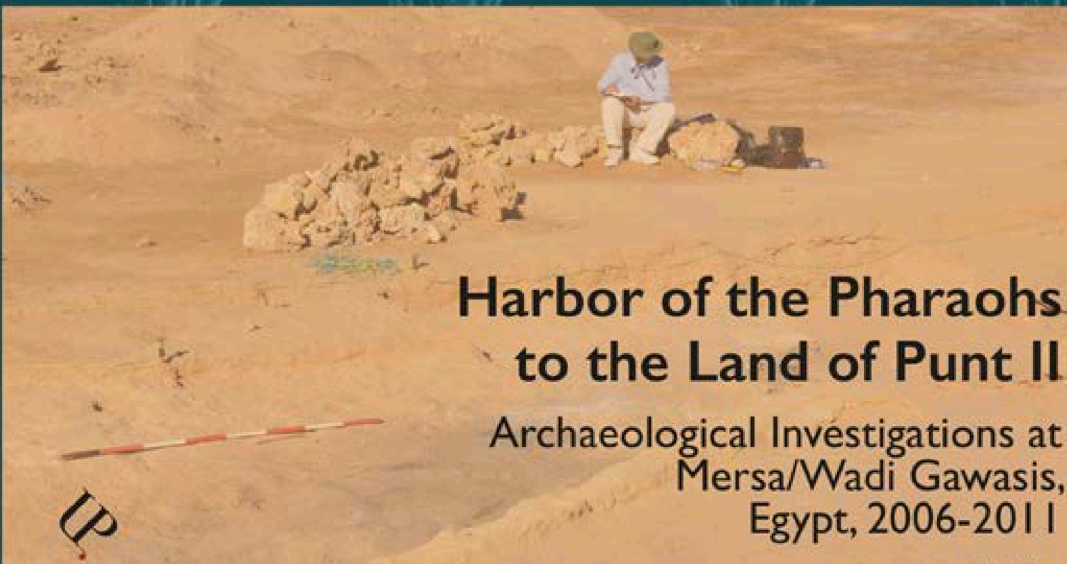
UNIVERSITÀ DI NAPOLI
L'ORIENTALE



Harbor of the Pharaohs to the Land of Punt II

Archaeological Investigations at Mersa/Wadi Gawasis, Egypt, 2006-2011

edited by
Kathryn A. Bard, Rodolfo Fattovich and Andrea Manzo

UniorPress
NAPOLI 2021

Rodolfo Fattovich (1945-2018)
"*Those having torches will pass them on to others*" (Plato)

UniorPress
Via Nuova Marina, 59 - 80133, Napoli

ISBN 978-88-6719-198-7

UNIVERSITÀ DI NAPOLI
L'ORIENTALE
DIPARTIMENTO ASIA AFRICA
E MEDITERRANEO

Harbor of the Pharaohs to the Land of Punt II

Archaeological Investigations at Mersa/Wadi Gawasis, Egypt, 2006-2011

edited by
Kathryn A. Bard, Rodolfo Fattovich and Andrea Manzo

UniorPress
NAPLES
2021

Table of contents

Chapter 3. Fieldwork at Mersa/WadiGawasis, 2006-2007 to 2010-2011: Archaeology

Chapter 1
Introduction

KATHRYN A. BARD AND RODOLFO FATTOVICH

In 2001 the University of Naples "L'Orientale" (UniOr), Naples (Italy), and the Italian Institute for Africa and the Orient (IsIAO), Rome, in collaboration with Boston University (BU), Boston (USA), began investigations at the site of Mersa/Wadi Gawasis on the Red Sea coast, Egypt, under the direction of Rodolfo Fattovich (UniOr/IsIAO) and Kathryn Bard (BU). Investigations have focused on testing the hypothesis of Egyptian maritime trade along the Red Sea in the 3rd – 2nd millennia BC, especially the problem of Punt.

The first five seasons of archaeological investigations at Mersa/Wadi Gawasis were published in *Harbor of the Pharaohs to the Land of Punt. Archaeological Investigations at Mersa/Wadi Gawasis, Egypt, 2001-2005* (Naples 2007). This volume presents the results of the second five seasons of archaeological investigations at Mersa/Wadi Gawasis, 2006-2011.

The project was part of long-term investigations, in progress at the UniOr since the early 1980s, regarding the development of long-distance trade between the Mediterranean Sea and the Indian Ocean, from late prehistoric to early historical times, and the possible impact of this trade on the origins of hierarchical societies and states in the northern Horn of Africa (see Fattovich 1991, 1995, 1996a, 1996b, 1997a, 1997b, 1997c, 1999; Manzo 1999).

1.1 Mersa/Wadi Gawasis and the maritime trade to Punt

The site of Mersa Gawasis, which is located at the mouth of Wadi Gawasis ca. 23 km south of Safaga, has been known for a long time. It was initially identified as the Roman port of Philoteras (*e.g.*, Tregenza 1958: 182).

In 1976 and 1977 Abdel Moneim Al-Hakim Sayed, University of Alexandria, conducted excavations at this site and found potsherds with painted (hieratic) inscriptions, well preserved wood, limestone anchors, inscribed stelae and structures associated with the stelae, which he interpreted as small votive shrines. From this evidence, Sayed identified the site as the 12th Dynasty port of *Saww* from where seafaring expeditions were sent to Punt (Sayed 1977, 1978, 1979a, 1979b, 1980, 1983, 1999).

The main evidence at the site for its use as a harbor for seafaring expeditions consisted of carved, round-topped stones, which have been identified as anchors (see Frost 1979, 1985), and a fragment of carved cedar timber with a mortise, most likely from a ship. Alessandra Nibbi (1976, 1981) rejected the identification of the site as a port, while Honor Frost (1996) supported Sayed's interpretation of the site as a port.

Given disagreement about the use of the Mersa/Wadi Gawasis site, and different interpretations of the evidence there, as well as its role in the trade with Punt, archaeological investigations by the UniOr/IsIAO and BU 2001-2011 focused on providing evidence for the use of this harbor and its chronological framework.

1.2 The UniOr/IsIAO and BU Research Project

The main goals of the UniOr/IsIAO and BU project at Mersa/Wadi Gawasis were to better understand a) the organization of seafaring expeditions along the Red Sea in pharaonic times, b) the development of maritime trade to Punt, and c) the use and organization of the site as a harbor.

The research was designed to:

1) Investigate a) the spatial organization of the site, in order to locate activity areas and understand the use of the site, and b) the paleoenvironmental conditions of the site in order to understand why Mersa/Wadi Gawasis was chosen as a harbor.
2) Collect evidence of a) seafaring ships, b) exotic imported materials, and c) inscriptions regarding expeditions to Punt.

Another important component of the project was the creation of a detailed map of the Mersa/Wadi Gawasis area, to facilitate archaeological heritage management of the site.

The multidisciplinary project consisted of archaeological, geo-archaeological, paleobotanical, paleozoological and geomorphological investigations, as well as a geophysicical survey, in order to outline the process of site formation in its environmental context. Digital technologies have been used for analysis of regional data and for a detailed reconstruction of the archaeological landscape, including analysis and classification by remote sensing (on-ground and satellite images) and Geographic Information Systems (GIS). All data were recorded in a database which can be used for archaeological heritage management by the Egyptian authorities.

Preliminary reports of the second five excavation seasons (2006-2007, 2007-2008, 2009, 2009-2010, 2010-2011) have been published in online reports (Bard and Fattovich 2008, 2010; Bard, Fattovich and Ward 2011; Fattovich and Bard 2006; Fattovich, Manzo and Zazzaro 2009). This book is a synthesis of these reports.

Participants in the fieldwork were: Mohamed Abd El-Maguid Mustafa (Supreme Council of Antiquities, Alexandria, Egypt), nautical archaeologist (2006-2007, 2009-2010); Trina Aprin (BU), geoarchaeologist (2006-2007); Mohamed Badr Eldin Omar (Egyptian Geological Survey, Cairo, Egypt) geologist (2006-2007, 2007-2008); Francesco Berna (BU), geoarchaeologist (2010-2011); Ksenija Borojevic (BU), paleoethnobotanist (2006-2007, 2007-2008, 2009-2010, 2010-2011); Claire Calcagno (BU), nautical archaeologist (2006-2007, 2007-2008); Alfredo Carannante (University "Suor Orsola di Benincasa," Naples, Italy), malacologist (2006-2007, 2007-2008); S. Terry Childs (U.S. National Park Service, Washington D.C.), archaeologist and archeometallurgist (2006-2007); Howie Choset (Carnegie Mellon University, Pittsburgh, PA), robotics/computer scientist (2010-2011); Otto Cichocki (University of Vienna, Vienna, Austria), dendrochronologist (2006-2007, 2007-2008); Andrea D'Andrea (UniOr), computer applications specialist (2009, 2009-2010, 2010-2011); Duncan FitzGerald (BU), geologist (2006-2007, 2007-2008, 2009-2010); Carlos de La Fuente, photographer (2007-2008); Rainer Gerisch (Free University, Berlin, Germany), paleoethnobotanist (2006-2007, 2007-2008, 2009-2010, 2010-2011); Christopher Hein (BU), geologist (2006-2007, 2007-2008, 2009-2010, 2010-2011); Giancarlo Iannone (Cyprus Center, Nicosia, Cyprus), technician (2009, 2009-2010, 2010-2011); Maria Imbrenda (University of Pisa, Pisa, Italy), assistant ceramic analyst (2010-2011); Ilaria Incordino (UniOr), Egyptologist (2006-2007, 2007-2008, 2009-2010); Caroline

Jacoby (Wellman Conservation LLC, Halethorpe, MD), assistant conservator (2010-2011); Giuseppe Lebro (UniOr), Egyptologist (2006-2007); Dixie Ledesma (BU), archaeologist (2009-2010); Chen Sian Lim, (National University of Singapore, Singapore), archaeologist (2006-2007); Guilio Lucarini (University of Rome "La Sapienza," Rome, Italy), lithic analyst (2006-2007, 2007-2008) Elsayed Mahfouz (University of Asyut, Asyut, Egypt), Egyptologist (2006-2007, 2007-2008, 2009-2010); Andrea Manzo (UniOr), archaeologist (2006-2007, 2009, 2009-2010); Giuseppe Morganti (Soprintendenza Archeologica di Roma and the Italian Institute for Africa and the Orient/IsIAO, Rome, Italy), architect (2006-2007); Rebecca Mountain, assistant paleoethnobotanist (2010-2011); Pasquale Musella (National Archaeological Museum, Naples, Italy), conservator (2006-2007, 2007-2008, 2009-2010); Carla Pepe (University "Suor Orsola di Benincasa," Naples, Italy), archaeologist (2006-2007); Cinzia Perlingieri (UniOr), archaeologist, ceramic analyst and illustrator (2006-2007); Rosanna Pirelli (UniOr), Egyptologist (2006-2007); Gwendaline Plisson (Sorbonne University, Paris, France), archaeologist (2006-2007); Talbot Easton Selby (Coastal Carolina University, Conway, SC), photographer (2010-2011); Tracy Spurrier (BU), archaeologist (2006-2007, 2007-2008, 2009-2010); Matthew Tesch (Carnegie Mellon University, Pittsburg, PA), assistant computer scientist (2010-2011); Stefano Tilia (Trerre, Rome, Italy), surface surveyor (2006-2007, 2007-2008, 2009-2010, 2010-2011); André Veldmeijer (PalArch Foundation, Amsterdam, the Netherlands), rope analyst (2006-2007, 2007-2008); Benjamin Vining (BU), geophysicist (2006-2007); John Wallace-Jones (Norwich, UK), ceramic illustrator (2007-2008, 2009-2010, 2010-2011); Sally Wallace-Jones (Norwich, UK), ceramic analyst (2007-2008, 2009-2010, 2010-2011); Cheryl Ward (Coastal Carolina University, Conway, SC, 2009-2010, 2010-2011), nautical archaeologist; Howard Wellman (Wellman Conservation LLC, Halethorpe, MD), conservator (2009-2010, 2010-2011); Cornell Wright (Carnegie Mellon University, Pittsburgh, PA), assistant computer scientist (2010-2011); Chiara Zazzaro (UniOr, 2001-2008; University of Exeter, Exeter, UK, 2009-2011), archaeologist (2006-2007, 2007-2008, 2009, 2009-2010, 2010-2011).

The Supreme Council of Antiquities, Cairo, was represented by Mohammed Rayan (2006-2007), Ayman Hendy Amin (2007-2008), Abdelafar

Mohammed (2009), Abdel Ghafar Abdelmoneim Mohamed (2009-2010), and Ahmed Sadiq Tawfiq (2010-2011), of the Quseir Inspectorate, Quseir.

The project was conducted with grants from the UniOr, IsIAO, Ministry of Foreign Affairs (Rome), and generous contributions by the late Mr. Wallace Sellers, and Mrs. Naudain Sellers, Lahaska, PA (USA), and the Glen Dash Charitable Foundation, Woodstock, CT (USA).

The members of the expedition are very grateful to:

Dr. Zahi Hawass, General Secretary, and the staff of the Supreme Council of Antiquities, Cairo, for their strong support of the expedition.

The staff of the Qena Inspectorate, Qena and Quseir, and the Qift Magazine, Qift, for their kind support and help in the field.

The authorities of the Egyptian Security, Police, Border Army, Army, Navy, and Safaja City Council for the permits to conduct the fieldwork, and their kind support.

H. E. Antonio Badini, Italian Ambassador to Egypt from 2003 to 2007, and H. E. Claudio Pacifico, Italian Ambassador to Egypt from 2007 to 2012; Dr. Maria Casini and, from 2008, Dr. Rosanna Pirelli, Experts for Archaeology, Italian Cultural Institute, Cairo; as well as the staff of the Italian Archaeological Centre, Italian Cultural Institute, Cairo for their kind and very helpful support.

The late Mr. Wallace Sellers, and Mrs. Naudain Sellers, Lahaska, PA, USA, for their generous donations.

Mr. Glen Dash, Woodstock, CT, USA, for his contributions.

Chapter 2
The Site of Mersa/Wadi Gawasis

2.1 Location and description of the site

KATHRYN A. BARD AND RODOLFO FATTOVICH

The site of Mersa/Wadi Gawasis (26°33”26’N, 34°02”11’E) is located on and at the base of a fossil coral terrace at the northern end of the Wadi Gawasis, ca. 23 km south of Safaga and 55 km to the north of Quseir. The site covers an area of over 20 ha, ca. 650 m (east-west) by 320 m (north-south), and is delimited by the seashore to the east, the bed of Wadi Gawasis to the south, and a playa to the west (Figures 1, 2).

A paved road along the coast and a railway, which crosses the site from north to south, divide the site into eastern, central and western sectors. The eastern sector, between the seashore and the coastal road, has been disturbed by abandoned military installations and gravel quarrying. The central sector, between the coastal road and the railroad, has been almost completely destroyed, but isolated areas with deposits up to ca. 50 cm thick have been preserved. The western sector of the site, between the railroad and the playa, is still well preserved. Excavations in the western sector demonstrate the preservation of stratified man-made features and caves/galleries that have been protected by the collapse of coral from the terrace and accumulation of windblown sand (see Sayed 1983: 27-28).

2.2 Geology

MOHAMMED BADR

Approximately 25 million years ago, a Tertiary cratonic rifting of the Red Sea began, splitting the Arabian-Nubian Shield in two parts. The Red Sea basin is considered an active rift where sea-floor spreading has occurred for the last 5 my. Nowadays, the western segment of the Red Sea is regionally occupied by syn- and post-rift deposits (Middle Miocene and Quaternary, respectively).

The eastern part of Wadi Gawasis consists of sub-horizontal to gently eastward dipping Quaternary deposits that are overlain by an alluvium plain. They create the plateau that parallels the coastline of the Red Sea and is drained by westerly flowing effluents of Wadi Gawasis. Quaternary deposits are directly followed to the west by syn-rift deposits of gypsum (Middle Miocene).

Structurally, the area is extremely dissected by reactivated fractures and faults. Two sets of fractures with a NW-SE and NW-SW trend are well developed and easily observed in the caves' site. Extensional fault systems with a NNW-SSE to NW-SE trend are dominant in this region.

The stratigraphy of the mapped area can be divided into different rock stratigraphic units from the younger to older as follows:

1) Wadi alluvial: this unit comprises up to 2 m of unconsolidated deposits of conglomerate, sandstone and halite intercalations, covered with talus and terraces.
2) Coral reef rocks: these rocks are represented by salty CO_3-rich material associated with fragments of rocks and fossils. The upper part is almost compact and fragmentary. The lower part near the base is dominantly characterized by the presence of conglomerate. The coral reef rocks are locally composed of chalk.
3) Conglomerate, semi-consolidated sandstone, fossiliferous halite, mudstone and shale intercalations: the conglomerate horizons are polymictic, poorly sorted and matrix supported. The matrix is fine grained sandy and salty. The halite deposits are discontinuous layers (pinched out) and fracture-filling deposits. Halite also forms thin layers as crustaceous developments.
4) Mudstone, shale and halite intercalations.
5) Gypsum (Middle Miocene deposits): these deposits are moderately to steeply-sloped gypsum and anhydrite beds. Shale and marl are common.

The Quaternary deposits are commonly crudely bedded. They are associated with irregular patches of gypsum ($MgSO_4$). Asbestos veins are developed along the fractures and faults underneath the coral reef rocks. The discontinuous halite layers are widely distributed in the area of the Quaternary deposits. Consequently the Quaternary and Middle Miocene deposits are not considered the favorable rocks to trap drinking water.

Mersa/Wadi Gawasis lies along the Red Sea coastal plain, a relatively narrow (2-15 km wide) zone which lies between the Precambrian basement rocks and the Red Sea shoreline. It is composed of Phanerozoic rocks of Quaternary, Tertiary and Cretaceous clastic and carbonate formations that are unconformably overlaid by the Precambrian metavolcanics, metasediments, and intrusive rocks comprising the Red Sea Hills. For approximately 25 million years, this region has been subjected to syn- and post-rift sedimentation along the Red Sea rift zone. The substrate encompassing the occupation site developed during the late Quaternary in the proximity to coral reefs and shallow-water carbonate and clastic sedimentation under arid conditions of the Red Sea coastal plain.

Wadi Gawasis is located approximately 500 m from the present shoreline. The site consists of topographically subdued Quaternary deposits. The strata are subhorizontal to gently eastwardly dipping; Pleistocene reef terraces are overlain by the Holocene fluvial and colluvial deposits, creating a narrow plateau along this stretch of the Red Sea coastline. This plateau is drained by westerly flowing, highly infrequent discharge events from Wadi Gawasis.

2.2.a Geology, stratigraphy

Late Pleistocene / Early Holocene facies in the study area are represented by a series of carbonate reef strata interbedded with siliciclastic deposits. Three or four distinct siliciclastic/coral terraces, each up to 15 m thick, were identified in the study area. A NNW-SSE trending fault scarp forms a prominent marine cliff, located between 10 and 16 m above mean sea level, where the caves are located.

The stratigraphy of the Quaternary (Pleistocene and Holocene) facies at the site can be subdivided into the following stratgraphic units:

1) Early conglomerate terrace: this unit is multicolored, partially compact, with a variable thickness and uneven contacts with adjacent units. The various clasts that compose this unit are derived from the neighboring basement and pre-Quaternary rocks. These clasts are poorly sorted, matrix-supported, composed of rounded to well rounded pebbles, cobbles or boulders, up to 25 cm in diameter. The matrix is calcareous sand, silt and mica.
2) Calcareous sand: the calcareous sand unit is up to 1.5 m thick, yellow-grey in color, partially compact, and coarse- to very coarse-grained with occasional pebbles. It consists of semi-consolidated quartz, pink and white feldspars, dark grey to green mafic ferromagnesium minerals and mica, cemented by carbonate. This unit is argillaceous at the base becoming calcareous toward the upper part of the sequence.

3) Raised coral reef limestone: the coral reef limestone is yellowish white to yellow in color, hard, porous and caverneous associated with an uneven surface. Carbonate-rich fossils (coral reefs, molluscs, echinoids, and shell fragments) as well as algae and rock fragments are often found within this unit. A 1-m thick conglomerate forms the base of this unit. Coral reefs are structures produced by the organic secretion of aragonite (a form of calcium carbonate). The ancient raised coral reefs of Wadi Gawasis are located above the present shoreline and were elevated to their present position above mean high water either by local crustal movements (uplifted) or by lowering of the sea level (see 2.3 Coastal geology).
4) Alluvial conglomerate terrace: the alluvial conglomerate terrace unevenly overlies the uppermost part of the coral reef limestone. It is composed of subangular to subrounded clasts, derived from local Precambrian basement and late Mesozoic and Cenezoic sedimentary rocks, in a sand with silty clay matrix. Quaternary sediments were deposited in a brackish or highly saline marine environment.

2.2.b Structural Geology

Mersa/Wadi Gawasis is located within a fault/fracture system associated with the Red Sea rift. The faults have two primary orientations: NNW-SSE to NW-SE and NE-SW.

Caves 2, 3, 4 and 5 were structurally investigated. They are extremely dissected by five major fractures dating to the late Pleistocene/early Holocene, and are associated with about four additional minor fractures (Figure 3). The predominant trend is NW-SE. They are characterized by several bifurcations at different heights with orientations ranging from 10° and 85° for the same fracture. Several masses and blocks have experienced gravity collapse as a result of weaknesses associated with these intersecting fractures. In some locations, these fractures intersect the subhorizontal bedding at the studied outcrop breaking apart units and leaving these sections precariously perched. As an example of the present situation, slight movements were observed forming a narrow space between the fractured blocks along a secondary NNE-SSW fault/fracture plane.

2.3 Coastal geology

Duncan FitzGerald and Christopher Hein

2.3.a Coastal geologic setting

Geological setting

Mersa/Wadi Gawasis is located 23 km south of the port of Safaga, at approximately 26°33'05" north, 34°02'08" east. 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 of Mersa/Wadi Gawasis were focused along the western and southern slopes of a cliff located approximately 450 m from the present shoreline (2006-2007 field season), as well as across the broad Wadi mouth and several kilometers up the two main tributaries of Wadi Gawasis. This formation contains inter-bedded conglomerates, reef rock, and fossil coral, and is overlain by river-derived 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), accelerated during the Oligocene Epoch (33.7-23.8 ma), and split the Arabian-Nubian Shield to create 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 is a narrow strait between the Arabian Peninsula and African continent connecting the Red Sea to the Indian Ocean, closed. During closure, partial evaporation of the Red Sea produced evaporate deposits, which are found throughout Wadi Gawasis and the surrounding region.

