.4 g, *Diospyros* sp.: 1 pc, 0.9 ml, 0.4 g, total: 21 pcs, 12.9 ml, 7.2 g / uncharred, slightly charred: *Cedrus libani*: 4 pcs, 1 ml, 0.2 g (o)
SU2 (9 samples) / *Acacia nilotica*: 76 pcs, 74.3 ml, 40.7 g (S), *Avicennia marina*: 24 pcs, 15.5 ml, 8.2 g (S), *Cedrus libani*: 35 pcs, 33.3 ml, 9.7 g (S), *Diospyros* sp.: 23 pcs, 35.8 ml, 19 g (S), *Ficus sycomorus*: 2 pcs, 2 ml, 0.5 g, *Leptadenia pyrotechnica*: 3 pcs, 1.9 ml, 0.6 g, *Quercus* sp., deciduous: 2 pcs, 0.6 ml, 0.2 g, *Rhizophora/Bruguiera*: 6 pcs, 2.5 ml, 1.1 g, *Salix* sp.: 5 pcs, 1.8 ml, 0.5 g, *Suaeda* sp.: 3 pcs, 2.9 ml, 1.1 g, *Tamarix* sp.: 17 pcs, 11 ml, 4.1 g, total: 196 pcs, 181.6 ml, 85.7 g
SU3 (1 sample) / *Acacia nilotica*: 7 pcs, 4 ml, 2.2 g (S), *Avicennia marina*: 2 pcs, 1 ml, 0.5 g, *Cedrus libani*: 4 pcs, 3.3 ml, 0.9 g (S), *Faidherbia albida*: 1 pc, 0.1 ml, 0.1 g, *Rhizophora/Bruguiera*: 1 pc, 0.2 ml, 0.1 g, *Suaeda* sp.: 8 pcs, 4.3 ml, 2.3 g, total: 23 pcs, 12.9 ml, 6.1 g / uncharred, slightly charred: *Ziziphus spina-christi*: 1 pc, 7 ml, 4.1 g (o)
SU4 (3 samples) / *Acacia nilotica*: 54 pcs, 61 ml, 37.3 g (S) (5-xx, 4-xxx), *Avicennia marina*: 23 pcs, 17.8 ml, 10 g (1-xx), *Cedrus libani*: 11 pcs, 9.2 ml, 4.4 g (S), *Diospyros* sp.: 1 pc, 1 ml, 0.4 g, *Faidherbia albida*: 1 pc, 0.3 ml, 0.1 g, *Ficus sycomorus*: 1 pc, 3.3 ml, 1.1 g, *Rhizophora/Bruguiera*: 9 pcs, 9.3 ml, 5.6 g (S), *Suaeda* sp.: 10 pcs, 10.3 ml, 5.2 g (S), *Tamarix* sp.: 9 pcs, 6.6 ml, 3.1 g (S), total: 119 pcs, 118.8 ml, 67.2 g / uncharred, slightly charred: *Acacia nilotica*: 14 pcs, 5.5 ml, 5.3 g (S) (x)
SU5 (3 samples) / *Acacia nilotica*: 34 pcs, 45.6 ml, 25.4 g (S), *Acacia* sp.: 1 pc, 4.5 ml, 1.8 g (S), *Avicennia marina*: 4 pcs, 2.7 ml, 1.3 g (S), *Cedrus libani*: 11 pcs, 12.5 ml, 4.7 (S), *Diospyros* sp.: 1 pc, 6 ml, 2.5 g, *Rhizophora/Bruguiera*: 4 pcs, 5 ml, 2.8 g, *Suaeda* sp.: 1 pc, 0.3 ml, 0.1 g, indet.: 1 pc, 1.2 ml, 0.4 g, total: 57 pcs, 77.8 ml, 39 g / uncharred, slightly charred: *Cedrus libani*: 4 pcs, 0.7 ml, 0.3 g (o)
SU6 (2 samples) / *Acacia nilotica*: 49 pcs, 49 ml, 28 g (S) (1-xxx), *Acacia* sp.: 1 pc, 0.8 ml, 0.5 g, *Avicennia marina*: 22 pcs, 19 ml, 11.4 g (S), *Cedrus libani*: 13 pcs, 10 ml, 3.8 g (S), *Faidherbia albida*: 3 pcs, 1.5 ml, 0.6 g, *Suaeda* sp.: 9 pcs, 5.5 ml, 2.9 g (2-xxx), *Rhizophora/Bruguiera*: 7 pcs, 6.2 ml, 3.3 g (S), *Tamarix* sp.: 1 pc, 1.8 ml, 0.5 g, indet.: 1 pc, 0.2 ml, 0.1 g, total: 106 pcs, 94 ml, 51.1 g / uncharred, slightly charred: *Cedrus libani*: 1 pc, 0.2 ml, 0.1 g (o)
SU8 (1 sample) / *Acacia nilotica*: 4 pcs, 4 ml, 2.4 g, *Avicennia marina*: 2 pcs, 0.9 ml, 0.3 g, *Cedrus libani*: 9 pcs, 1.2 ml, 0.5 g (5-xx), *Rhizophora/Bruguiera*: 2 pcs, 0.5 ml, 0.2 g, *Tamarix* sp.: 4 pcs, 5 ml, 2.8 g (S), indet.: 2 pcs, 0.1 ml, 0.1 g, total: 23 pcs, 11.7 ml, 6.3 g / uncharred, slightly charred: *Cedrus libani*: 1 pc, 2 ml, 0.9 ml (o)
SU11 (1 sample) / *Acacia nilotica*: 13 pcs, 21.7 ml, 6.1 g, *Avicennia marina*: 14 pcs, 8.5 ml, 4 g (S), *Cedrus libani*: 9 pcs, 3 ml, 1.2 g (3-xx), *Diospyros* sp.: 5 pcs, 4 ml, 2.4 g, *Ficus sycomorus*: 3 pcs, 0.3 ml, 0.1 g (2-xx), *Rhizophora/Bruguiera*: 2 pcs, 1.2 ml, 0.5 g, *Tamarix* sp.: 5 pcs, 4 ml, 1.5 g (S), indet.: 1 pc, 0.1 ml, 0.1 g, total: 52 pcs, 42.8 ml, 15.9 g / uncharred, slightly charred: *Cedrus libani*: 1 pc, 2 ml, 0.9 ml (x)
SU13 (1 sample) / *Acacia nilotica*: 11 pcs, 8.7 ml, 5.4 g (S), *Avicennia marina*: 19 pcs, 6.5 ml, 3.3 g, *Cedrus libani*: 15 pcs, 13 ml, 3.3 g, *Diospyros* sp.: 2 pcs, 1.2 ml, 0.5 g, *Faidherbia albida*: 1 pc, 1.5 ml, 0.5 g, *Leptadenia pyrotechnica*: 4 pcs, 0.8 ml, 0.3 g, *Rhizophora/Bruguiera*: 1 pc, 0.1 ml, 0.1 g, *Tamarix* sp.: 1 pc, 0.2 ml, 0.1 g, total: 54 pcs, 32 ml, 13.5 g

WG 56**:**

SU6 (1 sample) / *Acacia nilotica*: 3 pcs, 8.5 ml, 4.4 g, *Rhizophora/Bruguiera*: 1 pc, 1.1 ml, 0.4 g, total: 4 pcs, 9.6 ml, 4.8 g
SU8 (3 samples) / *Acacia nilotica*: 16 pcs, 12.2 ml, 6.5 g, *Avicennia marina*: 2 pcs, 1 ml, 0.6 g, *Calotropis procera*: 5 pcs, 1.2 ml, 0.4 g (5-xxx). *Cedrus libani*: 2 pcs, 3 ml, 0.8 g (S), *Tamarix* sp.: 1 pc, 1.8 ml, 0.9 g (S), indet.: 1 pc, 1 ml, 0.3 g, total: 27 pcs, 20.2 ml, 9.5 g / uncharred, slightly charred: *Cedrus libani*: 2 pcs, 2.5 ml, 1.6 g (o)
SU11 (2 samples) / *Acacia nilotica*: 164 pcs, 93 ml, 50 g (S) (3-xx), *Avicennia marina*: 37 pcs, 20.5 ml, 11.7 g (S) (3-xx), *Cedrus libani*: 34 pcs, 16.5 ml, 5.9 g (S) (1-xx), *Faidherbia albida*: 2 pcs, 0.3 ml, 0.1 g, *Ficus sycomorus*: 10 pcs, 6.2 ml, 1.8 g (S), *Rhizophora/Bruguiera*: 2 pcs, 1.2 ml, 0.9 g (S), *Suaeda* sp.: 6 pcs, 1.7 ml, 0.8 g, *Tamarix* sp.: 3 pcs, 2.7 ml, 1.5 g (S), total: 258 pcs, 142.1 ml, 72.7 g

Field season 2009-2010:
WG 32**:**
SU? (1 sample) / *Acacia nilotica*: 18 pcs, 12 ml, 6.2 g (S), *Avicennia marina*: 2 pcs, 0.8 ml, 0.3 g, *Cedrus libani*: 5 pcs, 4.5 ml, 1.9 g (S), *Faidherbia albida*: 1 pc, 0.3 ml, 0.1 g, *Ficus sycomorus*: 1 pc, 0.6 ml, 0.2 g, *Rhizophora/Bruguiera*: 1 pc, 0.8 ml, 0.4 g (S), *Salix* sp.: 1 pc, 0.6 ml, 0.2 g, *Tamarix* sp.: 3 pcs, 2.2 ml, 0.8 g, total: 32 pcs, 21.8 ml, 10.1 g