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.

Coastal Setting

Mersa/Wadi Gawasis is located in the northwest corner of the Red Sea, approximately 140 km from the southern end of the Gulf of Suez. It is located at the mouth of an ephemeral river system, with the main wadi-mouth surface situated approximately between 0.5 and 1.5 m above mean sea level (sea level data from Tilia, personal communication 2008). This stretch of coast is microtidal, with a mean tidal range of 0.25-0.50 m (Pugh 1996) and spring range of 0.5-0.6 m (Braithwaite 1987; Edwards 1987). Changes in wind regime produce a lower summer mean sea level (by ~0.5 m) than in winter. The northern part of the Red Sea is dominated by northwest winds (the “shamal”), with mean velocities ranging between 7 and 12 km/hr. 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).

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 9,000 yrs BP these conditions had initiated a wet phase in northeast Africa's climate ("Green Sahara"), known as the African Humid Period (de Menocal *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 8,000 and 5,000 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 4,000 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 stages of the recent transgression, highstand, and regression likely contributed substantially to the infilling of the paleo-bay.

Holocene sea-level change

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 $\delta^{18}O$ foraminifera records from a sediment core taken south of the Sinai Peninsula (Figure 4; Siddall *et al*. 2003). The curve suggests several relative sea-level excursions on the order of 10 m during the past 10,000 years, but that generally sea level in the Red Sea has been rising slowly during the past 4000 years. 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. Thus, little confidence is placed on the details of this curve due to the large error bars; estimates of late Holocene sea-level change must therefore rely on higher-resolution proxies such as coastal deposits, raised terraces, and wave-cut notches. 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. 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.

One particular area of focus for our investigations at Mersa/Wadi Gawasis was the possible existence of higher-than present sea level along the Egyptian Red Sea coast during the time of site occupation. Such elevated sea levels would have contributed positively to paleo-bay and wadi entrance depths, and comport well with sea-level change elsewhere in the world during this time. In particular, a mid-Holocene highstand along equatorial and southern 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. Taylor and Illing (1969) identified strandlines in Qatar located 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. We thus expanded our investigations of paleo-environmental conditions at Mersa/Wadi Gawasis over the years of our study to include mapping of evidence of higher-than-present sea levels locally, and later inclusion of rheological modeling of multi-centennial-scale sea-level change.

2.3.b Coastal geology, 2006-2007 field season

The first coastal marine geological studies were conducted at Mersa/Wadi Gawasis from 29 December 2006 through 11 January 2007. The primary objective of these studies was to determine the geologic setting of lower Wadi Gawasis at the time of occupation, *ca.* 4000 years before present (BP). The specific goal of this initial investigation was to determine if the low-lying area at the base of the cave-containing cliffs was in the past an embayment that ships might have used as a sheltered harbor.

Data collection, 2006-2007

During the 2006-2007 field season, several hundred meters of ground-penetrating radar (GPR) data were collected along the base of the cliffs. In addition, eight coring transects were completed that extend from the colluvial/alluvial deposits at the foot of the cave-containing cliffs toward the center of the wadi (Figure 5). Initial surveys indicated that the floor of the wadi was likely a shallow embayment 4000 years ago. Our coring transects sampled from protected shore settings (#1) to more exposed environment (#8). Twenty-eight auger cores were taken along these transects (3-4 holes per transect, generally spaced ~10 m apart). Eight of these were cored in pre-excavated archaeological pits and the other 20 auger holes were cored in new, ~1 m^3 pits dug by four workmen. All augers holes began at a depth of approximately 1 m into wadi sediments. The stratigraphy (layering) of the sides of the pits and the core was recorded. The cores were generally 1-2 m deep (deepest was 381 cm from wadi surface) and provided information concerning the sediments deposited in, and the fauna that once lived in, the bay.

Preliminary results, 2006-2007

Attenuation of the GPR signal caused by a salt layer and compact clay in the shallow subsurface hindered data collection and geophysical interpretation of the subsurface. One feature of note, which was traced across several GPR transects in the southeastern section of the site (near Pit WG 37, A4, SU3), was characterized by relatively steeply dipping to near-horizontal reflectors oriented toward the base of the cliffs at what has been interpreted to be the paleo-shoreline. Weaker wadi-ward dipping reflectors are seen near the terrace base (Figure 6). Analysis suggests these reflectors may represent a shallow (<1 m) salt horizon presently situated higher than any archaeological evidence of occupation.

Auger holes were subdivided by the sediments found at the bottom of each hole (Table 1). Nineteen of the holes ended at an impermeable layer found 1-2 m below the surface. This layer consisted predominantly of carbonate cemented coral and beach rock (Figure 7). At the remaining nine auger holes, grey sand was found at depths ranging from 1.5-2.5 m. The grey color is likely the result of anoxic conditions of previous water table levels resulting in iron oxide coatings. The depth-limiting factor of these auger holes was the inability to penetrate more than ~1 m below the water table due to collapse of the hole. In hole WG-T7A3, a beach rock layer (10 cm thick), which was penetrated with a hand axe, was underlain by the same grey medium fine sand. This implies a ubiquitous distribution of the grey sand layer at depth throughout the study area.

Shells were collected from all auger holes, and they generally increased in abundance, especially gastropods, from the sheltered to the more open-water setting (T1 to T8). Shells found in protected areas (T1-T4) were generally more delicate, thin bivalves compared with the thicker shells of the higher energy environments (T5-T8). However, one relatively fragile bivalve occurs throughout the study area.

Auger Hole	Pit Depth (cm)	Auger Core Length (cm)	Total Length of Strat Section (Bottom of Hole, cm)	Bottom of Hole (sediment type)
WG-T1A1	115	235	350	Beach Rock / Coral
WG-T1A2	102	183	285	Gray Medium Sand
WG-T1A3	72	150	222	Gray Medium Sand
WG-T1A4	74	170	244	Gray Medium Sand
WG-T2A1	94	200	294	Beach Rock / Coral
WG-T2A2	95	220	315	Gray Medium Sand
WG-T2A3	105	106	211	Gray Medium Sand
WG-T2A4	120	260	380	Gray Medium Sand
WG-T3A1	140	331	471	Beach Rock / Coral
WG-T3A2	115	50	165	Beach Rock / Coral
WG-T3A3	105	35	140	Beach Rock / Coral
WG-T3A4	90	210	300	Gray Medium Sand
WG-T4A1	100	6	106	Beach Rock / Coral
WG-T4A2	110	27	137	Beach Rock / Coral
WG-T4A3	105	80	185	Beach Rock / Coral
WG-T5A1	145	15	160	Beach Rock / Coral
WG-T5A2	120	25	145	Beach Rock / Coral
WG-T5A3	125	0	125	Beach Rock / Coral
WG-T5A4	140	241	381	Gray Medium Sand
WG-T6A1	145	0	145	Beach Rock / Coral
WG-T6A2	110	45	155	Beach Rock / Coral
WG-T6A3	125	20	145	Beach Rock / Coral
WG-T7A1	260	50	310	Beach Rock / Coral
WG-T7A2	202	0	202	Beach Rock / Coral
WG-T7A3	140	57	197	Beach Rock / Coral
WG-T8A1	160	100	260	Beach Rock / Coral
WG-T8A2	170	82	252	Beach Rock / Coral
WG-T8A3	160	130	290	Gray Medium Sand

Table 1. *Results of auger cores. Note that those augers labeled A1 are along the colluvial / alluvial slope at the foot of the coral terrace and generally start from a higher base level (>0.5 m) than the wadi.*

Our preliminary analyses suggested that, during the time of occupation, the wadi was a shallow, semi-enclosed bay. Along the base of the present cliffs was a narrow coral-beach rock platform. A shallow embayment existed seaward (south and west of coral terrace) of this platform, similar to shore condition today. Shell distributions indicate that much of paleo-bay shoreline was a low energy environment. However, much of these analyses remain speculative until further studies are completed.

2.3.c Coastal geology, 2007-2008 field season

Coastal geological studies were conducted at the Mersa/Wadi Gawasis archaeological site from 3-10 January 2008. The primary objective of this work was to determine the geologic setting of the Wadi Gawasis site at the time of occupation, 4000 years before present (BP).

Field studies accomplished during the 2006-2007 field season concluded that a bay once existed in the area presently occupied by Wadi Gawasis. The occupation site is located south of the coralline cliffs along the margin of the paleo-bay, and atop a coralline/beach rock surface that was found and mapped within the wadis sediments along the cliffs. This surface roughly parallels the cliff front and thins in a wadi-ward direction (seaward). Distal to the cliffs the beach rock was approximately 30 cm thick; here it likely represents a paleo-shoreline.

Efforts during the 2007-2008 field season were directed at further defining the bay seaward of the beach rock surface. Deep (> 5 m) cores were taken across the lateral extent of the wadi to better constrain its depth and geometry. Additionally, foraminifera studies and comparisons of the sedimentology and geomorphology of this area to similar sites to the south were used to determine the paleo-environment of the study site at 4 ka.

Data collection, 2007-2008

During the 2007-2008 field season, a pulse auger system was used to collect 11 deep (3-6 m) auger cores to supplement the 28 short (1-3 m) auger cores taken during the previous field season. Several auger holes from the previous field season were re-entered and three of the previous transects (T3, T5, and T6) were extended across the Wadi (Figure 8). Core sites were separated by several hundred meters such that south-trending transects ended half way across the wadi.

Due to the inability of the pulse auger system to penetrate hard strata (*e.g.*, salt and pebble layers), pits were excavated to a depth of between 1.5 and 2 m by workers. This allowed auger cores to start below the modern wadi surface and below any hard surfaces. A hand auger was used to dig to the water table. The pulse auger system was then used to retrieve sediment from the core holes. This method recovers sediments at known depths but does not allow for the observation of sedimentary structures. The detailed stratigraphy of the sides of the pits was recorded; coarser stratigraphic units from the auger and pulse auger holes were also recorded. The cores generally terminated between 4 and 6 m below the wadi surface. Sediment samples were taken from several pits for foraminiferal analyses.

Results, 2007-2008

A total of eleven cores was taken, reaching depths between 3 and 6 m below the present wadi surface. Cores WG-T3A4 and WG-T5A5 were taken in pits by the same name from last year; this method served to extend previous core records. Stratigraphic data from the cores were logged by transect and data converted to graphic core logs (Figure 9). Cores were subdivided by the sediments found at the bottom of each hole and these data were added to the database from the 2006-2007 field season (Figure 8). Twenty of the cores terminated at an impermeable layer found several meters below the ground level. This layer consisted predominantly of carbonate-cemented coral and beach rock (Figure 10). The remaining eighteen auger cores ended in gray, medium-fine sand; the depth of these holes was constrained only by the ability of the coring equipment to penetrate deeper below the water table.

Shells were collected from all auger holes during both years, and they generally increased in abundance, especially gastropods, from the sheltered to the more open water setting (T1 to T8). Shells found in the protected areas (T1-T4) as well as those found in the lagoonal sediments in the main wadi were generally more delicate, consisting of thin bivalves compared to the thicker shells of the higher energy environments (T5-T8). However, one relatively fragile bivalve occurs throughout the study area. Results of malacological investigations by Alfredo

Carannante of shell samples collected are presented in Table 2. Nearly all shells (bivalves and gastropods) collected typically live in intertidal or subtidal muddy or sandy bottoms in the very nearshore or lagoons.

Site	Primary Species	Notes
WG-T6 A6 570-586 cm	*Elphidium craticulatum*	*Quinqueloculina* and *Ammonia tepida* less common; fewer ostra-codes; less mica
	Ammonia tepida	
	*Peneroplis planatus**	
	Quinqueloculina sp.	
	Peneroplis pertusus	
WG-T6 A5 560 cm	*Elphidium craticulatum*	Lots of mica; highly weathered rock material
	Ammonia tepida	
	Peneroplis planatus	
	Quinqueloculina sp.	
	Peneroplis pertusus	
WG-T5 A4 550 cm	*Elphidium craticulatum*	Much more rock debris (less weathered); bugs are smaller proportion of sample; ostracodes
	Ammonia tepida	
	Peneroplis planatus	
	*Quinqueloculina sp.**	
	Peneroplis pertusus	
WG-T6 A6 440 cm	*Peneroplis pertusus**	Much less mica; som ostracod shells; several crab claws; several coral pieces; more lessweathered rock material
	Elphidium craticulatum	
	Ammonia tepida	
	Peneroplis planatus	
	Quinqueloculina sp.	
WG-T6 A7 320 cm	*Elphidium craticulatum*	Lots of mica; lots of ostracod shells
	Ammonia tepida	
	Peneroplis planatus	
	Quinqueloculina sp.	
	Peneroplis pertusus	

Table 2. *Results of foraminifera analyses. Asteriks after species name indicates the most common species in given sample.*

Sediment samples were retrieved from several cores in the wadi. These samples were studied for foraminiferal abundances (Tables 3-4). All results of these foram analyses suggest that the sediments were deposited in a lagoon with infrequent freshwater inputs. These species live in a salinity of 35-53 parts per thousand in depths of less than 50 m in warm, lagoonal environments.

Species	**WG-T6 A6 570-586 cm**	**WG-T6 A5 560 cm**	**WG-T5 A4 550 cm**	**WG-T6 A6 440 cm**	**WG-T6 A7 320 cm**
Elphidium craticulatum	x	x	x	x	x
Ammonia tepida	x	x	x	x	x
Peneroplis planatus	X	x	x	x	x
Peneroplis pertusus	x	x	x	x	x
Quin-quelo-culina sp.	x	x	X	x	x

Table 3. *The five most abundant species identified during faunal analysis are represented by an 'x.' 'X' denotes the most frequently occuring species within a sample.*

Species	**Substrate/ Lifestyle**	**Salinity (PSU)**	**Depth (m)**	**Temp. °C**	**Other**
Elphidium craticulatum	Epifaunal/ free; sand; vegetation	30-70	50	Temper-ate-warm	-
Ammonia tepida	Infau-nal/free; muddy sand	>0	0-50	Warm temper-ate-tropical	Brackish and hyper-saline lagoons
Peneroplis planatus *Peneroplis pertusus*	Epifaunal clinging: plants and hard sub-strates	35-53	0-70	18-27	Lagoons and inner-most shelf
Quin-quelo-culina sp.	Epifaunal free or clinging	32-65	-	Cold-warm	Hyper-saline lagoons; mar-ine marsh and shelf

Table 4. *Genera-specific habitat information is provided and suggested Wadi Gawasis constraints are based on overlap of environmental parameters, with* Peneroplis *spp. providing the narrowest salinity range.*

Discussion

Preliminary analyses suggest that, during the time of occupation, the wadi was a shallow, semi-enclosed bay (~1.5 km^2) with an open connection to the Red Sea.

The base of the present cliffs consists of a narrow coral-beach rock platform. Archeological excavations during the 2006-2007 and 2007-2008 field seasons found a number of occupation sites within one meter above this beach rock surface. From the cliffs toward the wadi of the coral-beach platform a medium-fine gray sand is found at depth in all auger cores. The grey color most likely results from anoxic conditions of previous water table levels resulting in iron oxide coatings. The occurrence of this sediment below the thin beach rock layer found in WG-T7A3 indicates a ubiquitous distribution of this sediment at depth throughout the study area. Based on the sedimentology and relative abundances of mollusk and foram species, this sediment is interpreted as having been deposited in a tidal lagoon. Shell and foraminifera distributions indicate that much of paleo-bay was protected and a low energy environment. Wadi sediment-delivery processes (largely ephemeral river flow) have since infilled the bay.

Quseir al-Qadim: A geological equivalent of Mersa/Wadi Gawasis?

During the 2007-2008 field season Myos Hormos/Quseir al-Qadim was visited. Quseir is located approximately 50 km south of Mersa/Wadi Gawasis and contains archeological evidence for the existence of both Roman and Islamic ports (Blue 2007; Figure 10, 11, 12). This site shows a number of similarities with Mersa/Wadi Gawasis. Stratigraphic sections created from cores taken at this site are nearly identical to those at Wadi Gawasis. The paleo-environment of Quseir has also been interpreted as an open lagoon. Over several thousand years, the lagoon was filled by wadi sedimentation and by 900 years BP had become a small embayment. This bay was subsequently filled, shifting the shoreline several hundred meters seaward of the paleo-ports. Though wadi infilling processes alone can explain the evolution of this bay, a change in relative sea level since the time of occupation could complicate this scenario. Evidence at Mersa/Wadi Gawasis suggests that this site followed a similar evolutionary history from a Middle Kingdom port to a filled, dry wadi.

2.3.d Coastal geology, 2009-2010 field season

Previous geological field studies at Mersa/Wadi Gawasis (2006-2007; 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. 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:

1) Confirmation of the existence of a bay in the area presently occupied by lower Wadi Gawasis.
2) The occupation site is located south of the coralline cliffs containing the man-made caves, along the margin of the paleo-bay.
3) 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. It is interpreted as a paleo-shoreline of the former bay.
4) Cores across the paleo-lagoon determined that the lagoonal sediments extended at least 6 m below present mean sea level.
5) 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.
6) A wave-cut notch and 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.
7) Quseir al-Qadim, a filled sabka similar to Wadi Gawasis, does indeed provide a comparison site in terms of stratigraphy, sedimen-

tology, 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 widespread 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 to 14 January 2010. The purpose of this final season of work was to address several outstanding 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?

Data collection, 2009-2010

During the 2009-2010 field season, a variety of methods were employed to address the questions described above; 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 13). 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.

Topographic and geomorphic surveys of wave-cut notches and erosional terraces along the coast and entrance to Wadi Gawasis were performed to confirm the existence and elevation 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, 2009-2010

All cores were stratigraphically logged on site, with particular attention paid to fining upward sequences (Figure 13 A; interpreted as flood 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:

1) *Wadi:* ubiquitous sediment (upper-most unit across all cores) composed of gravel, sand, silt, and multiple fining upward sequences; thickness is 2.5-4.0 m; thicker along the western and southern margins of the paleo-bay.
2) *Tidal Flat:* mottled clay, silt, and very fine sand with rootlets and multiple oxidized layers (Figure 14); rootlets identified (R. Gerisch per. comm.) as *Avicennia marina*, *i.e.*, mangrove; represent protected, quiet water environments.
3) *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.
4) *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.

5) *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 m and 7 m long 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 15). 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 above. An integrated discussion from all coastal geological studies at this site is presented by Hein *et al*. (2011).

Sea-level change

Despite the lack of a detailed Holocene sea-level curve for the Red Sea, there is ample documented evidence of a higher-than-present stand of sea level during the middle Holocene. This evidence is derived, in part, from 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. Features are located 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, we identify a 3 m wide erosional terrace (Figure 16). 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 tidal predictions, 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. 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 sea-level 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 best-fit model (Figure 17) predicts a highstand of 1.0 m at 5 ky BP (G. Milne per. comm.; Hein *et al.* 2011). 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.

Dimensions of paleo-bay and entrance channel

The paleo-bay at Mersa/Wadi Gawasis existed concurrently with the occupation of the site. 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 mapped at the far western and southern extremities of the coring transects. In the two western-most cores on T-11 (Figures 18; 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. 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 20). The maximum possible area of this bay is approximately 450,000 m^2, though as noted above, it likely never reached this size due to concurrent infilling from the wadi river. 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 m^3. Based on the empirical relationship between the tidal prism filling and draining a bay and the cross-sectional area of that bay's inlet channel (O'Brien, 1931), the paleo-bay at Mersa/Wadi Gawasis requires an inlet channel cross-sectional area of 32 m^2. By comparison, the channel identified at the mouth of Wadi Gawasis (Figure 15) has a cross-sectional area of 1300 m^2, 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 paleo-bay that existed during the time of occupation closed as a result of two processes: falling sea level and wadi infilling. 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 considerably more area than had sea level been 1–2 m lower than present at that time. Conversely, falling sea levels between 5000 and 2000 yrs BP were directly responsible for the contraction and eventual closure of the paleo-bay at Mersa/Wadi Gawasis.

The paleo-bay at Mersa/Wadi Gawasis likely never reached its maximum dimensions due to the persistence of sediment inputs from the nearby wadis. In fact, various lines of evidence suggest that sediment delivery from nearby rivers 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 22). 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 the period of sea-level rise, wadi inputs dominated the system and drove shoreline progradation, prior to the forced regression forced later by sea-level fall.

Paleo-climatic records can be used to explain these observed trends. The enhanced precipitation of the mid-Holocene African Humid Period 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 alongshore 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.

2.4 Geophysical Survey

BENJAMIN VINING

The geophysical survey that began during the 2005-2006 season at Mersa Gawasis was continued in the 2006-2007 season. During the previous year, slope and much of the wadi surface in the western portion of the site were surveyed with a magnetic gradiometer. This survey was continued to include the portion of the site on top of the fossil coral terrace. Ground Penetrating Radar (GPR) data were also collected along several transects. Both the gradiometer and the GPR were employed to detect known anthropogenic caves in the corral terrace, and the response from known caves served as controls for locating additional possible features. Additionally, the GPR survey formed part of a geoarchaeological program to compile data on the near-coastal and wadi geomorphology in the immediate vicinity of the archaeological site at Mersa/Wadi Gawasis. This report summarizes the methods used during the 2006-2007 field season and presents the results.

2.4.a Methods

The magnetic survey of 2005-2006 was extended using the same instrument, a Geometrics G-858 cesium vapor gradiometer. Gradiometers measure variations in the Earth's magnetic field using two magnetometers that acquire simultaneous readings. Localized variations in the earth's magnetism, referred to as anomalies, can be caused by geological features and also by human activity that concentrates or depletes or otherwise changes the distribution of magnetic minerals near the earth's surface. In archaeological contexts, this can be caused by high-temperature burning associated with fire-pits or kilns; concentrations of ceramics, brick, or other fired clay; and metal or rock that contain ferrous material. The gradiometer uses two sensors, subtracting one reading from the second, to be sensitive to subtle features near the surface that are typical or archaeological sites. Measures of the earth's magnetic field, or "total field readings," can also be recorded by using a single sensor. These are effective for broader, regional trends and larger features. Both gradient and total-field readings were taken at Mersa/Wadi Gawasis in 2006-2007, the first to map archaeological features at the surface and the second to try to identify caves excavated into the coral terrace.