WG 61**:**
SU1 (1 sample) / *Acacia nilotica*: 1 pc, 0.7 ml, 0.2 g
SU2 (1 sample) / *Acacia nilotica*: 28 pcs, 30 ml, 13 g (S) (3-xx), *Avicennia marina*: 3 pcs, 3 ml, 1.4 g, *Cedrus libani*: 3 pcs, 7 ml, 2.2 g (S), *Faidherbia albida*: 1 pc, 0.3 ml, 0.1 g, *Ficus sycomorus*: 2 pcs, 1.9 ml, 0.3 g, *Tamarix* sp.: 5 pcs, 2.5 ml, 1.2 g, total: 42 pcs, 44.7 ml, 18.2 g / uncharred, slightly charred: *Acacia nilotica*: 1 pc, 1 ml, 0.6 g (x)
SU3 (1 sample) / *Acacia nilotica*: 7 pcs, 6.5 ml, 3.1 g (S), *Avicennia marina*: 11 pcs, 19 ml, 9.4 g (S) (1-xx), *Cedrus libani*: 7 pcs, 17.5 ml, 4 g, *Faidherbia albida*: 1 pc, 0.4 ml, 0.1 g, *Ficus sycomorus*: 2 pcs, 2 ml, 0.4 g, *Rhizophora/Bruguiera*: 3 pcs, 2.6 ml, 1.4 g, *Suaeda* sp.: 2 pcs, 1.7 ml, 0.7 g, *Tamarix* sp.: 2 pcs, 1.8 ml, 0.7 g, total: 35 pcs, 51.5 ml, 19.8 g
SU10 (1 sample) / *Acacia nilotica*: 4 pcs, 2.5 ml, 1.1 g, *Avicennia marina*: 10 pcs, 11 ml, 5.1 g (S) (1-xxx), *Cedrus libani*: 18 pcs, 24.5 ml, 4.9 g, *Leptadenia pyrotechnica*: 1 pc, 0.1 ml, 0.1 g, *Suaeda* sp.: 1 pc, 0.2 ml, 0.1 g, *Tamarix* sp.: 1 pc, 0.3 ml, 0.1 g, *Rhizophora/Bruguiera*: 1 pc, 0.2 ml, 0.1 g, total: 36 pcs, 38.8 ml, 11.5 g
SU21 (2 samples) / *Acacia nilotica*: 118 pcs, 118 ml, 62.1 g (S), *Avicennia marina*: 87 pcs, 59.5 ml, 31.3 g (S), *Cedrus libani*: 50 pcs, 23.7 ml, 5.6 g (S), *Ficus sycomorus*: 3 pcs, 0.9 ml, 0.4 g, *Leptadenia pyrotechnica*: 14 pcs, 25 ml, 8.1 g (S), *Rhizophora/Bruguiera*: 25 pcs, 25.3 ml, 14.1 g (S), *Salix* sp.: 1 pc, 1.2 ml, 0.4 g, *Salvadora persica*: 2 pcs, 1.8 ml, 1.2 g (S), *Suaeda* sp.: 17 pcs, 19.2 ml, 11 g (S), *Tamarix* sp.: 9 pcs, 4.7 ml, 2.1 g (S), bark: 7 pcs, 3 ml, 2.3 g, total: 333 pcs, 282.3 ml, 138.6 g / uncharred, slightly charred: *Cedrus libani*: 3 pcs, 4.5 ml, 2.6 g (x), *Rhizophora/Bruguiera*: 2 pcs, 2 ml, 1.3 g (x), *Tamarix* sp.: 1 pc, 1.4 ml, 0.7 g (x)

WG 61/65**:**
SU19 (3 samples) / *Acacia nilotica*: 1,058 pcs, 872 ml, 404.6 g (S), *Acacia* sp.: 2 pcs, 0.5 ml, 0.2 g, *Avicennia marina*: 395 pcs, 245 ml, 122.5 g (S) (3-x, 5-xx), *Cedrus libani*: 121 pcs, 83.5 ml, 21.3 g (S), *Faidherbia albida*: 12 pcs, 9.5 ml, 2.8 g (S), *Ficus sycomorus*: 57 pcs, 57 ml, 14.8 g (S), *Leptadenia pyrotechnica*: 53 pcs, 28.3 ml, 10 g (S), *Quercus* sp., evergreen: 2 pcs, 2.5 ml, 1 g, *Rhizophora/Bruguiera*: 42 pcs, 31.8 ml, 17.1 g (S), *Salix* sp.: 6 pcs, 3.9 ml, 1 g, *Salvadora persica*: 2 pcs, 2.8 ml, 1.2 g, *Suaeda* sp.: 14 pcs, 9.3 ml, 5.5 g (S), *Tamarix* sp.: 86 pcs, 50 ml, 21.1 g (S), indet.: 10 pcs, 5.2 ml, 3.1 g (S), bark: 11 pcs, 3.6 ml, 2.2 g, total: 1,871 pcs, 1,404.9 ml, 628.4 g / uncharred, slightly charred: *Avicennia marina*: 4 pcs, 2.5 ml, 1.6 g (x) / weed/culm or rhizome (fragment, charred): 5 pcs, 1.3 ml, 0.5 g

SU27 (1 sample) / *Acacia nilotica*: 15 pcs, 2.6 ml, 1.1 g

WG 65**:**
SU1 (1 sample) / *Acacia nilotica*: 5 pcs, 98.2 ml, 50.6 g (S) (3-xx), *Avicennia marina*: 15 pcs, 7 ml, 3.7 g, *Cedrus libani*: 1 pc, 0.3 ml, 0.1 g, *Ficus sycomorus*: 1 pc, 0.6 ml, 0.2 g, *Rhizophora/Bruguiera*: 3 pcs, 3.8 ml, 1.9 g, indet.: 1 pc, 2.5 ml, 1.3 g, total: 26 pcs, 112.4 ml, 57.8 g
SU2 (2 samples) / *Acacia nilotica*: 61 pcs, 129 ml, 61.7 g (S), *Avicennia marina*: 5 pcs, 22 ml, 9.5 g (S), *Cedrus libani*: 2 pcs, 1.2 ml, 0.2 g (S), *Ficus sycomorus*: 10 pcs, 9.5 ml, 2.4 g, *Rhizophora/Bruguiera*: 1 pc, 2.2 ml, 1.5 g, *Suaeda* sp.: 1 pc, 3 ml, 0.6 g, *Tamarix* sp.: 6 pcs, 6.5 ml, 2.5 g, *Salix* sp.: 1 pc, 0.3 ml, 0.1 g, total: 87 pcs, 173.7 ml, 78.5 g
SU20 (3 samples) / *Acacia nilotica*: 144 pcs, 117.5 ml, 59.5 g (S), *Avicennia marina*: 65 pcs, 40.5 ml, 21 g (S), *Calotropis procera*: 1 pc, 0.9 ml, 0.2 g, *Cedrus libani*: 6 pcs, 2.6 ml, 0.9 g, *Ficus sycomorus*: 2 pcs, 2 ml, 0.7 g (S), *Leptadenia pyrotechnica*: 7 pcs, 2.4 ml, 0.9 g, *Quercus* sp., evergreen: 2 pcs, 0.9 ml, 0.5 g, *Rhizophora/Bruguiera*: 9 pcs, 3.2 ml, 1.7 g (S), *Salix* sp.: 2 pcs, 0.8 ml, 0.2 g, *Salvadora persica*: 1 pc, 2.5 ml, 1.1 g, *Suaeda* sp.: 6 pcs, 3.7 ml, 2.1 g, *Tamarix* sp.: 10 pcs, 5.5 ml, 2.6 g (S), indet.: 1 pc, 0.8 ml, 0.3 g (S), total: 256 pcs, 183.3 ml, 91.7 g
SU39/Fire-pit 17 in SU2 (1 sample) / *Acacia nilotica*: 74 pcs, 125 ml, 65.2 g (S), *Cedrus libani*: 4 pcs, 6.2 ml, 2.2 g (S), *Faidherbia albida*: 2 pcs, 5.8 ml, 3.1 g, *Ficus sycomorus*: 1 pc, 0.3 ml, 0.1 g, *Tamarix* sp.: 1 pc, 0.6 ml, 0.3 g, total: 82 pcs, 137.9 ml, 70.9 g
SU40 (1 sample) / *Acacia nilotica*: 3 pcs, 3 ml, 1.3 g, *Avicennia marina*: 11 pcs, 5.3 ml, 2.6 g (2-xx, 2-xxx), *Cedrus libani*: 2 pcs, 0.4 ml, 0.1 g, *Leptadenia pyrotechnica*: 1 pc, 0.3 ml, 0.1 g, *Quercus* sp., evergreen: 3 pcs, 2.3 ml, 1.3 g, *Rhizophora/Bruguiera*: 1 pc, 1.2 ml, 0.7 g, total: 21 pcs, 12.5 ml, 6.1 g / uncharred, slightly charred: *Acacia nilotica*: 1 pc, 1.3 ml, 0.8 g (x)
SU42/Fire-pit 19 in SU40 (1 sample) / *Acacia nilotica*: 1 pc, 2.8 ml, 1.2 g (S), *Cedrus libani*: 1 pc, 1.8 ml, 0.5 g, total: 2 pcs, 4.6 ml, 1.7 g
SU? (1 sample) / *Acacia nilotica*: 1 pc, 0.2 ml, 0.1 g, *Avicennia marina*: 2 pcs, 1.7 ml, 0.9 g, total: 3 pcs, 1.9 ml, 1 g

WG 66**:**
SU2 (1 sample) / *Acacia nilotica*: 15 pcs, 4.5 ml, 4.2 g, *Avicennia marina*: 1 pc, 0.2 ml, 0.1 g, total: 16 pcs, 4.7 ml, 4.3 g (W)

WG 67**:**
SU31 (3 samples) / *Acacia nilotica*: 19 pcs, 16 ml, 7.9 g, *Avicennia marina*: 3 pcs, 0.5 ml, 0.2 g, *Cedrus libani*: 1 pc, 0.6 ml, 0.2 g, *Faidherbia albida*: 1 pc, 0.3 ml, 0.1 g, *Ficus sycomorus*: 6 pcs, 2.9 ml, 1 g, *Tamarix* sp.: 5 pcs, 2.5 ml, 1 g, bark: 2 pcs, 0.6 ml, 0.5 g, total: 37 pcs, 23.4 ml, 10.9 g

Legend:
o-uncharred, x-slightly charred, xx-incompletely charred
xxx-uncharred traces
(S) salt incrustations present
(W) sample still wet from the excavation

Landscape reconstruction
The results obtained from charcoal analysis suggest that the environment of the harbor site was different from today's. The mangrove stands, which were typical for the landscape of the Red Sea coast, have disappeared, and in the wadi near the main excavation area only the salt tree (*Nitraria retusa*) occurs nowadays. In the past, *Avicennia marina* seems to have grown in greater stands in the shallow water along the shore. Layers of mangrove leaves were found from several contexts (for example 2006-2007: WG 32; WG 40, SU 3; 2007-2008: WG 33, SU 3; WG 53, SU 2; WG 54,

SU1-SU2; WG 55, SU 6; 2009-2010: WG 61/65, SU19; see previous reports) and the remains of roots in the "harbor area."

The littoral salt marsh in the area of the periodic inundation by tides could have contained the halophytic succulent *Suaeda monoica*, sea blite, perhaps accompagnied by the Nile tamarisk (*Tamarix nilotica*). *S. monoica* could have also grown in the wadi deltas of the region since it has a wide ecological range of distribution. Further shrubs in the wadis were *Leptadenia pyrotechnica*, *Salvadora persica* and perhaps the athel tamarisk (*Tamarix aphylla*). Wood samples from *Nitraria retusa* bushes have been charred and used as modern reference material in addition to wood anatomical atlases, but no charcoal was found in the excavated material so far.

Rhizophora mucronata occurs along the Egyptian Red Sea coast only close to the Sudanese border. *Bruguiera gymnorrhiza* may have grown in southern Egypt in the past, but at present there are no records of this species in the Red Sea north of Sudan. One can assume that the wood of these trees was cut in the south and taken with the ships to the harbor of Mersa/Wadi Gawasis.

Ebony at Mersa/Wadi Gawasis

Charcoal from ebony trees (*Diospyros* sp.) has been identified from 3 excavation seasons, in material from 2005-2006 (WG 16: in 1 sample;WG 32, in 1 sample), 2006-2007 (WG 32: in 1 sample), and 2007-2008 (WG 55: in 14 samples). Identified were 51 pieces from 3 excavation units at the western slope of the western coral terrace. The largest portion was obtained from WG 55, in front of Caves 6 and 7; this unit was excavated by Tracy Spurrier. Ebony wood represents one of the valuable trading goods from the land of Punt. For several years it was unclear of which items the ebony charcoal derived from and for what reason the precious wood was put in some fire-pits. The charcoal pieces from *Diospyros* were not found alone, but together with 2-10 other wood taxa, often 5-7, in the sample bags. These additional taxa comprise the typical woods for the charcoal assemblages at Mersa/Wadi Gawasis. Some of the remnants could have come from the burning of the ebony.