Magnetic data were collected in 20 × 20 m grids. Data were collected along transects spaced 100 cm apart (X interval) and at a rate of approximately one reading every 10 cm (Y interval). Variations in magnetism were measured to within 0.1 nano-Tesla (nT) per meter.

Ground Penetrating Radar uses pulses of electromagnetic energy in the radio-wave frequency to image abrupt changes and contacts between substrates in the ground's subsurface. Each material has a dielectric constant value, or relative dielectric permeability (RDP), that describes the velocity at which electromagnetic waves propagate through it. Features are detected as reflections that result from the changes in velocity that occur at the boundaries of materials with differing RDP. For conditions at Mersa/Wadi Gawasis, RDP values will change with moisture content, grain-size (of unconsolidated sediments), lithification, salt content, and air content, among other characteristics.

In addition to substrate conditions, signal resolution is a function of antennae frequency, or the amplitude of the radar pulse created by the antenna. Two antennae were used at Mersa/Wadi Gawasis: A 200 MHz antenna was used to map larger scale features, such as the evidence of earlier shorelines, while a 400 MHz antenna was used to map smaller cultural features and deposits.

2.4.b Results, cave detection

Given the significant archaeological finds that have been associated with artificial caves excavated into the western edge of the coral terrace (Caves WG 1-7), locating additional caves was an obvious focus of the geophysical research undertaken at Mersa/Wadi Gawasis. To date [2005-2006], three methods were attempted: electromagnetic induction, magnetic total field and gradient measurements, and GPR. The caves are difficult geophysical targets; their small cross-sections (ca. 2 × 3 m) relative to their depth beneath surface, at times over 6 meters, means that they fall between the windows of detection typical of most near-surface - shallow and deep subsurface sensors. Nonetheless, we tried modifying conventional applications in order to detect caves, with varying results.

Figures 20 A and 20 B show the areas surveyed magnetically in seasons 2005-2006 and 2006-2007 (Figure 21 A), and the total magnetic field measurements made above the locations of Caves 2-7 (Figure 21 B). It was found during the previous field season that the conglomerate bedrock underneath the coral and into which many of the caves are excavated had a significant magnetic signal. This is likely due to the number of volcanic cobbles that make up the conglomerate. We consequently measured the total magnetic field and an extended gradient (with sensors separated by approximately twice the normal distance) in order to try to identify any magnetism associated with these caves as air spaces or voids excavated into a magnetic medium. Theoretical computer models suggest that this should be possible, albeit by virtue of a very low magnetic contrast between the rock and the airspace. In the images, several large and disperse anomalies can be seen, some of which correspond to the locations of known caves. These data, however, are tenuous and additional processing and comparison of the total field and gradient data are necessary in order to determine whether or not these caves can be detected via magnetic methods.

2.4.c Results, detection of small-scale cultural features

The loose, dry aeolian sand found over much of the site at Mersa/Wadi Gawasis presents ideal conditions for resolving features with GPR, though the use of GPR is substantially complicated by clay- and salt-rich deposits that are found elsewhere at the site, such as within the wadi. A good example of the application of GPR in the former conditions is that of the wooden cargo boxes which were located outside Caves 5-6. These boxes were in a matrix of very fine and clean, wind-blown sand. This type of material has a very low RDP, allowing radar energy to propagate cleanly and with minimal loss of energy (Figure 22).

Prior to the start of the 2006-2007 excavations, we collected GPR data from this area in a 10 × 10 m grid (transects were spaced 50 cm apart) using the 400 MHz antenna. This relatively small antenna has a narrow footprint and generates moderately high-frequency radar energy. In the previous excavation season, several wooden cargo boxes had been located in this area and it was known that several more were underneath the sand, yet to be excavated. We ran the radar over this area both as an exercise to text equipment settings in this environment and to see if the boxes were detectable, as well as to try to identify how many boxes there were and what their distribution was.

Figure 23 shows four profiles in which the boxes are clearly visible. The excavation showed that the sand is this area was very homogenous and had only poorly defined lamination. All the features in the radar profile, consequently, can be attributed to the boxes and box fragments. Due to the reflection geometry of radar waves, the boxes appear as "parabolas," or ∩-shapes. Several of these can be seen to overlap in the excavations indicating box parts in close proximity to one another or actually being superimposed within the deposits.

2.4.d Results, geomorphological profiling across the hypothesized palaeo-coastline

With the increasing discoveries of maritime objects at Mersa/Wadi Gawasis, more attention was given to the hypothesis that the immediate vicinity of the archaeological deposits was an open waterway or port during pharaonic periods. The 2006-2007 season thus included a program of sedimentological augering with the intent of identifying beach deposits that would indicate earlier shorelines (see 2.3.b Coastal geology, 2006-2007 field season). Subsurface profiling with a 200 MHz Ground Penetrating Radar antenna was included in this program.

Eight profiles were run, as indicated in Figure 24. The profiles ran from the northeastern ends out into the wadi for approximately 70-30 meters. These profiles, numbered 1-8, are shown in Figure 24. All profiles were run in the same direction, such that the first trace (0) is on the northern, or upslope/landward end of the profile and the last trace (between 600-800) is on the southern or seaward end of the profile. Profile 1 is the westernmost profile and Profile 8 is the easternmost.

Several patterns were immediately apparent. Principally, there are few well defined features in any of the Profiles, with the exception of Profiles 1 and 2 that show several shallow bedding features between, approximately, traces 1-300. In contrast, the other profiles show horizontal-subhorizontal bedding units, and possibly only the suggestion of a channel (in profile) in number 8. This potential channel corresponds to a recent wadi channel which is visible at the surface and which was also detected in the previous field season's magnetic survey. There is also considerable antenna "ringing" (defined horizontal striping) from the increased clay content of this feature. The horizontal-subhorizontal bedding in the rest of the profiles suggests that the mapped deposits all reflect low energy sediments; this is consistent with the grain size (silt-fine sand with minimal clay) that was encountered through most of the upper profiles while augering.

At this point, it is not possible to calculate to what depth exactly is represented in these radar profiles. Velocity calculations are necessary, but were not possible in the field conditions. Given published RDP values for similar materials, however, I would conservatively estimate the depth at approximately 2 m beneath the surface for 500 samples (the depth of the indicated profiles).

2.5 Mapping

STEFANO TILIA

2.5.a Mapping, 2006-2007

During the 2006-2007 field season at the site of Mersa/Wadi Gawasis, the topographic survey operations were focused, in large part, on the completion of the elevation measurements of the site and its surrounding terrain (Figure 25). In particular, attention was placed on depicting the topography of a portion of the wadi bed directly facing the site. To achieve this, measurements were made following a grid pattern with a spacing between points of 5 to 10 meters. The result of this procedure was a DEM

(Digital Elevation Model) which was subsequently integrated into the general elevation model produced in the previous field seasons.

Other topographical operations were the mapping of a series of geological test pits necessary in the research of possible ancient coastlines and the positioning of the areas which had undergone geophysical investigation.

One important task was the mapping of Caves 1-7 and their positioning in respect to the general plan. These operations presented themselves with a number of difficulties, not to mention safety issues, and even though the results were satisfying, further work will be necessary in future field seasons probably through the use of special equipment such as, for example, laser scanners. Mapping of the caves was not yet complete since at least one of the caves has not been accessed yet [Caves 6 and 7] and some blind spots in another must still be tackled.

2.5.b Mapping, 2007-2008

During the 2007-2008 field season at Mersa/Wadi Gawasis, a number of tasks were planned concerning both the further definition of the area's topography and the documentation of the caves. In order to carry out the latter, it was decided to acquire surface data through the use of a new generation laser scanner. The topographer's duty in this case was to georeference the laser scan point clouds and to offer reference points where the lack of point cloud overlap created difficulties in their joining (*e.g.*, narrow passages between caves and at entrances). This was accomplished through the acquisition of point cloud registration markers using a total station. The coordinates assigned in this way to the markers were coherent with the site's chosen reference system (WGS84 UTM). Along with the collaboration with the laser scanning team, assistance was also given to the field archaeologists in order to position every excavation trench created during the fieldwork. In particular, the surveying of a number of points enabled better documentation of the features which were brought to light in WG 55-56.

Another task was the positioning of a series of test pits excavated along a number of transects crossing the wadi bed. The goal of these pits was to determine the ancient coast lines running deeper into the wadi and thus closer to the archaeological area. In fact, a series of trenches excavated just southeast of the main terrace had brought to light evidence of a possible beach environment. In this case it was important to assess the altimetry of this particular area also in relation to the test pit's geological stratigraphy. The positioning of these pits was carried out by taking their elevation (relative to sea level) into account.

The final phase of the topographical fieldwork was the acquisition of elevation points in the coastal area where there were tumuli/shrines along the northern side of Mersa Gawasis. These measurements will enable further advancement of the general topographic map of the area.

2.6 Laser scanning technology application

ANDREA D'ANDREA AND GIANCARLO IANNONE

2.6.a Laser scanning, 2007-2008

In the 2007-2008 field season laser scanning technology was applied with the support of the Centro Interdipartimentale di Servizi di Archeologia (CISA), UNO, Naples, to generate a detailed 3-D model of the western terrace wall, where Caves 2-5 were located, and the inside of Caves 2 and 3, in order to provide a proper reconstruction and plan of these caves, as well as a more precise assessment of the preservation and stability of these features for a future consolidation project. An Imager 5005 3-D scanner manufactured by Zoller & Frolich was used. The software JRC 3-D Reconstructor was used to generate 3-D reconstruction of the images.

Procedure, 2007-2008

The procedure required four days of fieldwork and four weeks of analysis and elaboration of the scanned images. Targets were applied to the outside and inside walls of the caves, paying much attention to place the targets in intermediate locations between the different surfaces in order to obtain one geometric reconstruction of all shots. On the whole, 15 shots were made (5 for the outside coral terrace wall, 4 in Cave 2, and 6 in Cave 3). Each target was also mapped with TLS to georeference the whole reconstruction. Finally, digital photos of the surfaces were used to calibrate the images produced with the scanner.

The last phase of the data elaboration was a 3-D model in movement in order to show the plan and profiles of the structures from different perspectives (Figures 26, 27, 28).

Results, 2007-2008

A relevant result is the elaboration of simulated horizontal and vertical cross plans, which can provide useful information for future work in the caves.

2.6.b 3-Dimensional models with laser-scanner, 2009-2010

During the 2009-2010 field season a laser-scanning survey of the western wall of the coral terrace at Wadi Gawasis was continued, which began in 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 where 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 × 20 m.

Two scans were made in Cave 2 with 5 targets at about 3.8 m apart, covering an area of 24 m × 5 m (120 m²). Two scans were made in Cave 3 with 4 targets 4.3 m apart, over an area of 15 m × 5 m (60 m²).

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 × 5 m (125 m²); and 2 scans were made inside, covering an area of 6 m × 4 m (25,23 m²).

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-referenced according to the absolute coordinate system. The geo-referenced points were used to align all scans in order to generate a complete geo-referenced 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.

2.7 Robotic inspection of Caves 6 and 7

HOWIE CHOSET

A robotic inspection of Caves 6 and 7, which are too unstable for humans to enter due to fear of collapse and thus are well suited for robotic exploration, was conducted in January, 2011 by Howie Choset (Carnegie Mellon University) to test a prototype of snake robot for archaeological investigation.

These robots are highly articulated mechanisms that can thread through tightly packed volumes reaching locations that people and machinery otherwise cannot (Figure 29). Their ability to move through a myriad of terrains suggests that snake robots have the potential to explore tombs, buried aqueducts, and pyramid passageways that are too small for people to enter. Once in a void space, the snake robot can move about with minimal disturbance to surrounding areas, through rugged terrain traversing distances over 150 meters. The snake robots consist of sixteen identical single degree of freedom modules arranged in a serial chain. The robot, approximately 91.5 cm long by 5 cm in diameter, moves by changing its body shape to push off the environment.

Unlike the robot used in the Giza pyramids, the snake robot can look around corners, pass through many holes and cracks, and access regions rigid mechanisms cannot. An on-board camera, with its own lighting, can return images from remote dark void spaces providing views which are otherwise unobtainable. These robots can also be fitted with water protective skin to pass through volumes containing water.

The snake robot was deployed to explore the caves (Caves 6 and 7) by having one person lay in front of the entrance to insert the robot and then manage the tether (Figure 30). The robot entered the first cave (Cave 6) and explored areas mostly in view from the entrance (Figure 31). At some points the robot was able to see parts of the cave not visible from the entrance, but no artifacts were found. It was clear from the view from the snake robot's camera that the cave went back further, however, the robot had difficulty getting up a slope which prevented it from continuing. The robot also entered Cave 7 with similar results.

From our experience at Wadi Gawasis, we learned what changes we would need to make to the robot in order to progress further in the caves in the future. Examples of this include better slope climbing, situational awareness, and forward movement of the robot.

Figure 1. *Map of location of the site and of other sites and regions mentioned in the text.*

Figure 2. *Satellite image of the site.*

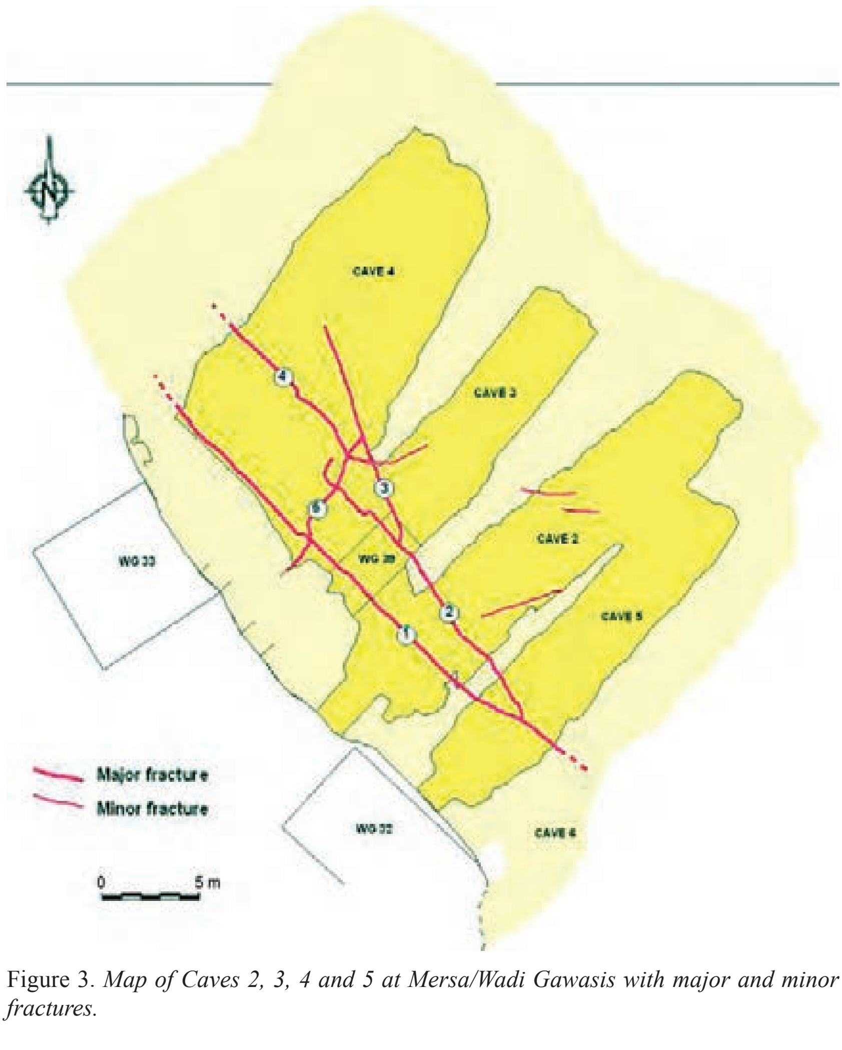


Figure 3. *Map of Caves 2, 3, 4 and 5 at Mersa/Wadi Gawasis with major and minor fractures.*

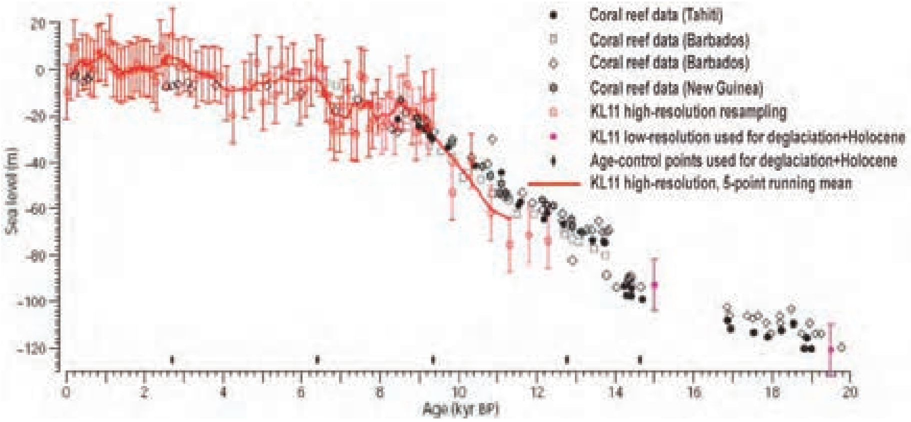


Figure 4. *Sea level curve for northern Red Sea, adapted from Siddall et al., 2003.*

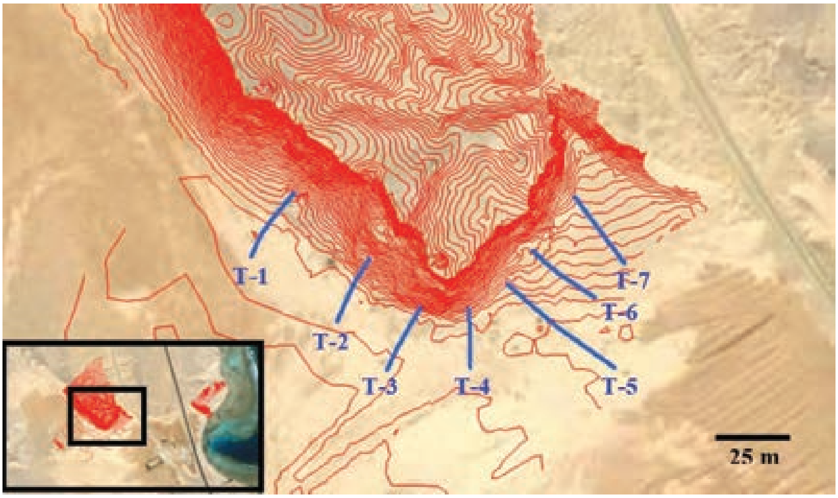


Figure 5. *Map of study area showing approximate locations of coring transects.*

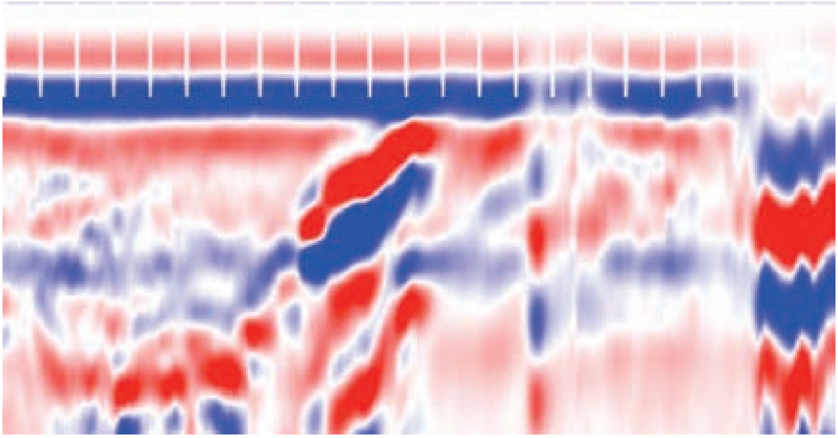


Figure 6. *Sample Ground Penetrating Radar (GPR) profiles showing relatively steep wadi-ward (northward) dipping reflectors.*

Figure 7. *Samples of reef rock taken from excavation pit consisting of coral, shells, and sand lithified by calcitic cement in excavation unit WG 37, A4, SU3.*

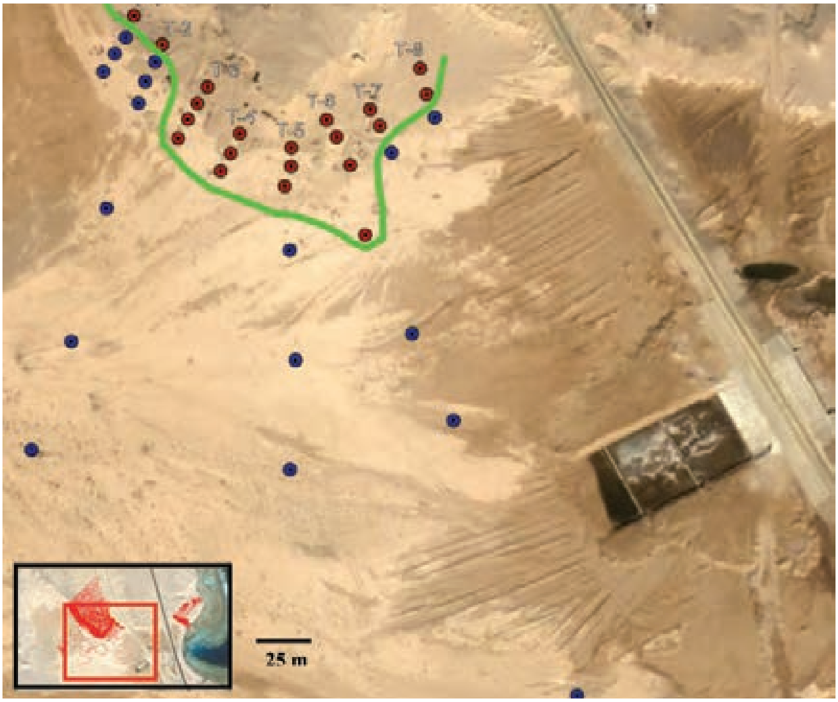


Figure 8. *Map of study area showing locations of cores and transects (T-1/T-8), red dots indicate cores that ended at beach rock/coral, blue dots indicate cores that ended in gray medium-fine sand (possible lagoonal sediments), green line approximates location of paleo-shoreline of bay, based on location of buried beach rock.*