The fragments identified in previous excavation seasons have been too small to be able to make a statement on the original shape of the items. Remaining charcoal samples from the excavations in 2007-2008, which were studied subsequently in the 2009-2010 field season, have now revealed several fragments of larger size, which gave hints to their outer structures. Mingled with charcoal from other taxa, a number of fragments were found that seemed to belong together by size and shape and roughly gave the form of 4 rod-like structures (width/thickness: 1.3-1.9 cm/1.0-1.2 cm; 1.8-2.5 cm/0.7-11 cm; 1.3-1.9 cm/0.9-1.4 cm; 1.2-1.7 cm/0.8-1.0 cm). They occurred in 3 sample bags from WG 55, C2, SU2 and are irregularly shaped. Further samples from this excavation unit contained 1-6 pieces of ebony charcoal with similar shapes and came from SUs 1-5, SU11, and SU13. The identified ebony pieces are charred completely and do not show traces of uncharred wood.

Ebony wood was brought to ancient Egypt through tribute and trade and was reserved for the kings and gods. Logs and rods that have reached the harbor of Mersa/Wadi Gawasis must have been registered, and damaging some of them would have been a serious incident. It can be assumed that the ebony was burnt as offerings after the return of a successful expedition. WG 55 is located outside the entrance to Cave 7 and included a shrine that was used throughout the 12th Dynasty. It is an interesting area, from where also two sherds from Minoan pottery vessels, brought from Crete, were identified. The possible finds of shaped ebony rods probably represent the first items of that kind excavated in Egypt. These rods were probably how they were brought from the land of Punt to the site, perhaps in some of the wooden boxes and bound together. Later they would have been manufactured into artistic wooden objects or used as inlays.

Below is a list of the complete ebony finds from the excavations at Mersa/Wadi Gawasis since 2005-2006, when wood anatomical studies were first conducted on a wider scale.

Finds of ebony charcoal (*Diospyros* sp.) at WG

(total: all taxa; length, width, thickness and weight of fragment, (cs) assumed nearly complete or complete cross section of possible rod fragment)

WG 16, 2005-2006, - , Trench 2, Square 2, SU19 (total: 13 charcoal pieces): 1 pc, 0.1 ml, 0.1 g / shape of original object not recognizable
WG 32, 2006-2007, - , C5, SU25 (total: 60 charcoal pieces): 1 pc, 1 ml, 0.4 g / shape of original object not recognizable
WG 32, 2005-2006, - , - , SU16 (total: 24 charcoal pieces): 8 pcs, 9 ml, 4 g / shape of original object not recognizable
WG 55, 2007-2008, 10.1., C1, SU11 (total: 52 charcoal pieces): 5 pcs, 4 ml, 2.4 g / possible rod fragments (1.9 cm × 1.9 cm × 1.3 cm, 1.4 g (cs); 1.5 cm × 1.0 cm × 1.1 cm, 0.6 g (cs); 0.7 cm × 1.3 cm × 0.8 cm, 0.2 g; 0.7 cm × 1 cm × 0.6 cm, 0.2 g; 0.7 cm × 0.7 cm × 0.4 cm, 0.1 g)
WG 55, 2007-2008, 5.1., C1, C2, C3, D1, D2, D3, E1, E2, E3, SU2 (total: 311 charcoal pieces): 6 pcs, 4 ml, 2.1 g / shape of original object mostly not recognizable, 2 pieces: possible rod fragments (2.0 cm × 1.4 cm × 1.0 cm, 0.7 g; 1.8 cm × 1.2 cm × 0.6 cm, 0.2 g)
WG 55, 2007-2008, - , C1, C2, C3, D1, D2, D3, E1, E2, E3, SU2 (total: 5 charcoal pieces): 1 pc, 0.2 ml, 0.1 g / possible rod fragment (0.8 cm × 1.4 cm × 0,5 cm (cs)
WG 55, 2007-2008, 12.1., C2, SU2 (total: 49 charcoal pieces): 3 pcs, 8.4 ml, 4.5 g / possible rod fragments (rod-like structure 1 / 3.7 cm × 1.9 cm × 1.4 cm, 2.7 g (cs); 2.9 cm × 1.6 cm × 0.9 cm, 1.1 g (cs); 2.0 cm × 1.3 cm × 0.9 cm, 0.8 g (cs)
WG 55, 2007-2008, 13.1., C2, SU2 (total: 31 charcoal pieces): 13 pcs, 19.3 ml, 10.3 g / possible rod fragments (rod-like structure 2 / 2.3 cm × 1.3 cm × 1.0 cm, 0.6 g (cs); 2.6 cm × 1.9 cm × 1.2 cm, 1.7 g (cs); 1.4 cm × 1.8 cm × 1.2 cm, 1.0 g (cs); 1.4 cm × 1.3 cm × 1.1 cm, 0.5 g (cs); rod-like structure 3 / 2.0 cm × 1.8 cm × 0.9 cm, 0.7 g (cs); 4.3 cm × 2.5 cm × 1.1 cm, 2.8 g (cs); 2.4 cm × 2.0 cm × 0.8 cm, 0.9 g (c); 1.8 cm × 1.8 cm × 0.7 cm, 0.5 g (cs); smaller pieces / 2.0 cm × 1.7 cm × 0.8 cm, 0.5 g; 1.6 cm × 0.9 cm × 0.6 cm, 0.3 g; 1.4 cm × 0.9 cm × 0.9 cm, 0.2 g; 1.3 cm × 0.8 cm × 0.7 cm, 0.2 g; 1.0 cm × 1.1 cm × 1.0 cm, 0.2 g)
WG 55, 2007-2008, - , C2, SU2 (total: 22 charcoal pieces): 3 pcs, 5.7 ml, 3 g (S) / possible rod fragments (rod-like structure 4 / 3.0 cm × 1.7 cm × 1.0 cm, 1.7 g (cs); 1.9 cm × 1.2 cm × 0.8 cm, 0.6 g (cs); 2.4 cm × 1.2 cm × 0.8 cm, 0.7 g (cs)
WG 55, 2007-2008, 10.1., C2, SU2 (total: 8 charcoal pieces): 1 pc, 1.2 ml, 0.6 g / possible rod fragment (2.4 cm × 1.5 cm × 1.1 cm (cs)
WG 55, 2007-2008, - , C2, SU13 (total: 54 charcoal pieces): 2 pcs, 1.2 ml, 0.5 g / possible rod fragments (2.4 cm × 1.0 cm × 0.6 cm, 0.4 g; 1.0 cm × 0.8 cm × 0.4 cm, 0.1 g)
WG 55, 2007-08, - , C3, SU1-2 (total: 21 charcoal pieces): 1 pc, 0.9 ml, 0.4 g / possible rod fragment (2,5 cm × 1,1 cm × 0.6 cm (cs)
WG 55, 2007-2008, - , D1, D2, SU2 (total: 98 charcoal pieces): 1 pc, 0.5 ml, 0.2 g / shape of original object not recognizable
WG 55, 2007-2008, - , D1, D2, SU3 (total: 123 charcoal pieces): 1 pc, 0.5 ml, 0.2 g / shape of original object not recognizable
WG 55, 2007-2008, 7.1., D3, SU2 (total: 55 charcoal pieces): 2 pcs, 1 ml, 0.5 g / possible rod fragments (1.3 cm × 1.3 cm × 0.6 cm, 0.3 g; 0.9 cm × 1 cm × 0.7 cm, 0.2 g)
WG 55, 2007-2008, - , E2, SU4 (total: 23 charcoal pieces): 1 pc, 1 ml, 0.4 g / possible rod fragment (1.6 cm × 1.5 cm × 0.7 cm (cs)
WG 55, 2007-2008, - , E3, SU5, from W459 (total: 45 charcoal pieces): 1 pc, 6 ml, 2.5 g / possible rod fragment (2.5 cm × 3.2 cm × 1.7 cm (cs)

Wood finds

The source for the quantity of deciduous oak charcoal in samples from WG 39, A7-A10, SU11, SU12, SUs14-17, and surface, excavated in 2006-2007, could be localized with one of the timbers of maritime equipment. It is a burnt block-like wooden object, which was called a “mystery object,”

and was excavated in the same season in Square A9, SU13. In 2009-2010, it was given the number T78. Stored in Cave 3, a wrong sample was chosen in 2007-2008, which has led to the identification of cedar of Lebanon. During work on T78 by conservator Howard Wellman that was conducted in the site lab during the 2009-2020 excavation season, loose fragments from the charred block were reexamined microscopically and could be identified as deciduous oak. Photographs of the oak charcoal pieces which were found in sample bags in 2006-2007 and 2007-2008 were compared with those of the remaining parts of T78, and the material proved to be of one origin.

Other analyzed wooden objects were the 2 steering oar blades from WG 32 (T72, T85/ *Faidherbia albida*), plank fragments (Type 2: T79, T80, T93; Type 3: T82, T94; Type 4: T81, T86; Type 5: T62, T63, T87; unknown: T83/ *Cedrus libani* except of T80, T87: *Acacia nilotica* and T83: *Ficus sycomorus*), tool handles (WG 60, D5, SU1, *Avicennia marina*), and a wooden spoon cut from a piece of cedar debris (WG 61/65, A4, A5, D4, D5, SU32, *Cedrus libani*).

3-Dimensional Models with Laser-scanner

Andrea D'Andrea and Giancarlo Iannone

Field Work

During the 2009-2010 field season laser-scanning survey of the western wall of the coral terrace at Wadi Gawasis was continued, which has been in progress since 2007-2008, in order to generate more detailed 3-D models of both the outside wall and the man-made chambers and galleries excavated into it. The survey was conducted over a length of about 64 m, and included a new laser-scanning of Caves 2 and 3 to complete the previous models of these caves, as well as the first scanning of Cave 5, the rope coils were stored.

Ten scans were made along the external wall, at a distance of 6 m from each other and 3-4 m from the surface of the wall, using 15 targets on the wall to maintain their alignment. Eight scans of the upper part of the coral wall were also made with 10 targets at about 8 m apart, over an area of 60 m x 20 m.

Two scans were made in Cave 2 with 5 targets at about 3.8 m apart, covering an area of 24 m x 5 m (120 m^2). Two scans were made in Cave 3 with 4 targets 4.3 m apart, over an area of 15 m x 5 m (60 m^2).

Three scans with 9 targets were made in Cave 5. Because of the ropes stored in the cave, the laser scanner could not be placed on the floor of the cave and 2 scans with 5 targets along the walls between Caves 2 and 5 were made in order to link the model of Cave 5 to Cave 2.

Finally, at Cave 8, 3 scans were made outside, with 11 targets 4 m apart over a surface of 25 m x 5 m (125 m^2); and 2 scans were made inside, covering an area of 6 m x 4 m (25,23 m^2).

Registration

Because it was not possible to directly link all scanned areas, due to the great distance (over 80 m) between Cave 2 and Cave 8, some targets inside Caves 2, 3, 5 and 8; outside Caves 2, 3 and 5; and on the top of the terrace were recorded by Stefano Tilia with the total station and geo-refered according to the absolute coordinate system. The geo-refererd points were used to align all scans in order to generate a complete geo-refered model of the area.