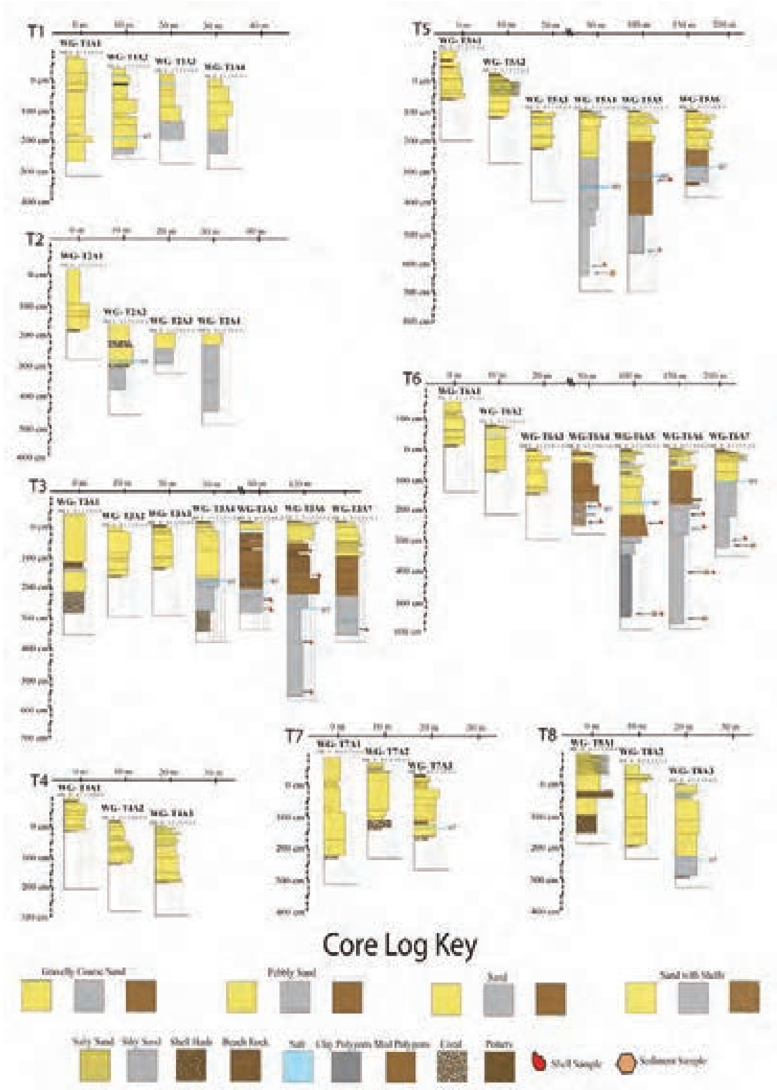


Figure 9. *Graphic core logs from each of the 8 auger and pulse auger core transects taken during the 2006-07 and 2007-08 field seasons. A) Transect 1. B) Transect 2. C) Transect 3. D) Transect 4. E) Transect 5. F) Transect 6. G) Transect 7. H) Transect 8. I) Core Log Key.*

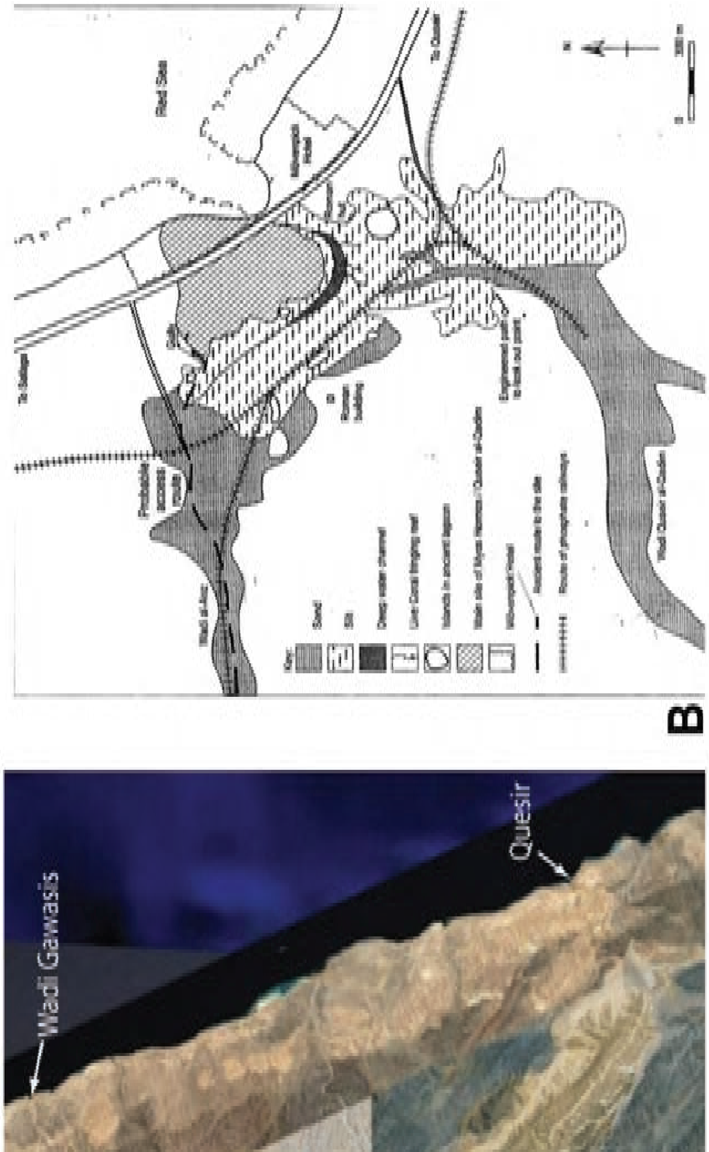


Figure 10. *Site of Quseir al-Quadim and postulated silted lagoon (A. from Google Earth; B. from Blue, 2007).*

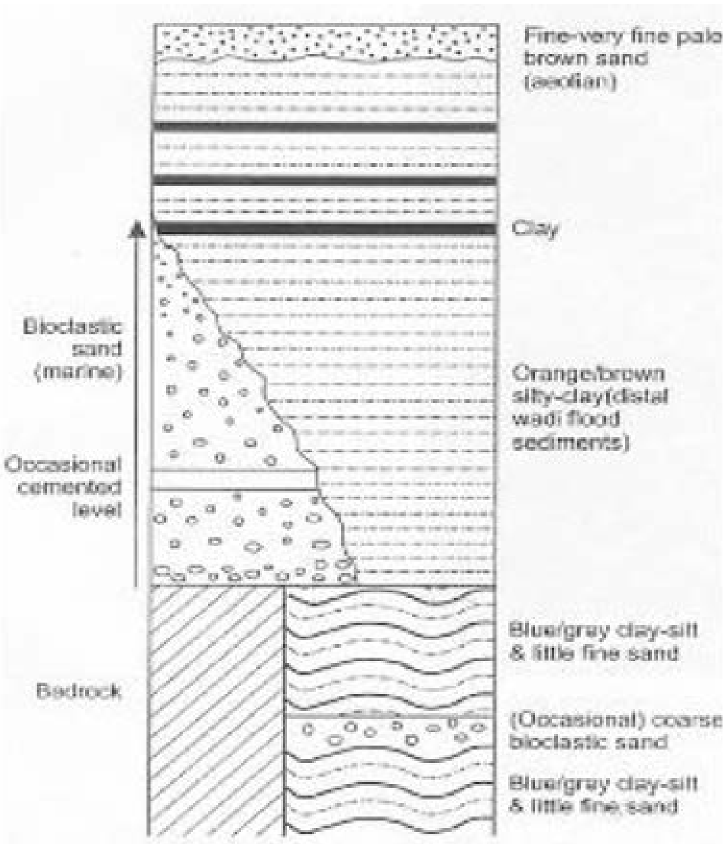


Figure 11. *Generalized lithological sediment units described by Blue, 2007 at Quseir (Blue, 2007).*

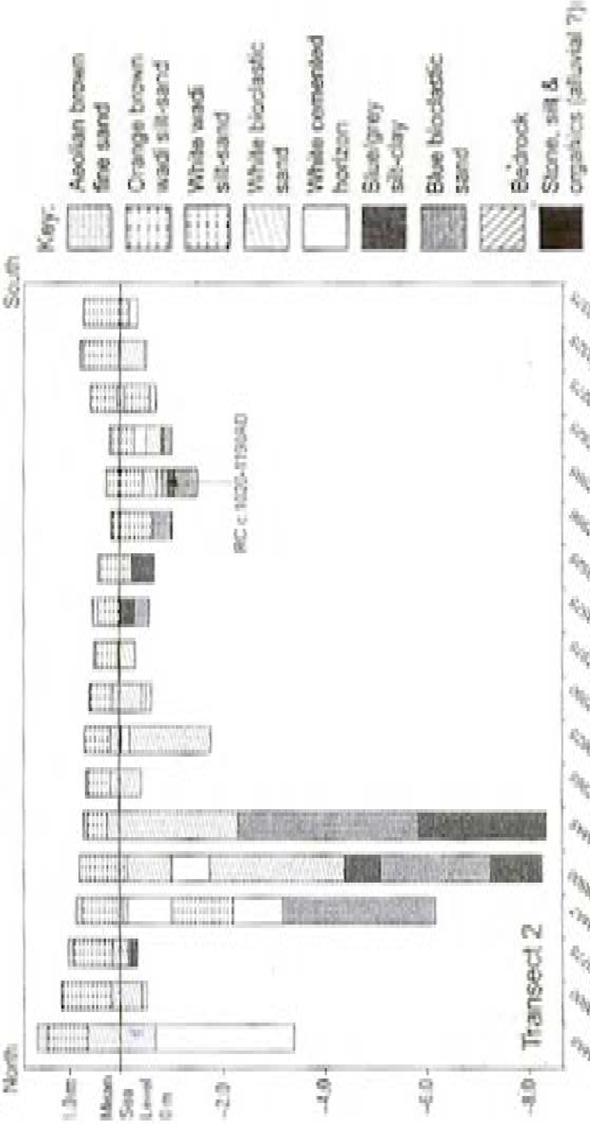


Figure 12. *Sample core transect from Quseir (Blue, 2007) with associated core log key.*

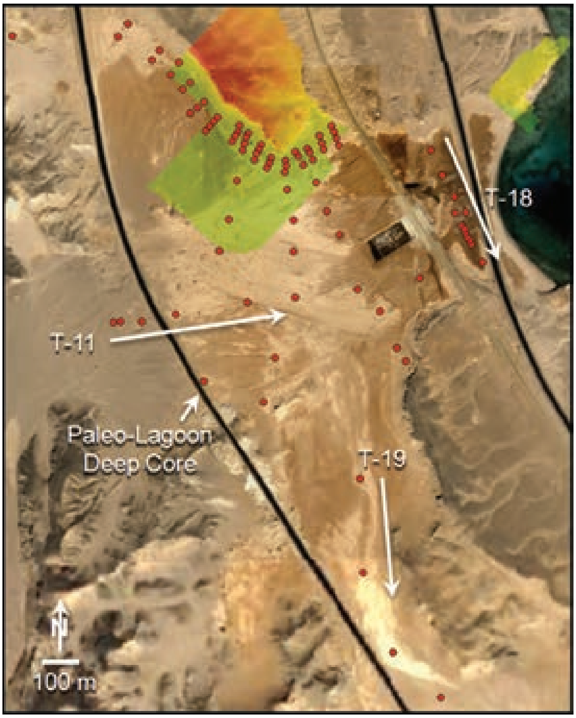


Figure 13. *Map of study area showing locations of cores drilled during all three field seasons. Cores are shown as red dots.*

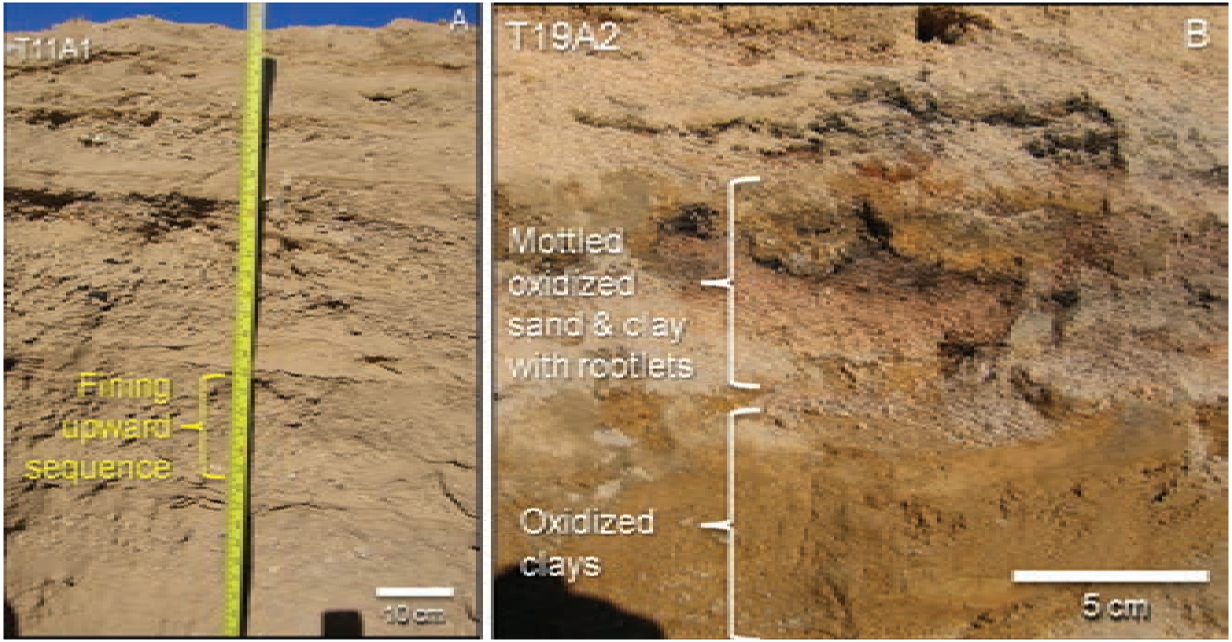


Figure 14. *Pictures from auger hole pits in two cores at Mersa / Wadi Gawasis: A) Wadi sediment from T11-A1 showing several 10-15 cm thick fining upward sequences; B) Lagoonal sediment from T19-A2 showing both the mottled and oxidized clays along with some oxidized root structures.*

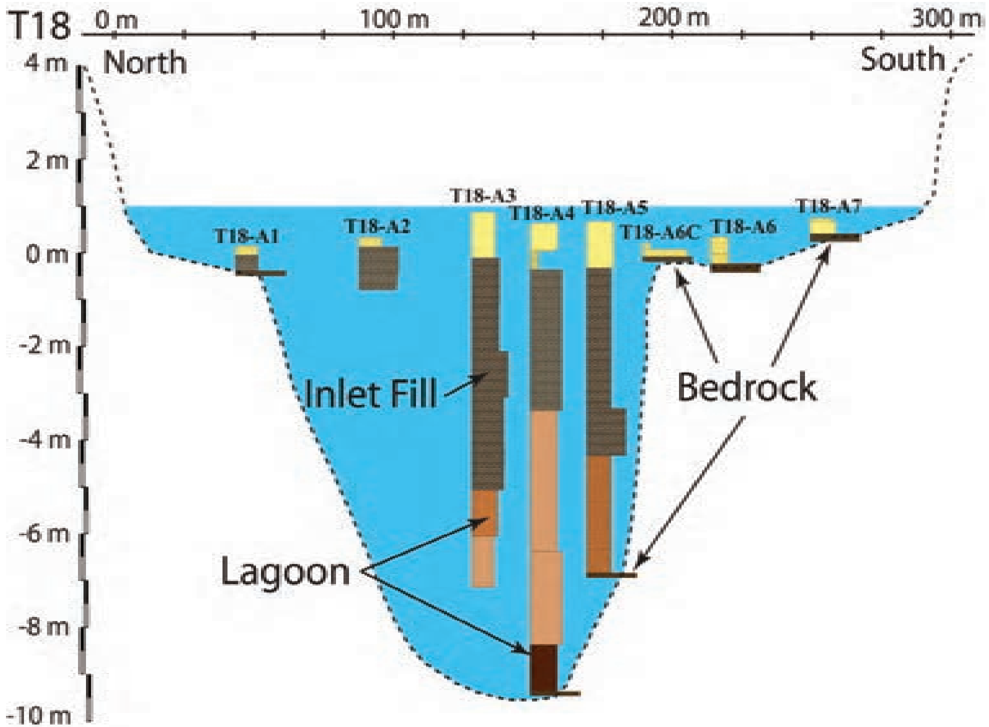


Figure 15. *Transect T-18 showing a series of five auger cores and three deep wash borings; north is to left and south to the right. The primary sediment found in this core is inlet fill. The channel is bedrock controlled, especially on the southern side. The channel is approximately 10 m deep and 150 m across.*

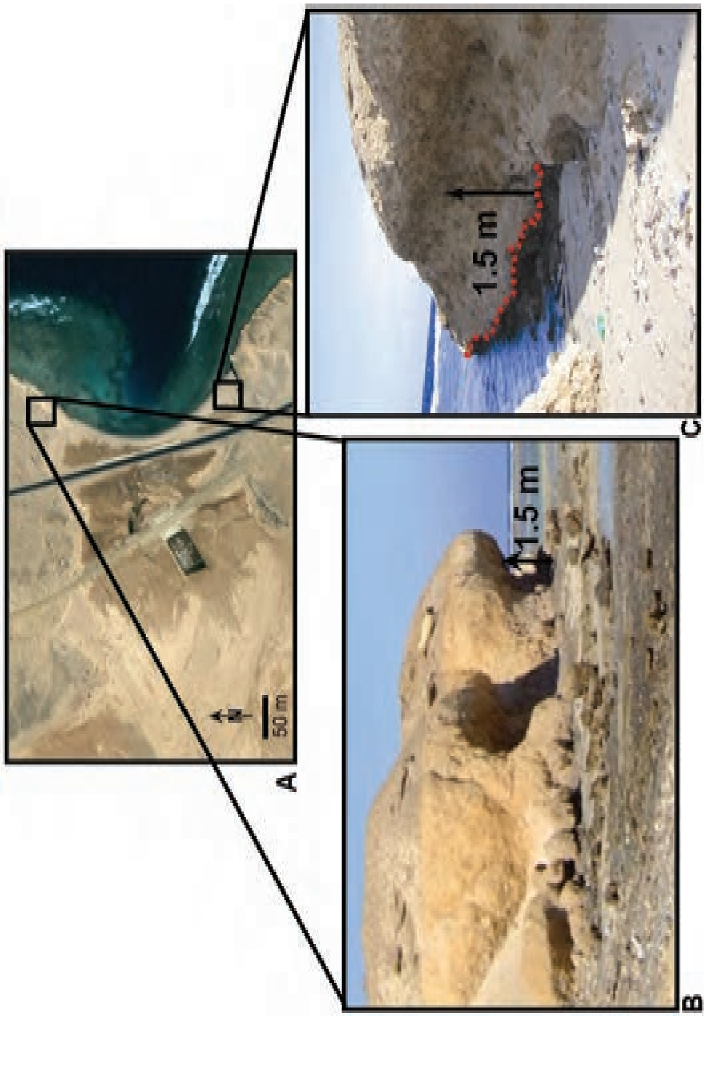


Figure 16. *Pictures from the northern (B) and southern (C) side of the present mouth of Wadi Gawasis (as per location image A) with wave-cut scarps in coral terrace, the top of which is ca. 1.5 m above the present high tide line (marked by dashed red line in right photo). Erosional terrace to south of Wadi mouth also noted in location image.*

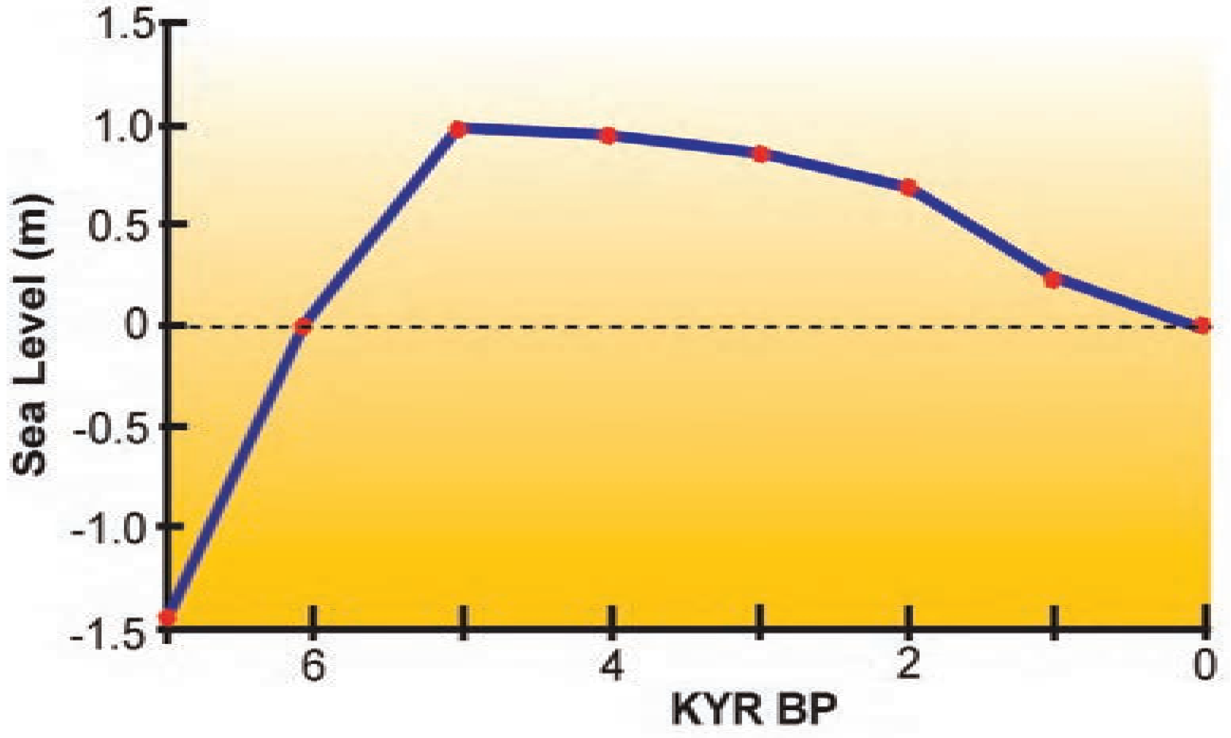


Figure 17. *Coupled Ice / Earth (viscosity) model using values LT = 71 km; UMV = 0.3 x 1021 Pas; LMV = 10 x10^{21} Pas. This variation fits the data of Plaziat et al. (1995) best, with a highstand of 1.0 m at 5 ka BP.*