Post-processing phase

All scans were filtered to reduce noise, pre-registered, aligned and geo-referenced. At the end of this alignment process the estimated mean error was below 1 cm. Finally, all point-clouds were transformed in a mesh to extract plans and sections of the scanned structures.

Conservation

Howard Wellman

Introduction

Conservator Howard Wellman arrived at the Wadi Gawasis Project on 29 December, 2009 to assist with the recovery of archaeological remains. The broad outline of his remit was to assist with the recovery of timbers, but also to review the previous care of organic finds, plan for the care of future finds, and to assist with general conservation as needed.

Environmental Monitoring

In 2008, five HOBO (Onset Computer Corp) U-10 Temperature and Relative Humidity environmental data loggers were placed in the collections: one each in Caves 1, 2, 3, and 5, and one in a box of wooden artifacts delivered to the Supreme Council of Antiquities storage room in Qift.

The data loggers from the caves were downloaded during the 2009-2010 season, and provided a year's worth of data from 2008 into 2009. The data logger sent to Qift could not be located.

Ignoring the first few days' worth of data (the data loggers were set to start automatically on 5 January, 2008, but were not placed in the caves until approximately 9 January, 2008) the cave data showed some interesting trends. All four temperature graphs show a steady annual cycle varying from ca. 26° C (March) to 30° C (October). Daily variations in temperature are greater for Caves 2 and 3, which are connected, and open to the external environment.

Relative Humidity (RH), which is much more critical for the preservation of organic materials, shows a different picture. The unsealed Caves 2 and 3 showed an annual cycle varying from ca. 29% (January) to 55% (September/October), with daily variations as much as +-8%. These curves changed in direct proportion to the temperature curves.

The sealed Cave 1 showed a much flatter RH curve peaking at 69% in May and bottoming out at 61% in November/December with low daily variation (+-2% in summer and +- 4% in winter). This RH curve was in inverse proportion to the temperature curve. The effect of this high RH on the objects stored in Cave 1 is discussed below.

Sealed Cave 5 (the "rope cave") showed a similar trend, but at much lower values. The low point was 45% in January and the high 49% in September, with daily variations about +-1%. Since the data logger was not downloaded until near the end of the 2009-2010 excavation season, the graph also shows the effects of staff opening the cave and inspecting the rope – the RH plummets 10% to 36% in about 24 hours, then recovers to ca. 45% in the following week.

The effects of this climate variation are manifold. The variation seen in Caves 2 and 3 mimic the changes in climate in a natural unsealed cave – climate varies with the external climate, but the cave itself buffers the external climate and reduces the variation. In this case, the RH in Caves 2 and 3 are barely within the ranges recommended for the storage of organic materials, especially those suffering from mold, insect decay, and salt impregnation. Objects stored here in the long term will require preventive conservation measures to ensure their preservation (see detailed discussion below). In Caves 1 and 5, the effect of sealing the caves is seen in the flatter RH curve, and the inverse relationship with changing temperature. In Cave 1, the elevated RH caused continued degradation of the stored wood via fungal growth and salt crystallization (P. Musella in Bard and Fattovich 2008; C. Zazzaro, per. comm. 2009). The source of the excess moisture in Cave 1 should be determined, but at the current time the cave cannot be considered suitable for storing organic objects, or porous materials impregnated with salts. By contrast, Cave 5 maintains an RH level below 50% RH, which should help preserve the rope in its current state. It is possible that the bulk of organic material, already reduced by time to lower RH levels, is helping to buffer the effects of visitors and site work.

The data loggers were placed back in Caves 1, 3, and 5 to continue monitoring, and one was placed at the mouth of Cave 2 to monitor the external climate for comparison.

Ship Timbers

The main focus of conservation efforts was on the ship timbers currently being excavated, and those in storage in the caves. Timbers were examined to determine their condition, and tests were performed with different consolidants and lifting systems to see how they should best be preserved.

In Storage

Twenty-nine timbers excavated in previous seasons were examined in the storage caves. Notes were taken on their dimensions and general condition. No treatments were undertaken. Trends in condition were noted, and correlations between condition to material and context were attempted. In general, all timbers were considered to be highly degraded, though some materials (especially cedar) were more robust than others. Materials excavated from the sand outside the caves were usually more degraded than those found inside the caves. Degradation followed the patterns discussed by Blanchette et. al. (1994). Fungal attack seems to be the primary mode of degradation (assisted by insect decay), especially on the material recovered from exterior contexts, though the effects of salt crystallization can also be noted. Microscopic examination of the wood cell walls would be necessary to confirm this.

The degradation leaves the wood light in weight, and very fragile. Most show radial cracking often associated with normal drying, and cross-grain checking usually associated with fungal decay. A number also have voluminous powdery deposits replacing sound material, commonly associated with insect damage (frass), but could also be disassociated material damaged by fungal activity and salt crystallization. Many timbers stored in Cave 1 showed significant salt crystal growth as fine hair-like growths. Staff who had examined these timbers in past field seasons suggested that they were continuing to degrade in storage.

The timbers are stored uncovered on plywood or cardboard sheets. Some are isolated from the cave floor on wooden beams; some are laying directly on the cave floor. In addition to the degradation noted above, most are also covered with a layer or dust or fine sand, which had either settled out of the atmosphere or had fallen from the cave ceiling.

Based on the environmental conditions noted above, the timbers stored in Cave 1 were moved on their supports to a new area at the end of Cave 2. The high RH in Cave 1 is probably responsible for continued fungal activity and salt crystallization. The lower RH in Cave 2 should help retard this while better long-term solutions are put into place.