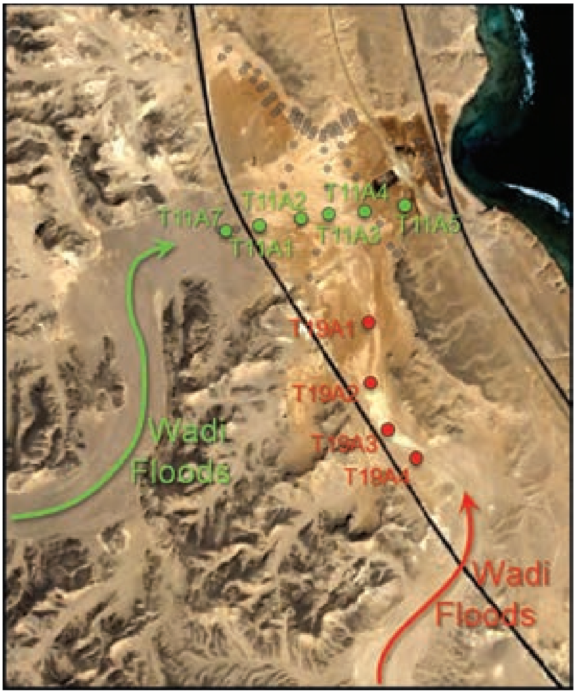


Figure 18. *Map of study area showing locations of coring transects T-11 (green dots) and T19 (red dots) as well as pathways of wadi channels.*

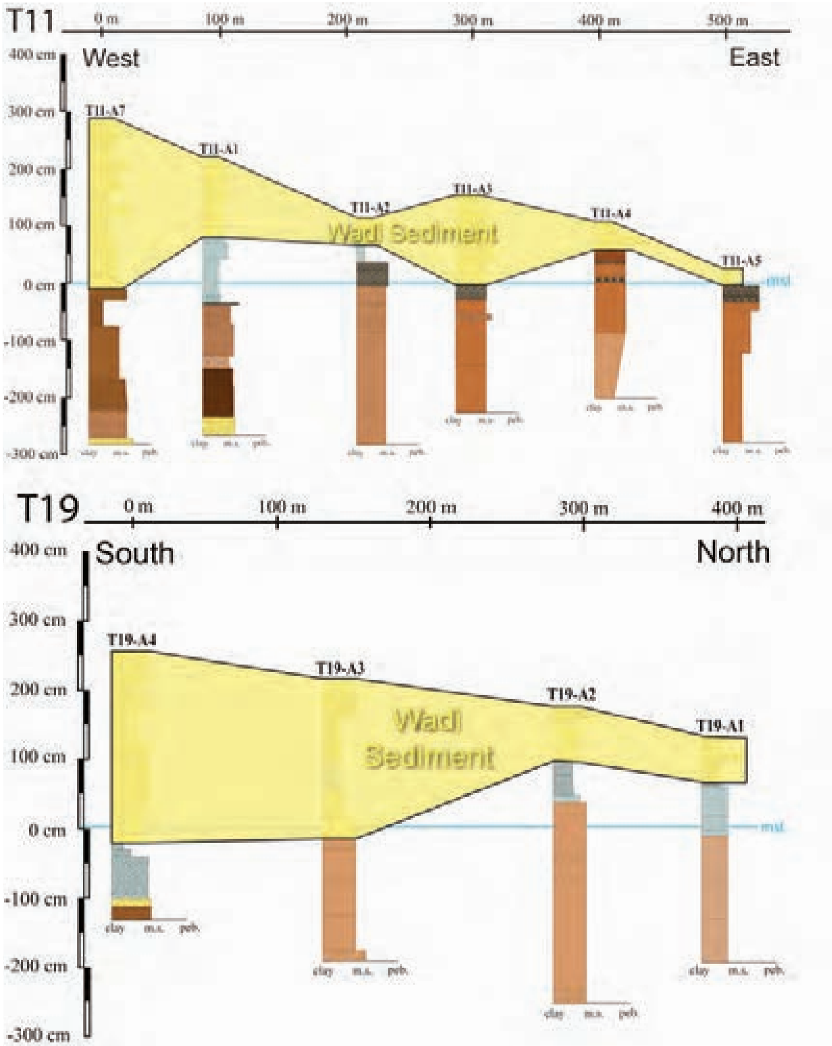


Figure 19. *Coring transects shown as graphic cores logs (Keys: wadi: yellow; tidal flat: blue-gray; la-goon: light to dark brown).*

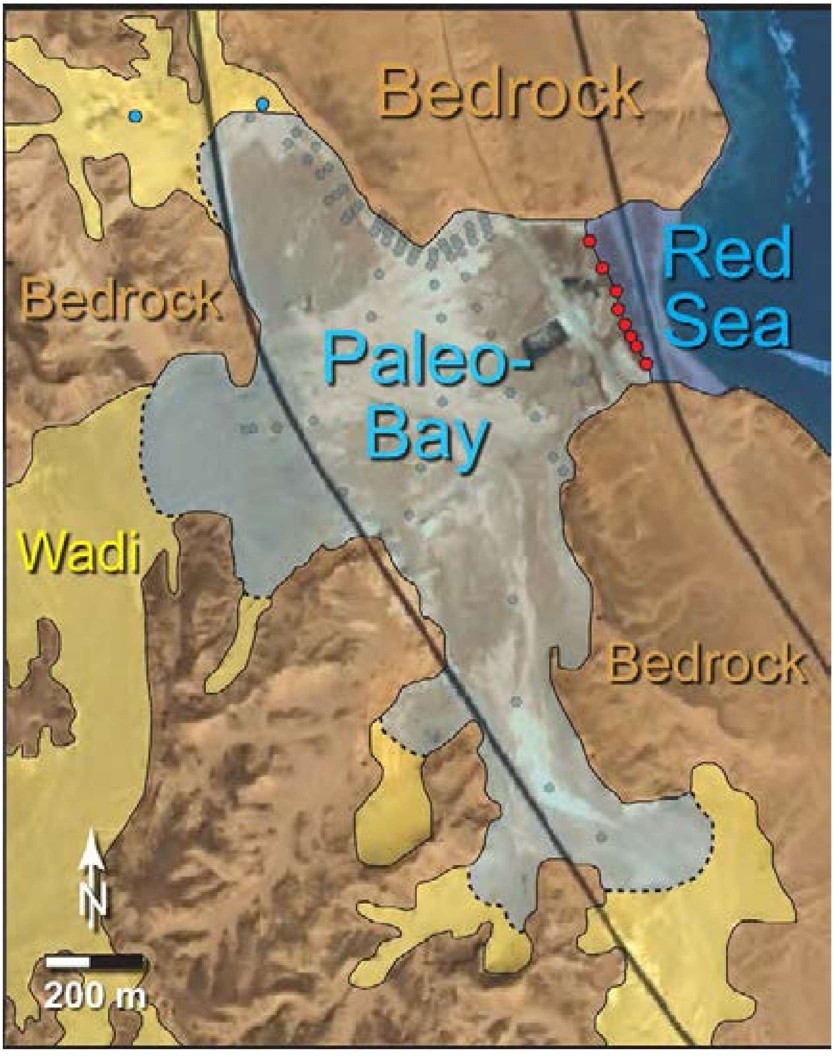


Figure 20. *Map of the paleo-bay. Dashed lines indicate its estimated boundaries. Two large yellow dots are cores where lagoonal sediments were not identified. Series of small red dots show locations of inlet channel cores. All other cores shown as shaded light gray dots.*

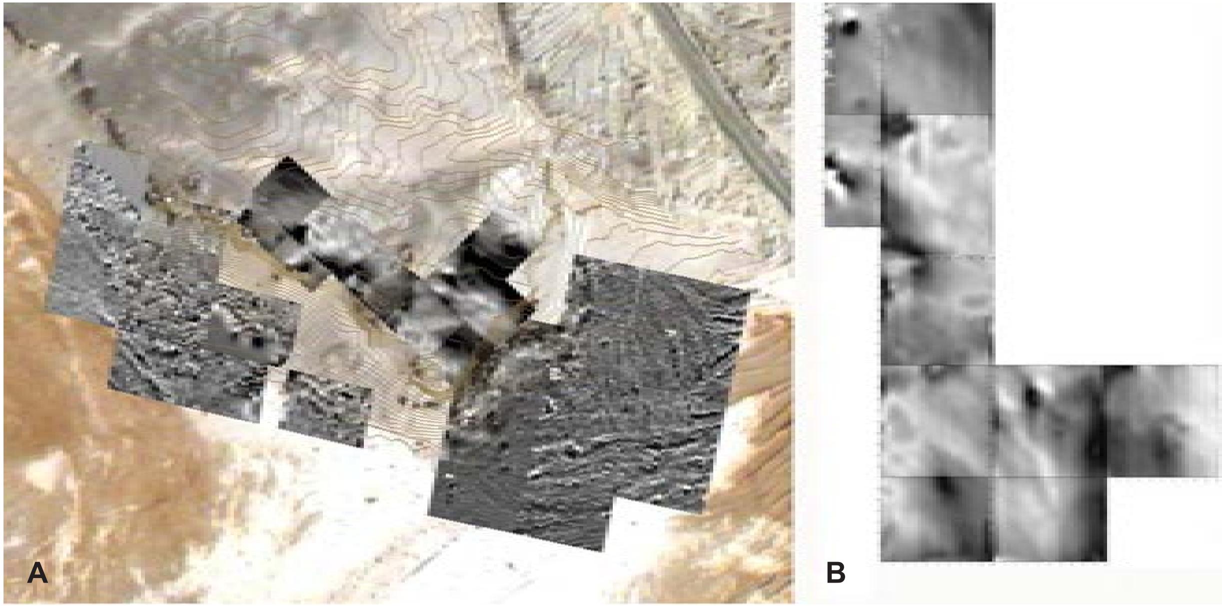


Figure 21. *A) Map showing the areas surveyed magnetically in seasons 2005–06 and 2006–07. Grids on the left and right are mapped with a gradiometer. Grids in the middle show total field measurements. Grids are overlain on a Quickbird true color composite (pan-sharpened). Contour interval = 50 cm; B) Total magnetic field data measured on the terrace top. Caves WG 1–7 are located along the western edge of the survey area, approximately 4–6 meters beneath the surface.*

Figure 22. *Excavation unit profile showing laminated eolian sand deposits in front of Caves 5–7.*

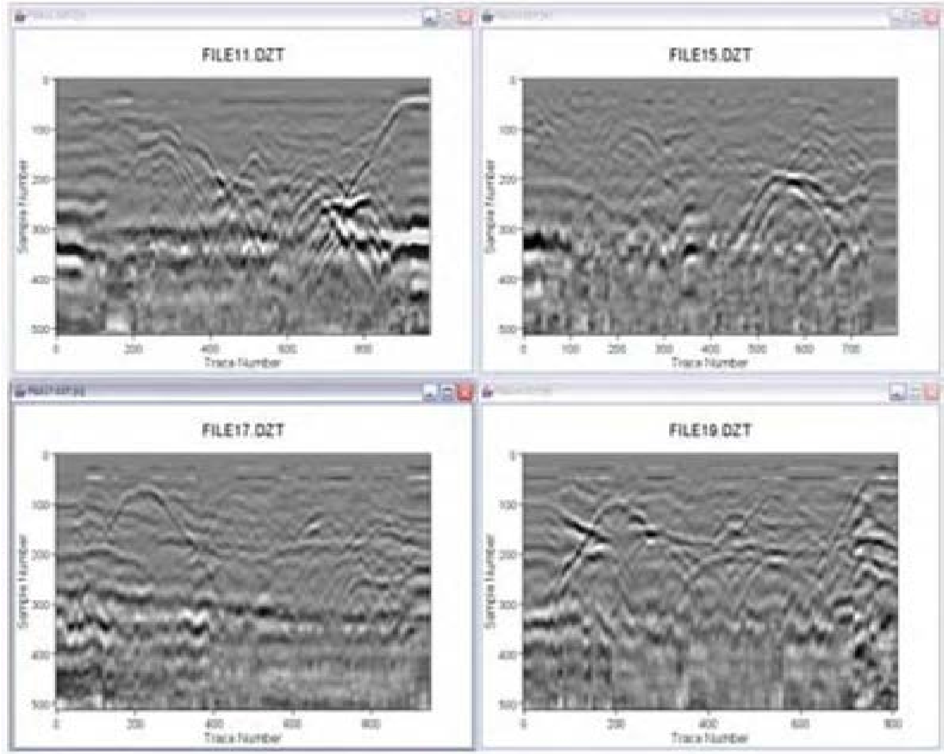


Figure 23. *Radar profiles through the same deposit. Wooden boxes are visible as pronounced but low magnitude parabolic reflections (an example is indicated by the arrow).*

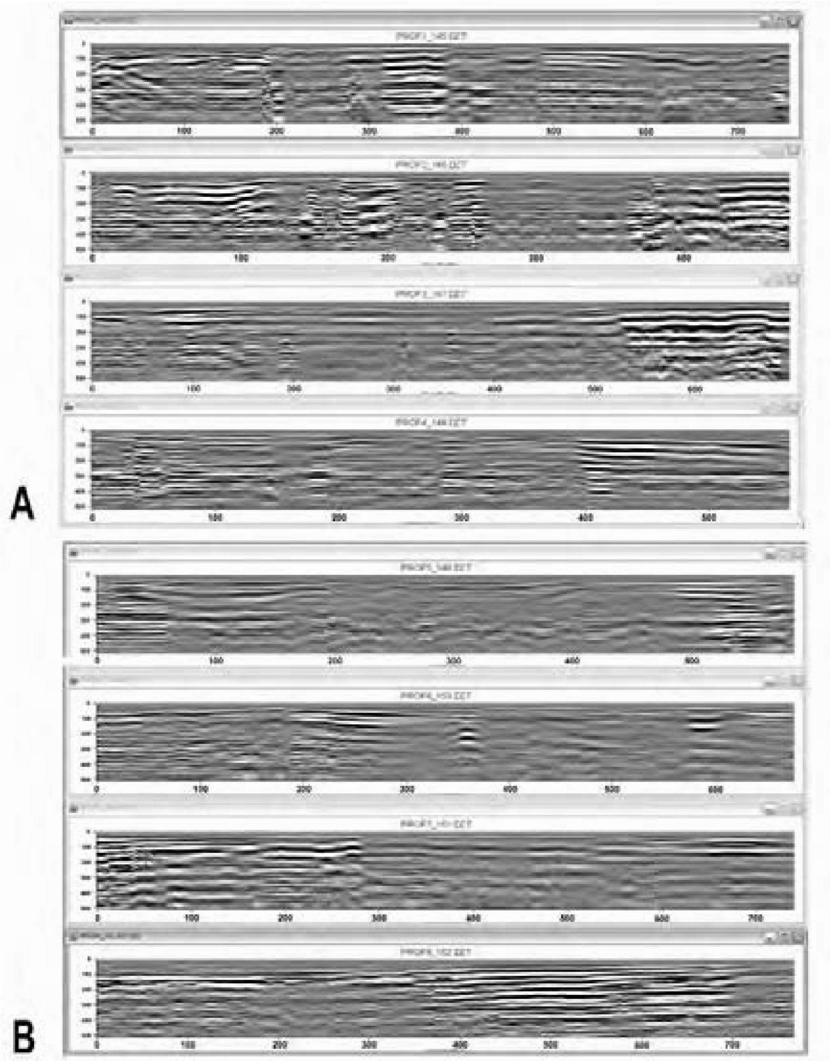


Figure 24. *A) Radar transects for geomorphological profiling, Transects 1–4; B) Radar transects for geomorphological profiling, Transects 5–8.*

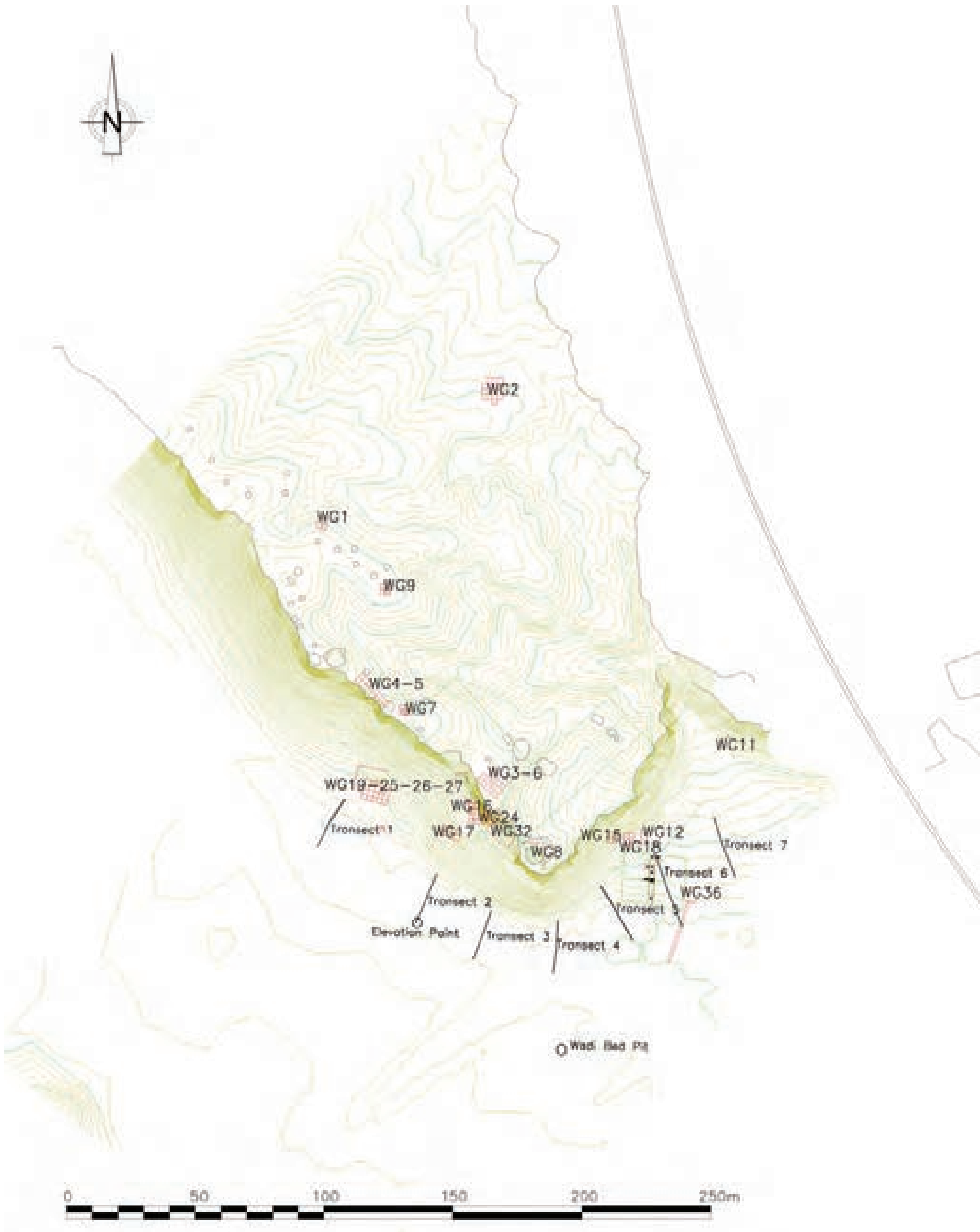

N
WG2
WG1
WG9
WG4-5
WG7
WG11
WG3-6
WG19-25-26-27
WG16
WG24
Transect 1
WG17
WG32
WG15
WG12
WG18
Transect 7
WG8
Transect 6
WG36
Transect 2
Transect 5
Elevation Point
Transect 3
Transect 4
Wadi Bed Pit
0
50
100
150
200
250m

Figure 25. *WG site map with contour lines.*

Figure 26. *Longitudinal cross-profile of Caves 2 and 3 with laser-scanning technology.*

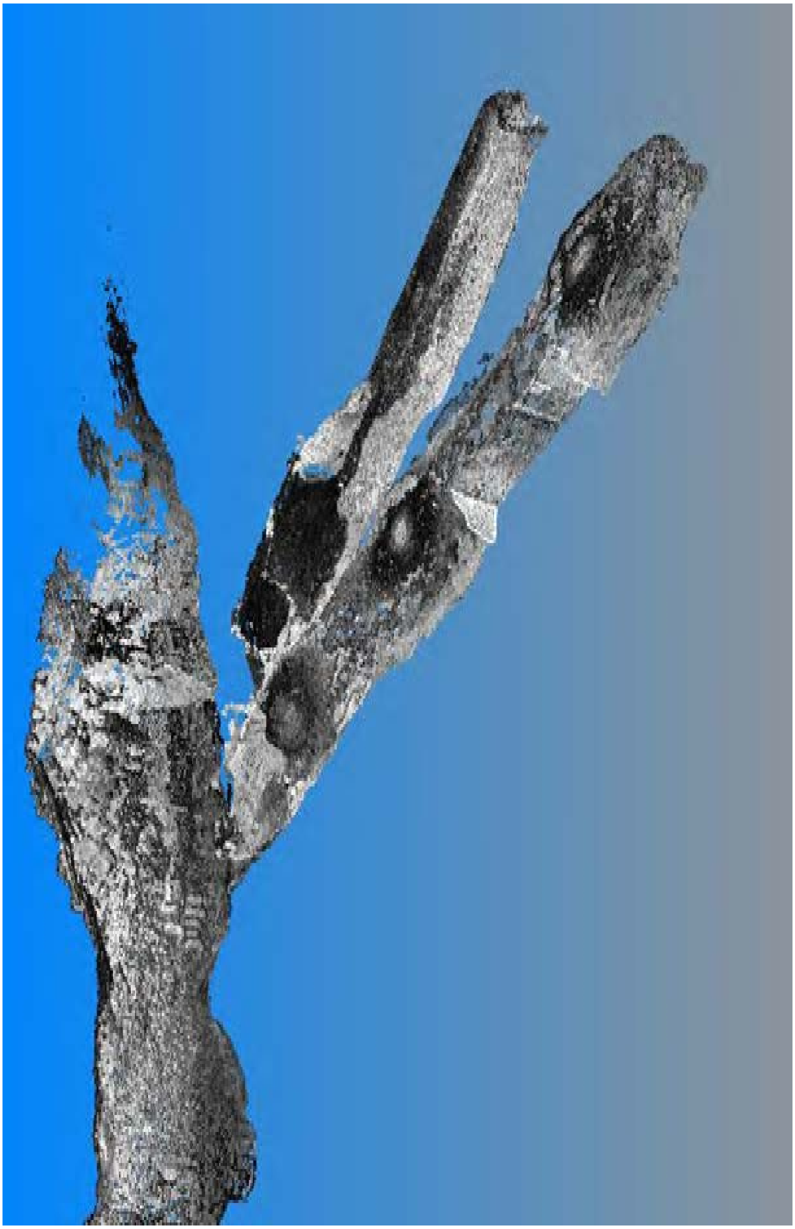


Figure 27. *Axonometric view of Caves 2 and 3 with laser-scanning technology.*

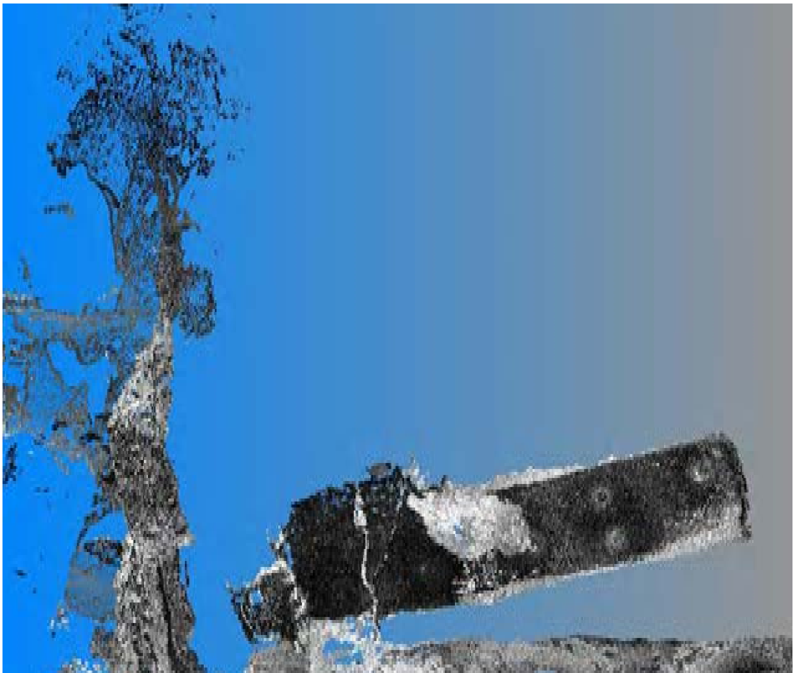


Figure 28. *Map plan of Caves 2 and 3 with laser-scanning technology.*

Figure 29. *Preparation of the snake robot before cave inspection.*

Figure 30. *Introducing the robot into Cave 7.*

Figure 31. *Snake robot inside Cave 6.*

Chapter 3
Fieldwork at Mersa/WadiGawasis, 2006-2007 to 2010-2011: Archaeology

3.1.a. Excavations at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011

KATHRYN A. BARD, RODOLFO FATTOVICH AND ANDREA MANZO

Excavations at Mersa/Wadi Gawasis were conducted in the following field seasons: 2006-2007, 2007-2008, 2009, 2009-2010 and 2010-2011 (for location of excavation units see Figure 32). Along the eastern terrace overlooking the Red Sea, excavations were conducted at three shrines (Features 7, 9, 10) in 2009. In the western sector of the site excavations in the production area (WG 19/25/26/27/44) were completed in 2006-2007.

Most of the excavations in these field seasons focused on the western terrace slope, where the man-made Caves 1-8 are located, and where considerable evidence of expedition activities was also excavated outside of these caves. Excavations continued in Caves 2 and 3, and a new cave (Cave 8) was excavated in 2009-2010.

Large, areal excavations were conducted in the "harbor area" (WG 45/46/47/48/49/50, WG 51, WG 52, WG 54, WG 57, WG 63/66),where evidence of camps was excavated in 2007-2008 and 2009-2010. Excavations were also conducted on the southern slope of the western terrace which sloped into the beach area of the harbor; in 2010-2011 a rock shelter storage area, with a constructed mud-brick platform that had been destroyed by terrace collapse at some point during its use, was excavated.

Finally in the last field season (2010-2011), three constructed ramps/slipways were excavated at the base and on the lower western slope of the coral terrace at Wadi Gawasis to the north of Cave 8, between the shore of the paleo-lagoon and the terrace.

3.1.b Methodology and fieldwork procedures

KATHRYN A. BARD, RODOLFO FATTOVICH AND ANDREA MANZO

The excavation units investigated at Mersa/Wadi Gawasis were ideally 10 × 10 m trenches oriented to the North and divided into squares of 2 × 2 m, to keep control of the spatial distribution of the finds. The excavation units were identified by the acronym WG followed by a progressive number, continuing the numbering of the 2001-2005 field seasons. Each excavation unit was divided into five West-East rows labelled with capital letters from A to E from North to South. Each row contains five 2 × 2 m squares labelled with the letter of the row following a progressive number from 1 to 5, from West to East. Therefore, square A1 is the one in the northwestern corner of an excavation unit, while the one in the southeastern corner is E5.

In conformity with the methodology already adopted in the 2001-2005 field seasons (see Bard and Fattovich 2007: 37-38), the excavations were conducted adopting the procedures outlined by E. C. Harris (1979). Therefore, all the traces of natural and anthropic actions identified during excavation in the different excavation units were given a "stratigraphic unit" (SU) number. Stratigraphic Units could be represented by soil strata, features, and structures. In the case of thick soil strata over 20 cm in depth, such as deep deposits of windblown sand, artificial levels of ca. 5-10 cm were excavated. The physical relationships between Stratigraphic Units in the excavated areas were carefully recorded to understand their chronological order and site formation processes. These relationships can be synthetically represented in a "Harris Matrix."

The excavated features and structures as well as the soil strata were systematically recorded with maps, drawings and photographs referenced according to the above described system of labelling the excavation units, the squares inside them and the Stratigraphic Units. The excavation units and specific features and structures were mapped by means of a TLS and plotted on the general map of the site. The general map of the site was georeferenced by means of differential GPS, which automatically allowed each feature and structure to be georeferenced.

Artifacts and ecofacts from the excavation were labelled according to the excavation unit and square, as well as the Stratigraphic Unit in which they were collected. Most of the artifacts were collected directly by the excavators during excavation, but some artifacts were collected by sieving the excavated sediment with 0.5 or 0.2 meshes, which helped to collect not only very small complete or fragmentary artifacts, but also the smaller ecofacts.

Since the sediments consisted mostly of sand, the artifacts and ecofacts usually did not need to be washed, but carefully cleaned with soft brushes, so that future analysis of residues and traces of use could be done. Salt incrustations were mechanically removed by project restorers when needed.

After being studied and, when needed, cleaned and restored, artifacts were stored in plastic bags and wooden boxes in the storehouses of the Supreme Council of Antiquities in Qift. Some of the artifacts, especially some of the timbers and other organic materials, were stored after restoration at the site in Wadi Gawasis caves, where more stable conditions needed for preservation could be guaranteed.

3.2.a Excavations, eastern terrace

RODOLFO FATTOVICH AND ANDREA MANZO

In January, 2009, three excavation units (WG 58/59 and WG 60), 10 m × 10 m in area, were opened to investigate Feature 9/Feature10 and Feature 7, respectively.

Excavations, Eastern terrace, WG 58-59

Excavation units WG 58 and WG 59, immediately to the east of WG 58, were opened to investigate Feature 9 and Feature 10. Before excavation, Feature 9 was a shallow pit within a low mound of small and middle size rocks on the top of the eastern terrace. Feature 10 was an oval mound encompassing a central chamber delimited with vertical conglomerate slabs along the western, northern and southern sides, with a possible entry to the east.

The following Stratigraphic Units were recorded:

SU1: stratum of sand with fragments of straw covering the structure and overlapping SU2 and SU7, ca. 0.1 m to 0.25 m thick.

SU2: mound of gravel, 11 m × 10 m in area, covering irregular alignments of undressed coral blocks, most likely opening to the east; up to 1.1 m in height and ca. 2.0 m thick. The mound was built over the natural coral terrace (SU3) and abutted an alignment of conglomerate slabs (SU19) delimiting a central chamber.

SU3: bedrock at the top of the coral terrace beneath SU2 and cut by SU4.

SU4: shallow pit in the middle of the central chamber, ca. 6 m × 6 m in area and 0.7 m deep. The hole, approximately oval in shape, cut into the bedrock (SU3) and was filled with loose gravel (SU5) and sand (SU7).

SU5: lower fill of loose gravel along the northern, southern and western edges of the pit (SU4), ca. 0.3 m thick. This stratum most likely resulted from the excavation of the natural gravel of the terrace beneath SU1, SU7 and SU19.

SU6: concentration of limestone chunks ca. 1.43 m × 1.23 m in size and 5 cm thick in squares WG 58, A5-B5, beneath SU2 and above SU3.

SU7: lower stratum of sand with concentrations of straw inside the central chamber and partially filling the upper part of the hole (SU4), ca. 0.5 m deep, beneath SU1, SU2, and SU5.

SU8: stratum of sand with pebbles, fossilized shells, small rocks and badly preserved human bones inside a pit (SU10), ca. 0.2 m deep, beneath SU5.

SU9: stratum of gravel and medium-size rocks including fragments of limestone anchors and an bivalve mother of pearl shell inside an elongated pit (SU11) in the eastern sector of Feature 10, beneath SU13 and SU7.

SU10: pit with human bones, ca. 1.4 m × 0.75 m. The pit cut into SU3, and was filled with sand and pebbles (SU8).

SU11: foundation trench, ca. 2.5 m × 0.4 m × 0.45 m in size, in the eastern sector of Feature 10. The trench cut into SU3 and was filled with gravel and medium size rocks (SU9).

SU12: two fragments of a large conglomerate slab at the eastern opening of Feature 10. Originally the slab was ca. 2.1 m × 2.0 m × 0.4 m, and most likely was erected in an unexcavated foundation trench. The fragments of the slab were beneath the stratum of sand and straw (SU7) and above the bedrock of the coral terrace (SU3).

SU13: large, broken conglomerate slab at the eastern opening of Feature 10, ca. 2.5 m × 2 m × 0.37 m. Most likely this slab was erected in a foundation trench (SU11), and was beneath the stratum of sand and straw (SU7) and above the stratum of gravel and medium size rocks (SU9).

SU14: circular concentration of burnt sand and small flakes of charcoal (hearth), ca. 0.5 m in diameter and 7 cm thick, in WG 58, E1-E2, on the bedrock of the coral terrace (SU3) beneath the mound (SU2).

SU15: shallow pit filled with sand (SU16), ca. 1.5 m × 1.2 m in area and 0.25 m deep, in WG 59, A1-B1 to the east of Feature 10.

SU16: sand mixed with gravel and a few scattered, small flakes of limestone, as well as (intrusive) fragments of plastic and straw, inside the pit (SU15).

SU17: oval concentration of limestone chunks, ca. 1.2 m × 1.0 m in area and 5 cm thick, in WG 58, E2, on the bedrock of the coral terrace (SU3) beneath SU2.

SU18: rounded concentration of limestone chunks, ca. 1.0 m in diameter and 3 cm thick, in WG 58, E3 lying on the bedrock of the coral terrace (SU3) and beneath the windblown sand SU1 and the mound SU2.

SU19: alignment of 12 vertical conglomerate slabs, ca. 0.7 m × 0.5 m × 0.25 m, with an opening to the east, which delimits a chamber, ca. 6.0 m × 5.5 m in area. The slabs were covered with superficial sand (SU1, SU7) and were erected above the stratum of loose gravel (SU5).

Both Feature 9 and Feature 10 had been excavated by Abdel Moneim Sayed in the mid-1970s, as can be inferred by a number of pits or shallow depressions close to the two large slabs (SU12, SU13) in the eastern sector of the excavated area and inside Feature 10. These pits were filled with sand and a great quantity of straw, which was originally used to cover the bottom of the excavations.

The 2009 excavations demonstrated:

1) Feature 9 was a shallow hole filled by windblown sand in recent times and is located between Feature 10 and Feature 8, which was investigated in 2002-2003 (Bard and Fattovich 2007: 39-41). The function of this feature is uncertain, as the few limestone flakes in the hole may be intrusive from the limestone concentrations at the eastern side of Feature 10 (SU17, SU18).
2) Feature 10 consisted of a gravel mound encompassing a large, open-air chamber in the shape of a horse-shoe, ca. 5.5 m × 6.0 m in area, with an opening to the east (Figures 33-34). Associated ceramics pointed to a 12th Dynasty dating.

The mound was built with gravel (SU2) from the top of the terrace (SU3) and was possibly sustained with irregular walls of coral rocks. The internal chamber was delimited with an alignment of vertical conglomerate slabs (SU19). Two large conglomerate slabs with an east-west axis were originally erected at both sides of the entrance.

Engraved on the smooth surface of the upper part of the southern slab was a graffito, which included a badly preserved and unreadable cartouche within a panel, ca. 0.5 m × 0.4 m in size, framed with a groove, ca. 2.0-2.5 cm wide and 2.0 cm deep. Other signs, including a long horizontal zig-zag, were engraved to both sides of the panel (Figure 35).

The occurrence of three concentrations of limestone flakes (SU6, SU17, SU18) under the mound suggested that at least three large (crushed) anchors were placed around the central chamber (Figure 36). A hearth (SU14) was beneath the mound construction in the northeastern sector of the feature. This evidence may represent an earlier phase of use of the area than the construction of Feature 10.

The shallow pit at the center of the feature (SU4) may have largely destroyed earlier pits excavated in the same spot when the feature was built. This is suggested by the occurrence of loose gravel (SU5) filling the lower part of the pit (SU4) beneath some of the *in situ* conglomerate slabs (SU19), which delimited the main chamber of Feature 10 to the west.

At the bottom of the pit (SU4), in the centre of the structure, was a burial with human bones partially covered by small rocks (Figure 37). The badly preserved bones were not in an anatomical position, which suggests either a post-depositional disturbance or a disarticulation of the skeleton before the burial. This burial is most likely a later, intrusive one. No grave goods were associated with the burial.

Feature 10 provided evidence of a new type of ceremonial structure, without any clear parallel at Mersa/Wadi Gawasis or elsewhere in Egypt.

Excavations, Eastern terrace, WG 60

This excavation unit investigated Feature 7. Before excavation, this feature resembled a mound of coral rocks and conglomerate slabs with an irregular western side and three pits or shallow depressions filled by sand. Only two-thirds of Feature 7 was excavated.

The following SUs were investigated:

<u>SU1</u>: stratum of windblown sand with straw fragments covering the structure, 0.1 m to 0.25 m deep, above SU2, SU4 and SU5.

<u>SU2</u>: irregular structure of coral rocks, 7.5 m × 8 m, with a rounded perimeter to the east and north and a more irregular perimeter to the west and south, where an alignment of rocks with a north-south orientation was identified. The structure was built on the bedrock of the coral terrace (SU3) and abutted on two parallel slabs (SU4, SU5) forming a small chamber opened to the east.

<u>SU3</u>: natural bedrock of the coral terrace on which the structure (SU2) was built.

<u>SU4</u>: pit, ca. 1.5 m × 1.0 m in size and 0.2 m deep, which cut SU2 and SU3 in WG 60 E2-E3.

<u>SU5</u>: sand with fragments of rock and straw inside pit SU4.

SU6: circular pit, ca. 0.75 m in diameter and 0.3 m deep, which cut SU2 and SU3 in WG 60 D2.

SU7: sand with chunks of rock, plastic and paper inside pit SU6.

SU8: irregular pit, ca. 4 m × 2.5 m × 0.3 m in size, which cut SU2 and SU3 in WG 60, D4.

SU9: sand with a few chunks of rock inside pit SU8.

SU10: floor beneath SU1 and above a stratum of sand (SU12) in squares WG 60, D5-E5. On the top of this floor were three well preserved cylindrical sticks of wood, ca. 0.3-0.4 m long and 2.5-3 cm in diameter.

SU11: elongated hearth, ca. 1.0 m × 0.6 m in size and 6 cm thick, with burnt sand and small flakes of charcoal, above the floor of SU10 and beneath the superficial sand of SU1.

SU12: partially excavated stratum of sand beneath the floor (SU10), over 0.25 m thick, in WG 60, D5-E5.

SU13: floor to the east of WG 60, E4, above the sand of SU18 and extending at least 1.0-1.5 m to the east of the entrance of the chamber. A large fragment of limestone and two hearths (SU16, SU17) were on it. This floor may be contemporary to the floor SU10 to the south of the structure.

SU14: collapsed and broken conglomerate slab, ca. 2 m × 0.85 m in size and 0.2 m thick, lying on the bedrock (SU3) and beneath the superficial sand (SU1).

SU15: standing conglomerate slab, 2 m × 0.82 m in size and 0.2-0.25 m thick, lying on the bedrock (SU3) and beneath the superficial sand (SU1).

SU16: unexcavated circular hearth with burnt sand and charcoal flakes, ca. 0.35 m × 0.5 m in area, beneath the superficial sand of SU1 and above the floor of SU13.

SU17: unexcavated circular hearth with burnt sand and charcoal flakes, ca. 0.6 m in diameter, beneath the superficial sand of SU1 and above the floor of SU13.

SU18: stratum of sand, ca. 0.2 m thick, with fragments of rocks a few potsherds immediately to the east of slabs SU14 and SU15, above the floor of SU19 and beneath the floor of SU13.

SU19: floor immediately to the east of the slabs SU14 and SU15 in WG 60, E4, above a stratum of sand (SU20) and beneath another stratum of sand (SU18), with a large fragment of a limestone anchor immediately to the southeast of the slab SU15.

SU20: stratum of sand, ca. 0.1-0.15 m thick, abutting on the slabs SU14 and SU15 to the east of WG 60 E4, above the bedrock (SU3).

SU21: stratum of sand with straw, paper and plastic, ca. 0.3 m thick, between the slabs SU14 and SU15 in WG 60, E3-E4.

SU22: pit on top of the bedrock (SU3), which cuts the strata of sand SU18 and SU20 between the stone slabs SU14 and SU15.

The 2009 excavations demonstrated:

1) the small pits (SU4, SU6, SU8, SU22) visible on the surface before excavations in 2009 that were filled with sand and fragments of plastic, paper and straw (SU5, SU7, SU9, SU21) were recent features, most likely test pits made by Sayed in the mid-1970s.
2) Feature 7 originally was a mound of coral rocks with a horse-shoe shape and a SE-NW axis consisting of a chamber delimited by two conglomerate slabs and opening to the sea (SU14, SU15), similar to Feature 6 (Bard and Fattovich 2007: 42-43) (Figures 38-39).

The straight north-south alignment of coral blocks in the western sector of the structure probably represents the partial dismantlement of the original structure by Sayed. Partial destruction of the structure was also evident in the northern and western sectors (WG 60, C1-C2, D1-D2), where only a single course of blocks of the original rounded perimeter were visible, while the internal coral blocks of the mound were removed. It is possible, however, that the western alignment of blocks was the only the only evidence of an earlier rectangular feature, which was later incorporated into the horse-shoe shaped structure.

At least two phases of use of the horse-shoe shaped structure could be recognized. These phases are represented by the two floors (SU13, SU19) abutting the slabs (SU14, SU15) to the east. The two hearths (SU16, SU17) dated to the last phases of use and were possibly associated with offering activities as in Feature 6 (Bard and Fattovich 2007: 42). Large fragments of limestone anchors (SU13, SU19) also were found on the two floors at the entrance of the chamber, as in other structures at Mersa Gawasis (Bard and Fattovich 2007: 39-43) (Figure 40).

The few potsherds associated with this structure can be ascribed generically to the 12th Dynasty.

3.2.b Excavations, western terrace slope
Excavations, Western terrace slope, WG 32
ElSayed Mahfouz, Andrea Manzo and Rosanna Pirelli

Excavation unit WG 32 was opened to the south of the entrance to Cave 2 in 2005-2006. Three inscribed stelae, a concentration of clay sealings some of them bearing seal impressions, 21 wooden boxes, and a box with a painted inscription dating to the reign of Amenemhat IV (ca. 1797-1790 BC)[1] were recovered in this trench in 2005-2006 (Fattovich and Bard 2007: 47-48). Moreover, the entrance of a rock-cut cave (Cave 6) was discovered in the rock terrace in the southern part of the excavation unit (see Bard and Fattovich 2007: 60-61).

In 2006-2007 investigations were resumed in a 6 m × 12 m area of the excavation unit, in order:

1) to find out the living floor on which the pile of wooden boxes was laying;
2) to collect more evidence on the administrative activities performed in the area;
3) to clear and investigate the entrance of Cave 6.

The later phase which was investigated is an abandonment phase marked by a stratum of windblown sand sometimes mixed with concentrations of sea grass (SU10).