Since the greatest danger to these timbers is continuing fungal and salt activity, for the 2010-2011 season we will recommend that all timbers to be left in storage in the caves be packed in microenvironment bags. These bags will consist of a high density deposited ceramic film, with an oxygen scavenging desiccant inside to reduce oxygen and moisture below levels that support fungal or crystalline growth. The bags will also protect the timbers from dust and soil accumulations.

Timbers in Excavation

The conservator worked closely with the Marine Archaeology team examining and excavating a series of ship timbers, especially those located at the mouth of Cave 6. These timbers, parts of a ship's steering oar, were heavily incrusted with salt and sand concretions. The concretions had to be removed to accurately document the timbers and to safely retrieve them. The size of the timbers (some greater than 4 m in length) precluded lifting them with the concretions intact at this time.

The revealed wood was in very poor condition, and could not be handled without treatment. The concretions were from 1 to 5 centimeters thick and very hard. The concretion appeared to grow from within the wood matrix, so the "original surface" of the wood appeared to be trapped within the salt matrix, and disassociated from the existing wood surface. The concretion was separate from the wood in many places, but tightly bound in others.

Tests were performed to see if the concretion could be dissolved by cotton or paper poultices or localized application of water. It is still possible that this will work, but the process is very slow,

yielding less than five millimeters removal in 24 hours. Tests with other poultice materials may yield better results.

It was finally determined that breaking the concretion with small chisels to reveal the wood surface was the least bad alternative. This allowed the wood to be documented, then preserved in situ. Several consolidants were tested in situ and on lab samples.

Paraloid B72 (acrylic copolymer) 10% in acetone was applied by brush and dropper. It did not wet sandy powdery surfaces well, and tended to evaporate too quickly, but remained soft and pliable. Butvar B98 (polyvinyl butyral) 5% in methanol was applied by brush and dropper. It penetrated well on most surfaces, and has a good track record in the conservation literature for the consolidation of dry degraded wood. Cyclododecane (a volatile wax-like material) was applied both by aerosol spray and as a molten liquid (melting point ca. 60C). The aerosol, propelled by propane, proved too aggressive for delicate surfaces. The liquid penetrated slightly and provided a good surface layer, but not deep consolidation.

In the end, a two-step process was put into practice. Consolidation with 5% Butvar B98 was followed by the application of a gauze facing adhered with 5% Paraloid B72, followed by final coat of 10% B72. This resulted in a hard-jacketed wooden object that can be excavated by traditional lifting techniques. If necessary, the facing can be removed with acetone with out disturbing the Butvar consolidant. Due to time constraints, no consolidated pieces were lifted this season, but they were covered and reburied for the next field season.

For the 2010-2011 field season, this procedure will continue, together with lifting the conserved timbers and preparing them for long-term storage as above.

Rope

The other major material being examined this season was the rope in Cave 5. On closer examination and reading previous reports on the ropes' condition (Veldmeijer and Zazzaro 2007), the conservator concurs with others that they should not be removed from the cave. The ropes are badly degraded and cannot support their own weight if lifted. However, the environment in the sealed cave is appropriate for their long-term preservation.

To satisfy persistent questions about whether the ropes could be moved, a series of consolidants were tested on samples in the field laboratory. Two problems are encountered when considering moving the rope:

1) stabilization in situ for excavation and lifting;
2) stabilization post-excavation for study and display.

In situ treatment is problematic given the enclosed, unventilated cave. Traditional solvent-based consolidants cannot safely be used without respirators, and they also create an explosion hazard by concentrating flammable vapors. Cyclododecane, a sublimating waxy material, has been successfully used as a temporary consolidant on a wide range of archaeological materials, including basketry. When applied as an aerosol or a molten liquid (melting point ca. 60° C), it forms a protective coating. It is a temporary consolidant only as it sublimes (changes from solid to gaseous state) at room temperature under moving air.

Two forms of cyclododecane were tested in the laboratory. The aerosol created a thick surface layer, but the propellant blast was too strong, scattering loose fragments. The liquid application was more successful. The low viscosity liquid (viscosity can be controlled somewhat by adjusting the temperature) flowed through the entire open rope structure, coating and filling internal structure from the bottom up, and finishing with a thick durable surface.

Traditional solvent born resins (Paraloid B72 and Butvar B98) were also tested on laboratory samples. Both were absorbed into the rope fibers, but left a glossy surface. When dry, the rope samples were rigid and could be handled without losses.

It is our considered opinion that cyclododecane could be applied to ropes in situ for the purpose of controlled excavation to reveal more details about the size and deterioration of the rope coils (no one has seen an entire coil exposed, so we are uncertain if the buried portions are intact).

But because cyclododecane is a temporary consolidant, this will not be sufficient to prepare a rope coil for laboratory study or museum display.

Because of the volume of solvent necessary, solvent-resin mixtures cannot be used safely in situ. Under controlled conditions in the laboratory, such resins may possibly solidify the rope enough to be handled, studied, or displayed, but further tests are necessary to determine if the appearance can be made display worthy.

Other Objects

The conservator assisted with other projects on site and in the field laboratory, as needed. The conservator assisted the epigrapher in cleaning the surface of an inscribed stela (Stela 29) of sand and soil. Loose soil was removed with a soft brush. The epigrapher removed some concretions and deep soiling from the inscriptions using dental tools, wooden picks, and a scalpel. Recommendations for future treatment are included in the treatment reports sent to the Principle Investigators.

The conservator also unrolled some fragments of papyrus for study by careful brushing, rehumidification by breath, and careful unfolding. Fragments of matting, linen, and a sandal were partially cleaned with gentle brushing. No further treatments were deemed necessary.

An inscribed potsherd (ostraca) was cleaned of salt concretion by localized wetting to soften the salt crust and scalpel cleaning.

On site, the conservator assisted excavators by lifting various fragile wooden objects.

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