The windblown sand and sea grass covered 22 compete or fragmentary wooden boxes (Figure 41) (see 6.1.a Wooden boxes, 2006-2007), one of them with a painted inscription dating to the reign of Amenemhat IV (ca. 1797-1790 BC) (see 9.4 Cargo box inscriptions). These boxes were near the 21 boxes and a large ship timber discovered in 2005-2006, confirming that they were piled up there after emptying.

The wooden boxes and all related materials were laying on a living floor (SU25) with some small hearths in the western squares of the excavation unit (SU26, SU27, and SU30). Most likely, these hearths were contemporary to those discovered in 2005-2006 near the entrance to Cave 2.

Concentrations of clay sealings were associated with the boxes and the living floor on top of which the boxes were placed. They show the

[1] For the adopted dynastic chronology see Shaw 2000.

impressions of pegs and ropes used to close the wooden boxes, as well as the impressions of fabrics and ropes, vegetal fibers, leather and rope bags, and papyrus. On some seals the institution of the granary and treasury were recorded. Some fragments of pure clay for sealing the containers were also found, suggesting that containers were opened and closed in this area. The variety of seal impressions and containers confirm administrative activity in WG 32 and WG 16, as was suggested in 2005-2006. Several thin ropes (one of which very long), pieces of wood, pieces of partially baked clay, wooden lids or stoppers for jars, and several potsherds were also associated with the boxes.

This concentration of artifacts on top of a sand stratum (SU25) marks an occupation phase which can be dated to the very end of the 12th Dynasty. This occupation phase was apparently preceded by a phase of less intense use of the area when a thick stratum of sand (SU25) accumulated. This stratum also sealed also the entrances to Cave 5 and Cave 6 along the coral terrace, suggesting that access to the two caves was already covered with sand and the caves were no longer used when the boxes and large ship timber were abandoned there.

The evidence of earlier layers (SU31) was found close to the entrance of Cave 6. They were sometimes covered with concentrations of organic materials (SU33), and represent the last phase of use of the entrance to Cave 6. A concentration of ca. 50 shallow complete or fragmentary bowls over a large broken but complete jar to the southwest of the entrance to Cave 6 dates to this phase.

The roughly rectangular entrance to Cave 6, ca. 140 cm × 110 cm, was cut in the wall of the terrace, and originally had two mud-brick walls at the sides (SU32 and SU34). The wall on the northern side was better preserved because of a thick salt crust over it.

In this phase two walls of coral and conglomerate blocks were built immediately to the north of the entrance to Cave 6 and south of the entrance to Cave 5 (SU35 and SU36, respectively), delimiting a space between the two entrances. These two walls seem to abut the rock terrace (SU37) and may have been built and possibly used in earlier occupation phases.

An important discovery in 2006-2007 in SU1 was a limestone stela of Senusret III, broken into two fragments (Stela 14).

In 2007-2008, excavations were conducted on the top of the slope of the fossil coral terrace, in front of the entrance to Cave 6 (WG 32) where some large pieces of timber from seafaring ships were found and carefully studied *in situ*, because their removal could badly damage the wood. These timbers provided the maritime archaeologists with important information about the construction of ancient pharaonic ships. Excavations outside Cave 6 also provided more fragments of clay sealings with the imprint of seals dating to the late 12th Dynasty.

Excavations, Western terrace slope, WG 32/WG 53
Claire Calcagno and Chiara Zazzaro

A new excavation unit, WG 53, was opened southeast of WG 32 in 2007-2008 in order to investigate the extension of the different occupation levels toward the terrace slope. Investigation in WG 53 was conducted in a 4 m × 4 m area.

The surface (SU1) in WG 53 consisted of a thin stratum of windblown sand with a few potsherds and fossil coral or conglomerate rock fallen from the terrace. The bottom of this stratum included several scattered wooden box fragments and potsherds. The strata below the surface, in WG 53, were consistent with strata excavated during the 2006-2007 excavations in WG 32, although the quantity of materials and occupation evidence was reduced. This is typical of the strata at Mersa/Wadi Gawasis, where the archaeological deposits are more concentrated in the slope area near the terrace wall and at the cave entrances.

Noteworthy is a painted rim sherd dating to the Second Intermediate Period-Early New Kingdom, recovered at the eastern end of the WG 53 unit on top of a stratum of windblown sand (SU10) which covered the wooden boxes in WG 32.

Excavation of the surface on which the wooden boxes lay continued in WG 32-53. A hearth (SU39) arranged within a large sherd from a jar was found on top of a stratum of windblown sand (SU25) dating to the end of the 12th Dynasty. This hearth was associated with other hearths excavated in 2006-2007.

The lower layers identified in 2006-2007 included a thick stratum of salt concretion (SU38) and a concentration of organic materials (SU33). During the 2007-2008 excavations, the molded shapes of several large ship timbers, covering an area ca. 2.30 m × 1 m, were identified beneath the salt concretion SU38, at the entrance to Cave 6, in squares B5 and C5) (Figure 42). These included a steering oar blade (T72), similar in form and wood to the two blades recovered in 2004-2005, but larger (see "5.1 Ship timbers" in Bard and Fattovich 2007: 150-153). Excavation was discontinued in this area until the timber conditions could be further assessed.

Excavation continued in squares A4, B4 and C4, in an almost sterile sand stratum, SU40); a few charcoal fragments, two sherds and salt crystals, were excavated. This stratum (SU40) covered an irregular stratum (SU42), ca. 10-40 cm thick, containing scattered cobbles and one badly preserved wood fragment, possibly a tenon.

A concentration of mud was recorded to the west of the Cave 6 entrance, covering a natural stratum of cobbles (SU41), 1.5 m thick. SU41 can be compared to strata of cobbles in Cave 2 and between Cave 2 and Cave 3 (see Bard and Fattovich 2007: 63). In that area, SU25 (of windblown sand) covered a further stratum of cobbles (SU43) without cultural materials. This stratum (SU25) seems to be associated with the timber accumulation in WG 32.

A test pit, 1 m × 1 m and ca. 1.70 m deep, was made in WG 32, A4, in order to investigate if earlier occupation phases existed. Two different strata were identified: a sandy stratum (SU44), ca. 85 cm thick, covering a more compacted stratum (SU45), ca. 85 cm thick, consisting of mud and pebbles.

Copper alloy artifacts excavated in WG 32 included a pin (ca. 8.7 cm in length) found in SU4 and what appears to be a blade fragment (ca. 8.2 cm × 0.2 cm × 0.2 cm) in SU25.

Excavation in WG 32 conducted during the 2007-2008 field season allowed researchers to better investigate the three different occupation phases already identified by Andrea Manzo in 2006-2007. Below the first occupation level in WG 32/WG 53, excavation also revealed evidence of a lower layer of cobbles (SU42) similar to the floor of cobbles from one of the earlier occupation phases at the entrances of Cave 2 and 3 (units WG 24 and WG 16; see Bard and Fattovich 2007: 54-57, Figs. 23 and 24). However, unlike the living floor found in the area outside Caves 2 and 3, there is no clear evidence of human occupation associated with the cobble layer in WG 32.

Consequently, at present, the first level of use attested in this area consists of a surface on which was found a concentration of organic materials and ship timbers which had accumulated at the entrance of Cave 6 and were associated with the two walls giving access to the cave. The westernmost wall, made with mud and cobbles, was probably built in order to separate Cave 5 from Cave 6.

The surface on which the boxes and hearths were found represents a successive phase dating to the reign of Amenemhat IV (ca. 1797-1790 BC), based on texts inscribed on two boxes (see Bard and Fattovich 2007: 238).

The later period of abandonment at the site during which windblown sand and leaves accumulated may date to the early New Kingdom, on the basis of the associated potsherd found in WG 53. This phase is characterized by very little archaeological evidence.

In summary, WG 32 has revealed only three phases of use, which implies a less intense level of human occupation compared to the sequence of seven phases identified in the area outside Caves 2 and 3. It suggests that Cave 6 was possibly carved and used later than the other caves.

Excavations, Western terrace slope, WG 33

KATHRYN A. BARD, GIUSEPPE LEBRO, ELSAYED MAHFOUZ AND CHEN SIAN LIM

WG 33 was first excavated in the 2005-2006 field season. Uncovered during this field season were two large niches carved into the coral conglomerate bedrock. Also discovered during then was a large pink granite stela. Only SU1 was excavated during this field season (Bard and Fattovich 2007: 68-69). In 2006-2007 the excavated unit was approximately 7 m × 3 m in area, and excavation was resumed in SU2. This SU consisted primarily of windblown sand. A niche measuring 25 cm (base) × 35 cm (height) was uncovered approximately 2 m east of the large stela niches recorded in 2005-2006, at a depth of 1m (Figure 43). To the left, a second niche measuring 30 cm (base) × 45 cm (height) was uncovered. Both niches were empty.

Associated with these niches were an unfinished limestone anchor and a limestone stela. The stela (Stela 31), was found lying face downward in the sand on its inscribed face (Figure 44). Deterioration of the limestone was too advanced and no inscription was discernable. Other artifacts from SU2 include potsherds, a wooden dovetail tenon, rope and cordage, and planks. WG 33, SU2 was excavated to a depth of 2 m.

Excavation was later extended to the north in an area of 8 m × 2 m. The whole unit was covered with a stratum of soft sand, ca. 1 m thick (SU1), where concentrations of sea grass were found. They may have occurred in a phase of abandonment, possibly during the Second Intermediate Period, when windblown sand and sea grass accumulated. Most likely, during this phase a limestone stela (Stela 32) from SU1 fell down from a niche in the terrace wall. Unfortunately, the inscription and images on the stela are now gone.

Beneath SU1, at least two hearths (SU2 and SU3) with concentrations of burnt wood were recorded. Several wood fragments, mostly burnt, were found to the west of the hearths. All of these features may mark a living floor with big fragments of pottery and complete or fragmentary shells.

On the western side of the trench a huge coral rock, ca. 6 m × 1.3 m in size and over 0.5 m thick, was found beneath SU1, extending over most of the excavation unit (Figure 45). The upper surface of the rock was covered with a layer of salt. This rock probably originated when part of the coral terrace collapsed at some point in antiquity.

In 2007-2008 excavations were resumed to the north of the entrance to Cave 3 in WG 33 where the remains of a mud-brick structure, hearths, inscribed stelae and exotic ceramics had been found. The objective of these excavations was to open as much as possible the surface of this area in order to better understand the organization of this sector in front of the entrance to Caves 3 and 4. Excavations were conducted in a 7 m × 7 m unit. After removing the surface fill of the 2006-2007 excavations, a small limestone stela (Stela 16) was found. The stela is in the Abydos style and dates to year 31(?) of the reign of Amenenhat III; it belongs to the Guard of the Great Palace, Ameny.

SU1 consisted of a mix of sand, small pieces of wood, salt, pebbles, and fragments of limestone. At the base of SU1, a very damaged stela (Stela 20), covered with a thick crust of salt, and the lower part of another stela (Stela 17) were found.

After the removal of modern debris, a stratum (SU2) of sand mixed with pebbles, limestone fragments, and pieces of wood and potsherds was recorded. In this area were three hearths (Hearths 1, 2 and 3, from south to north). Hearth 1 was found in the southeastern sector of the unit and contained charcoal, pieces of burnt wood, and potsherds. Hearth 2, the largest of the three hearths, was roughly circular in shape and contained charcoal, pieces of wood from boxes, and sherds of Canaanite pottery. Hearth 3 contained the remains of a burnt box, pieces of wood, potsherds, charcoal and carbonized cereal. Between Hearth 3 and the wall of the coral terrace, a rectangular ship timber was found.

A layer of mud-brick (SU3) was encountered and WG 33 was enlarged to 10 m × 7 m. There was no evidence of a wall structure or foundations for a wall and the mud-brick layer appeared to be some kind of (thin) platform construction, only partially preserved (Figure 46). The mud-bricks, which were locally made and tempered with sand, seem to have been laid in one course on top of a surface prepared with a thin layer of (mangrove) leaves and sometimes twigs of wood (mangrove?), below which is a stratum of windblown sand. In the northwest sector of WG 33, beneath the mud-brick construction, was a large sherd of a typical Middle Kingdom storage jar.

The layer of windblown sand (SU4) on which the mud-brick platform was constructed post-dated (and covered) the entrances to Caves 3-4. The purpose of the mudbrick platform is unknown.

Excavations, Western terrace slope, WG 40
Chen Sian Lim

A ground penetrating radar (GPR) survey was conducted in this area by Benjamin Vining with Chen Sian Lim on 26 and 27 December, 2006. A 10 m GPR transect was set up along the terrace approximately 2 m east of Cave 1, which was excavated in the 2004-2005 field season. The 200 MHz GPR antenna signature suggested anomalies beneath the sand deposits, perhaps in the form of an artificial cavity with a straight cut feature, but the GPR survey on 27 December with the larger 400 MHz readings was inconclusive.

Ground testing was conducted by removing deposits of windblown sand to a depth of 150 cm. The windblown sand was found to be occasionally interspersed with small coral rocks broken off from the conglomerate bedrock overhang. The 3 m wide unit WG 40 was excavated between the 5 m and 8 m mark off the GPR transect (see 2.4 Geophysical survey).

Several layers of cultural deposits were uncovered in WG 40: SU1, the surface, deposits of windblown sand with few cultural remains (0-150 cm); SU2, Feature A, a hearth (150-220 cm); SU3, windblown sand with cultural remains (220-250 cm); SU4, Feature B, a fire-pit and ceramic platter (250-300 cm); SU5, sterile sand (300-420 cm).

SU2 Feature A was a hearth with mud-bricks flanking three sides and its base made up of potsherds lying on a bed of charcoal and ash. The size of hearth is 80 cm (north-south) × 50 cm (east-west), and the mud-bricks are approximately 30 cm × 15cm in size. A palm print could be made out on one of the bricks. The layer of charcoal and ash was approximately 5-7 cm thick. Artifacts and ecofacts recovered associated with Feature A consisted of wood, possibly mangrove leaves, fragments of linen, rope and cordage, and ceramics. A piece of pottery found within the hearth appears to be an ostracon with red/ochre paint with a "triangle" sign on both sides of the potsherd.

SU3, approximately 30 cm in depth, continued to yield potsherds, cordage, wood remains, mangrove leaves, charcoal etc.

SU4 revealed Feature B, a fire-pit with a ceramic platter 30 cm below Feature A. The platter was fragmentary and fired. Approximately 150 cm south of Feature B was Feature C, a salt encrustation with ash and charcoal some 5-7 cm thick and 50 × 50 cm in diameter. A limestone block measuring 50 cm × 45 cm × 20 cm was found 1 m west of Feature C. The block was partially worked with chisel marks evident on its sides.

SU5 was comprised of sterile sand only, and excavation in WG 40 ceased when a depth of approximately 4.2 m was reached.

Excavations, Western terrace slope, WG 55 and WG 56, and the "alcove shrine"

In 2007-2008 two new excavation units (WG 55 and WG 56) were opened on the top of the western terrace slope, to the south of the entrance of Cave 6. In this area the opening to another cave (Cave 7) was found and partially excavated. A large quantity of wood debris from ship timbers and lithic artifacts were found in front of this entry (in WG 55), suggesting the occurrence of an activity area there. A stela with an offering inscription to Osiris of *Wadj-wer* (Osiris of the sea) was excavated there.

To the south of the entrance to Cave 7, another opening to a rock-cut cavity was found, but was not completely excavated due to safety concerns. In front of this opening was an arrangement of three upright conglomerate slabs and a rock-cut wall (along the vertical wall of the fossil coral terrace), suggesting a ceremonial use of this area. This structure has been named the "alcove shrine."

Excavations, Western terrace slope, WG 55, C-D1-2-3 and the entrance to Cave 7

TRACY SPURRIER

WG 55 was located on the western terrace slope south of/around the corner from the entrance to Cave 6. The unit was oriented to the northeast in order to follow the natural orientation of the terrace wall. Excavations consisted of squares C1, C2, C3, D1, D2, D3 and E1, E2, E3 (E squares were excavated by C. Calcagno). Squares A1, A2, A3 and B1, B2, B3 were not excavated because they consisted of a large build-up of sand which may be supporting a weakened area of the coral terrace between Caves 6 and 7. The excavation area of C2-C3-D2-D3 was 4 m × 4 m in area; squares C1-C2 were just under 2 m × 2 m because they were shortened by the presence of the terrace wall.

The major reason for excavating in this area was because the edge of a very large stone with worked edges and small, carved square recesses was visible on the surface. SU1, which consisted primarily of eolian sand, covered the large stone, which was rounded on one edge and straight on the other. The square recesses were probably quarry marks. At the end of the 2007-2008 field season, once Cave 7 had been discovered, it appeared that this stone had been standing on end in front of the cave entrance, but had fallen over at some point. Along the bottom edges of the stone, mixed in with the sediments, was modern debris such as fragments of tea package labels, newspaper, plastic, styrofoam, etc. It was not known how recent this debris was, but this evidence indicated that the sediments and sand had moved around considerably in recent times. There was no debris directly under the rock, only along the sides, indicating that it had fallen some time ago, but was buried more recently in sand. SU1 consisted of a layer of sand approximately 1 m deep. Corresponding to the bottom of the stone, at the end of SU1 and the beginning of SU2, there was a layer of sea grass which extended to the coral terrace wall.

Near the bottom of SU1 and once the large stone was fully exposed, a large hole was visible in the northwestern corner of square C1. Along the coral terrace wall at the bottom of SU1 and the top of SU2, there was a red residue indicative of burning, and some sea grass. Also, the terrace wall began to be indented at this point, as if forming an alcove. In square C2-3, there were the remains of a hearth. Excavations continued in SU2 in squares D1-2 along the terrace wall where the burning, sea grass, and indentation were, to investigate whether there might be a cave entrance below. Along the terrace wall, there were clods of mud, which may originally have been mud-bricks used to seal a cave entrance. SU2 was filled with wood debris, twigs, sticks and leaves, as well as an intact corner of a reed mat and a very well preserved piece of heavy cloth. Also excavated in SU2 were a large piece of folded linen and two hearths.

Beneath SU2 was SU3 in a smaller area of square D3. SU3 consisted of large cobbles in sand. There were occasional salt deposits throughout the top of SU3 on the cobbles. The cobble layer appeared to slope downward toward the wadi. By examining the balk, it was apparent that the cobble layer continued into the other squares of WG 55 and it corresponded to the cobble layer in WG 56. The cobbles were also present in the coral terrace wall. Underneath the cobble layer was sterile sand with no cultural remains (SU4).

It was suspected that the cobbles in the terrace wall were actually man-modified and built at the entrance to a cave, but after much work with a pick-axe and hammer, the cobbles remained in place: they were a natural part of the coral terrace deposited geologically and not the entrance to a cave. Excavation continued in SU2 in the neighboring D3 square so that all units in WG 55 could be at the same stratigraphic level. In WG 55, D3, SU2, the composition of the sediments was the same as in D1, SU2, thus the same SU number was used. Finds in this square included a piece of an ostracon and a Middle Nubian rim sherd.

After excavating SU2 in D3 and reaching the top of the cobble layer (SU3), which continued from square D2, excavations continued in C1-2-3 down to the cobble layer (SU3). Located in C1 was the above mentioned hole (that was filled with bricks). Once C1 had been cleared of sand that had fallen in from the terrace slope, a small section of the top right corner was investigated because the hole appeared to be square, which clearly indicated that it was man-made, or at least altered, at some point. A limestone stela (Stela 23) was discovered in an upright position at the top of the hole. The stela had a layer of salt encrustation and its bottom right corner was resting on top of a large potsherd.

Upon removing Stela 23, it was revealed that its bottom left corner was sitting near another limestone stela (Stela 24), which was lying horizontally in the entrance to a cave (Cave 7). The inscribed side of the stela was facing upward and was encrusted in a layer of salt.

The two stelae were discovered in SU8, which consisted of medium grain, loose sand that appeared to have been deposited naturally once the cave was no longer used. Also in this layer were many clay sealings (some with very clear details), pieces of inscribed boxes and ostraca. It was unclear how the stelae came to be in their positions and whether it was purposeful, or if they had fallen from somewhere else. At one time there may have been stela niches carved in the coral terrace wall directly above the cave, but this wall had deteriorated over time and no niches were now visible.

Because of the finding of important artifacts such as the two stelae and clay sealings, it was decided to continue excavating in square C1 and to investigate approximately 1 m deep into the cave entrance, but not to excavate the full opening because of the fragile nature of the terrace slope. Thus, the cave entrance (approximately 1.5-2 m long) was not fully opened (Figure 47).

Within the entrance to the cave, there was a large, salt encrusted timber in a very deteriorated condition that continued into the unexcavated area beyond the entrance. This timber (T57) was left *in situ* because of its fragile nature and unknown length. The position of the timber indicated that it had fallen from its intended position, or was thrown into the cave after a period of disuse because it was deposited in a layer of compact sand, and not in any particular position.

Approximately 130 cm from the top of the cave entrance in SU10 there was a mostly intact small jar, missing only its bottom, that was entirely encrusted with salt. It measured approximately 15 cm tall and 8 cm wide at the shoulder. Directly under the small jar, was a possibly well preserved timber (T74). At this point, the stratigraphy changed to SU11 because the timber could have been used as a threshold for the cave and may indicate a living floor. (SU11 in C1 appears to correspond to SU2 in the other squares.) This timber was lying parallel to the cave entrance along the bottom. It was left unexcavated and was covered to preserve its environment until a conservation plan could be implemented. As the ceiling of the cave entrance began to crumble, excavations inside the cave were discontinued.

To the right side of the cave entrance large rocks of conglomerate had been placed together and may represent a small wall or border of some sort that had shifted somewhat over time. In Square C1, SU11 and continuing into C2, SU2 outside the cave entrance and perpendicular to it, was a large, well preserved timber (T75). It had a layer of salt and a bright green square of copper residue. It appeared that the timber had fallen from another location as it was not in any perpendicular or parallel position to the cave entrance. T75 was found sloping downward toward the cave entrance.

Excavations continued in WG 55, C2, with the same SU2 as in the D squares. In WG 55, C1, however, there were many more Stratigraphic Units because the sediments fell differently into the cave entrance and directly outside of it. Associated with the end of T75 in C2 were a small wooden finial type of artifact and a wooden peg approximately 15 cm in length. In C2, SU2 under the timber were the remains of a hearth, Feature 3 (SU12), approximately 35 cm × 30 cm, and a concentration of burnt seeds. This evidence may indicate that there was more than one period of occupation in SU2 if there was a hearth, and later a timber had been placed or fallen on top, but it was not possible to determine how many occupation periods there may have been because they were probably temporally close.

Also of note, sea turtle bones were found in the stratum of WG 55, C2, SU2, stuck between the coral terrace cave entrance wall and conglomerate rocks. A few pieces had the preserved remains of skin on them. In WG 55, C2, SU2 there were also a small piece of papyrus without evidence of inscription and a tiny Minoan sherd.

Excavation then moved to square WG 55, C3, SU3. C3, SU3 consisted of the same composition of sediments as SU2 in the other squares and a hearth (Hearth 4, SU13) was uncovered. The hearth had a large jar fragment on top of it.

All this suggests that the area outside of Cave 7 was a workshop area (Figure 48). The wood debris there was indicative of re-working ship timbers. The many clay sealings and wooden box pieces also indicated that this area was used for unpacking and packing goods, either upon first arrival to Mersa/Wadi Gawasis, or in re-packing the goods from Punt for transit to the Nile Valley. This was also supported by the fact that Cave 7 is near the work area in front of Cave 6, where the majority of clay sealings and wooden boxes were found in earlier field seasons. Even though WG 55, SU2 is not a very thick stratum, it appears to have had multiple occupation periods, which were evident by multiple hearths, clay sealings, timbers and an abundance of wood debris. Different occupation periods, however, are very difficult to understand by the strata alone because there is little to no change throughout the composition of the sediments, but the features and artifacts are easier to interpret.

Excavations, Western terrace slope, WG 56 and WG 55, E1-2-3: the "alcove shrine"
Claire Calcagno, Ilaria Incordino and Chiara Zazzaro

Excavation unit WG 56 was opened east of WG 55 in order to investigate the rock shelter area all along the coral terrace wall. The unit was oriented to the northeast in order to follow the natural orientation of the terrace wall. The excavated area, measuring 6 m × 6 m, was originally covered by a large deposit of sand (SU1) that sloped from the terrace wall toward the wadi bed with a height difference of ca. 2.30 m.

A stone structure composed of four boulders, associated with an opening carved into the wall terrace, and with a large curved wall cut into a natural stratum of cobbles, was discovered in WG 55-56 and was partially investigated (Figures 49-50).[2]

The uppermost stratum (SU1) was composed of windblown sand and small pebbles coming from the deterioration of the conglomerate stratum of the terrace wall. This naturally accumulated deposit, ca. 40-20 cm in thickness, included sherds with a very eroded surface, suggesting they had been exposed for a long time on the upper terrace surface, and fell down together with the deterioration and collapse of parts of the terrace (see below, description of SU6). A few centimeters below the surface in the northeastern part of the unit, several modern hearths were found that had been made recently by workers to boil water. The westernmost area comprising WG 55, E1-2-3 also yielded significant modern rubbish and cloth debris. An inscribed stela (Stela 28) was discovered at the base of this stratum, in the southern limit of the unit.

The sand deposit (SU1) covered two large slabs of conglomerate (SU6) that had collapsed at one time from the coral terrace, and a structure composed of four large stone blocks (SU12, SU13, SU14, SU16). SU1 also completely covered the stratigraphic sequence of the terrace

[2] This man-made structure was located partly in WG 55, E1-2 and in WG 56, A1-2; for this reason WG 55, E1-2-3 was investigated together with WG 56, and separately from the rest of WG 55.

wall, including a stratum of consolidated sand (SU5) and a stratum of cobbles (SU4). The consolidated sand (SU5) was a natural stratum of wadi sediment cemented with carbonate (ca. 1.30 m thick), into which a man-made opening (SU15) was carved. This stratum was probably intentionally modified all along the exposed surface.

The alcove-like opening in the terrace wall had two large horizontal fractures above it, and its ceiling lacked structural integrity. For these reasons, excavations were conducted only in part of the sand deposit filling, in which two different accumulation levels were distinguished. The upper level (SU17) was ca. 1.0 m thick and consisted of windblown sand that had fallen in through the crack at the top of the opening. The lower level (SU7) consisted of windblown sand and sea grass. A small limestone slab (20 cm × 21 cm × 4.5 cm), possibly with an eroded inscription, was found at the top of SU7. A strip of painted linen (20 cm × 3 cm) with a red mark and hieratic inscription was recovered from the middle of this stratum. At the bottom of SU7 were clay sealings with seal impressions, a few fragments of wood, and, close to the stone structure, some large sherds of jars, shells, fish bones and some pieces of mud.

The alcove opening was delimited southwest by the stone structure, which consisted of three erected conglomerate stones arranged in a U-shape and a fourth conglomerate stone leaning against the southernmost stone. Another conglomerate stone was found lying at the base of the structure. The three principal blocks forming the structure were almost rectangular in shape and featured several small rectangular recesses on their faces or in the corners between two different faces.[3] The leaning stone had an irregular pentagonal shape and measured 67 cm × 63 cm × 22 cm. The stone structure was constructed by cutting into the natural cobble stratum (SU4). The two lateral stones were consolidated and sup-

[3] Block 1 (74 cm x 69 cm x 29 cm) had two recessed cuts at the two corners (12 cm x 6 cm and 4 cm in depth; and 16 cm x 10 cm and 7 cm in depth); Block 2, the central one (74 cm x 54 cm x 42 cm) had two recessed cuts, one in the center (14 cm x 9 cm and 6 cm in depth), and one in the lower corner (10 cm x 9 cm and 3 cm in depth); Block 3 (61 cm x 59 cm x 21 cm) also had two recessed cuts, one in the center (9 cm x 7 cm and 6 cm in depth) and one on the same face but in the lower part (9 cm x 9 cm and 6 cm in depth).

ported with small coral blocks (ca. 10-15 cm in diameter) stacked in a pile on either side and mixed with some mud clods and organic material. The remains of a wooden pole was found inserted in the southwestern consolidation mound, between the stone structure and the “cobble wall” (SU4); another pole was found in the corner between two stones.

The two large collapsed slabs of conglomerate (SU6) lying in front of this opening were broken up and removed, in order to continue excavation in the southwestern portion of the trench to better investigate the wall cut into the cobble stratum (SU4) connected to the stone structure and to the opening. The natural cobble stratum was part of the fossil coral terrace stratigraphic sequence and consisted of cemented conglomerate. It was also found in WG 32, in WG 55, and in Cave 2, and had been artificially modified in several places. In WG 56 the cobble stratum was shaped into a large curved wall ca. 50 cm thick, which had been partially consolidated with mud plaster. Outside the wall structure was evidence related to construction of the structure, as well as evidence of human occupation.

A stratum (SU8) of mud and organic material (leaves, branches, rope, textile fragments and Papyrus 2) extending into WG 56, in the area around the external part of the structure, most likely represents deposits accumulated next to the retaining wall. This stratum corresponded in WG 55, E2-E3 to SU4; a fragment of an inscribed papyrus (Papyrus 1) and a Middle Nubian potsherd were also found in this stratum. Thickness of these two strata was very irregular, varying from 10 cm to 30 cm. The windblown sand stratum, SU1, and the two large collapsed blocks (SU6), originally covered this stratum. A particularly thick, compact concentration of mangrove leaves (WG 55, SU6; < 12 cm), extended along part of the terrace wall within WG 55, E1-2, and continued westward into WG 55, C-D.

Below SU8 a stratum of compacted sand (SU11) associated with three hearths and with a great concentration of organic materials (wood fragments, ropes, bones) and potsherds (including dishes, bowls and small bottles), was found at the base level of the “cobble wall.” A well preserved ceramic jar, missing only its neck, was found on top of this stratum and was associated with the stone structure. SU11 was not completely excavated.

Three hearths associated with this stratum were found in WG 56 near the “cobble wall.” Hearth 1 (SU9), ca. 40 cm × 40 cm, was located close to the southern limit of the excavation unit. Hearth 2 (SU10), ca. 40 cm × 30 cm, was located close to the wall structure. Hearth 3 (SU2), ca. 85 cm × 40 cm and 10 cm deep, included one large, burnt potsherd and a flat granite stone. It was located at the eastern limit of the unit and the "cobble wall."

A test pit, 70 cm × 50 cm and 40 cm deep, was excavated at the eastern end of the unit in order to investigate other possible occupation phases. A layer of organic material (SU3) was found that seemed to be related to SU11. No earlier occupation phases were identified.

The archaeological deposits associated with the alcove and stone structure in WG 55-56 seem to be distinct from deposits that have usually been excavated on the terrace slope, which typically include evidence of woodworking activities and/or remains of accumulated materials connected to the expeditions. This structure and the related mound delimited by the "cobble wall" can be compared to features excavated on the top of the terrace and interpreted as ceremonial structures (Bard and Fattovich 2007: 244-245). The associated types of ceramics (dishes, bowls and small bottles); the possibly votive, large jar; and the hearths found all along the structure enclosure suggest that ritual activities were performed in this area. The evidence of papyrus fragments also points to the administrative-ceremonial importance of this area.

Excavations, Western terrace slope, WG 61/65

KATHRYN A. BARD, DIXIE LEDESMA, ANDREA MANZO AND TRACY SPURRIER

WG 61/65 was located on the western slope of the coral terrace northwest of Cave 1. This area was chosen in 2009-2010 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 × 10 m trench, which was divided into 25 2 m × 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 51). 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 (Figures 52-53). The base of the mud-brick wall was not far below the top of the cave entrance, indicating that the mud brick walls were built much later than when Cave 8 was excavated. A ramp paved with some timbers found aligned on the axis of the entrance of Cave 8 may have allowed the access to the cave from the living floor where the mud brick walls were 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.

As excavations continued, a new 10 m × 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 (Stela 29) and its hieroglyphic inscription was well preserved. 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 × 23 cm × 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 54). There were also remains of mud-bricks on top of the timbers (from the mud-brick structure?). The fact that these timbers were almost perfectly aligned with the axis of the entrance to Cave 8 suggests that they were used as a ramp leading into the cave, as found at the entrance to two other caves at the site. 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.

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 × 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.

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 deteriorated limestone block with a hole in it, which was probably at one time a stone anchor, as well as the above mentioned stela (Stela 29). 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 remains 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 55).

There were many other artifacts of interest throughout most of the sediment strata in WG 61/65. 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 defleshed 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 × 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. [*Editor's note*: in 2016 this limestone artifact was identified as lamp.]

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 entrance 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.

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 mudbrick 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 SU46.

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 56).

Excavations, Western terrace slope, WG 31

KATHRYN A. BARD

Near the end of the 2009-2010 field season, excavations were resumed in WG 31, an area next to the coral terrace wall that had been excavated by Bard and Fattovich in 2005-2006 (Bard and Fattovich 2007: 72-73). In 2005-2006 SU1 of these excavations contained a great mixture of materials, including a ram horn and other animal bones; donkey (?) dung; a doum palm nut; mud-bricks; a (papyrus) sandal; plastered and unplastered pieces of cedar; a small, badly eroded limestone stela (round-topped); a large complete, late 12th Dynasty storage jar with many sea shells inside; and a cut piece of (modern) sugar cane.

In the 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.

In 2010-2011 a 8 m × 4 m excavation unit was placed here, oriented along the face of the coral terrace. As in 2005-2006, SU1 consisted of a deposit of windblown sand (ca. 40-60 cm deep), containing Middle Kingdom potsherds, one of which had a hieratic pot mark(?). Wallace-Jones also identified a Canaanite potsherd from this deposit.

Other materials in SU1 included: a wooden bottle lid, rope (large and small types, including one with a large knot), linen fragments, linen string, bird nests (partially made with ancient linen threads), many small pieces of wood, pieces of clay (for sealings?), 1 shell, 1 seed (of unknown species), pieces of mud-brick and burnt mud-brick, and much charcoal.

In the northern part of WG 31, SU1 there was a concentration of mud-brick fragments, and to the north of this, some large Middle Kingdom potsherds, large pieces of wood and charcoal.

Below SU1, the workmen excavated a sterile layer of sand, and continued to find more sterile sand in a 5 m extension of the excavation unit to the northwest. The fossil coral terrace extended outward at this level, and there was no evidence of any openings for a man-made cave here. It is presumed that the sand in this area of the western slope was leveled off for a limited amount of work activity in proximity to hearths, as reflected in the artifacts and other remains found here.

Excavations, Western terrace slope, WG 40
KATHRYN A. BARD

Excavation unit WG 40 was opened just to the south of the entrance to Cave 1, which was not excavated in 2004-2005 when Cave 1 was found (Bard and Fattovich 2007: 70-72). This was a 7 m × 3 m excavation unit, located next to the fossil coral terrace wall. The Stratigraphic Units of WG 40, beginning at the coral terrace wall and diminishing in slope outward, were:

SU1: ca. 66 cm of colluvium and windblown sand, beneath which is ca. 36 cm of windblown sand.
SU2: a layer, ca. 20 cm, of sea-grass and mangrove leaves.
SU3: ca. 30-40 cm of sand with cultural material, including hearths.
SU4: ca. 10-20 cm of deposit with layers of mats.
SU5: sterile deposits.

SU3 contained the following:

1) Artifacts: half of a wooden tag with rope still attached to the hole (5.8 cm long), painted with a boat sign; 2 lithic tools, including a blade, 7.2 cm long; small piece of copper; heavy unknown material(?); many potsherds; 2 Middle Nubian potsherds from a bowl rim; many linen fragments; rope fragments; mat fragments, 1 whole mud-brick (30 cm × 15 cm × 8 cm).
2) Wood: many small fragments and some large pieces, including a cedar fragment with a mortise cut, and one long piece (40 cm) cut flat on one side and rounded on the other side.
3) Bones: mammal, bird and fish bones, including a sheep/goat scapula(?), and a goat horn.
4) Molluscs: shells, including a bivalve (14.5 cm long), pieces of a squid (chitinous) pen.
5) Charcoal.
6) 2 doum palm nuts (inner part).

Excavated in the northern end of WG 40, next to (south of) the entrance to Cave 1, was a large stone (83 cm long) found lying at an angle, next to which was a large deposit of burnt mud-bricks. These artifacts probably originally formed the door and sealing of the Cave 1 entrance, which were removed in antiquity. Also next to the large stone was a conglomerate grinding stone (21 cm × 24 cm × 7 cm), both smooth and pitted on one side where the grinding was done, and broken at one end.

In the southern end of WG 40, a concentration of ropes, cut reeds (raw material), and a large fragment of an *in situ* mat, were found in SU4. Excavations continued here in SU4, which contained a fragmented rope bag and basket fragments, beneath which was a large fragment of a mat. The rope bag fragments and mat fragment were removed with plywood boards underneath. Also in SU4 was a kind of construction with 2 coral rocks and a wooden stake, cut to a point at one end. At the bottom of WG 40, SU4 were 2 burnt mud-bricks associated with charcoal (a hearth?), small pieces of wood and some animal bone fragments.

Aside from the rope bag fragments and the mat fragment, WG 40, SU4 contained: a deposit of large rope fragments, many smaller rope fragments, small pieces of wood, potsherds, 1 piece of linen, bone fragments, grass/reed fragments, charcoal, and a broken wooden peg (?) cut at one end.

Since a large articulated mat was found at the end of WG 40, SU4 extending south, the excavation unit was extended 2 m south and was named WG 40, S extension. SU1 and SU2 were cleared off of WG 40, S extension, and a well articulated hearth was found in SU3, associated with an almost whole marl jar. Beneath the hearth in SU4, more matting was found. At least two 4 different types of matting were piled here, extending out from the coral terrace wall for up to 260 cm:

1) Mat made of two twisted rope fibers, identified by Ksenija Borojevic as halfa grass.
2) Woven mat made of flat strips, identified by Ksenija Borojevic as strips of doum palm leaves.

The mats were thrown here in a pile and large quantities of thick storage jar sherds were also found above and associated with the mats. Some large mammal bones were also found here, along with much wood, mainly of local types with bark and branches.

Also in WG 40, S extension, SU4 was a broken, wooden furniture (?) leg, flat on one side with evidence of red paint (35.5 cm long, 3.0 cm wide at widest point).[4]

According to Wallace-Jones, all the pottery from WG 40 and WG 40, S extension is domestic, mainly cooking pots and plates, so this area was associated with domestic activities: cooking and eating.

SU3 and SU4 in WG 40 and WG 40, S extension represented multiple episodes (at least two) of use for domestic activities in this area, and there was no evidence of administrative activities here as farther north outside the entrance to Cave 8.

Since the pile of mats was fragile - and large - they were left *in situ* and covered with a plastic sheet and then sand. As in WG 31, there was no evidence of any man-made caves in WG 40 and WG 40, S extension, which were excavated down to sterile deposits of sand.

Excavations, Western terrace slope, WG 61/65 (C3, SU36 in SU2 Fire-pit 14 (SU35), formerly (east) 15A and Fire-pit 15 (SU36), formerly (west) 15B)

KSENIJA BOROJEVIC, FRANCESCO BERNA AND REBECCA MOUNTAIN

Unearthed during the 2009-2010 field season was a structured combustion feature delineated by mud-brick walls and composed of two fire-pits, Fire-pit 14 (SU35), formerly 15A, and Fire-pit 15 (SU36), formerly 15B, containing thousands of charred barley seeds. The feature was located in square C3 of Area WG 65, near the entrance of Cave 8 (Figures 57-59). The aim of the fieldwork in 2010–2011 was to conduct a micro-stratigraphic excavation of SU35 and SU36, and integrate the botanical and chemical-mineralogical results, including the FT-IR analysis, in order to obtain information about the age and use of the combustion feature.

The whole feature, including both fire-pits, was ca. 2 m long × 1 m wide. Both fire-pits were situated against the coral terrace wall and were covered by SU1, the surface layer consisting of alternating sub-layers

[4] Ksenija Borojevic suggested that some of the mat fragments here associated with the wooden furniture leg may be from a bed. According to K. Bard, the piece of furniture was probably a smaller stool/seat, as the wooden furniture leg(?) is not large enough to support a bed.

of colluvium (large-grain aeolian sand, large pebbles and rock fragments from the coral terrace). SU36 (Fire-pit 15 on the west side) sat on top of a mud-brick feature (a possible platform) that in its turn sat on top of SU2 (aeolian sand with many mud-brick fragments, potsherds and wood fragments). The feature sloped ca. 25 cm southward. The highest elevation, the preserved central mud-brick walls abutting the coral terrace, was taken as a datum point at 9.960 m ASL (point 0 during the excavations). The two fire-pits were excavated and analyzed separately.

Excavation strategy: the space in WG 65, SU35 and SU36 was subdivided into 1 m squares and excavated by delimiting arbitrary horizontal areas and following the visible Stratigraphic Units. The mud-brick walls were left in place. The micro-Stratigraphic Units were then partially excavated (and sampled) by removing arbitrary spits (thickness) that followed their specific thickness. The excavations of the two fire-pits concentrated on the careful removal and sampling of the southern edges of the fire-pits to reveal the microstratigraphy in section.

In Fire-pit 14 (SU35), two smaller areas were systematically excavated to the bottom layer of sand (Figures 60). In the southeast corner, a block (ca. 20 × 20 cm) was excavated to a depth of ca. 20 cm below the surface. On the east side, a block (ca. 20 × 30 cm) was excavated to a depth of ca. 35 cm below the surface. In the southern and eastern part of the unit there were three rows of sand/mud-bricks (each brick ca. 23 × 11 × 8 cm). The mud-bricks were placed on the top of the sand layer. Most of the mud-bricks were left in place, but the mud-bricks in the middle of the preserved eastern wall of Fire-pit 14 were removed. The sand layer was reached at 9.61 m ASL, and it was the lowest excavated point in SU35. From Fire-pit 15, 46 cm of deposits were excavated until the sand layer was reached at 9.5 m ASL in the southern part (Figure 61).

Field observation revealed significant stratigraphic differences between Fire-pit 14 (SU35) and Fire-pit 15 (SU36). Fire-pit 14 appeared to have been used last. In fact, the ashes comprising the topmost layer of SU35 covered the topmost ashes of SU36. Moreover, Fire-pit 14 was composed of a single 2- to 5 cm thick layer of white wood ashes containing charcoal and mud-brick fragments on top of a 1cm-thick sand layer (Figure 60). The topmost portion of the ash layer was transformed into a few-millimeter-thick crust. At the eastern margin of the feature, the ash and sand layer sat on top of a 5- to 8 cm thick layer of uncombusted plant material. Therefore, the stratigraphy of feature Fire-pit 14 (SU35) can be described as follows, from top to bottom (Figure 60):

1a) encrusted 5 mm thick layer of wood ashes.
1b) 2- to 3 cm thick layer of wood ashes with charcoal and mud-brick fragments.
2) 2- to 3 cm thick sandy layer, slightly grayish.
3) 5 cm thick layer of uncombusted plant material.
4) 3 cm layer of sand.

In contrast, Fire-pit 15 (SU36) was characterized by the presence of several millimeter- to centimeter-thick layers). From top to bottom (Figure 61):

1) 5 mm thick layer of charred cereals seeds, wood fragments, and cord material.
2) 2 to 5 cm thick layer of highly cemented wood ashes, with charcoal. The difference between layer 1 and 2 is that the charred material in layer 1 comprised almost 100% of the sample; in layer 2, 75% of the sample was calcitic ash and 25% was charred material. This difference could indicate a higher firing temperature in layer 2).
3) 1 cm thick layer of sand and uncombusted plant material with a few charcoal fragments.
4) to 3 cm thick layer of slightly cemented gray fine sand and ash.
5) 1 to 2 cm thick layer of sand and uncombusted plant material with a few charcoal fragments.
6) 2 cm thick layer of grayish discolored sand.
7) 1 cm thick layer of sand and uncombusted plant material with a few charcoal fragments.
8) 5 cm thick sand layer.

The alternation of combustion residues and uncombusted material suggested that the feature was used periodically. The cementation of some of the combusted material suggested that the period of disuse was long enough to allow the formation of a salt crust.

Fourier Transform Infrared Spectroscopy (FT-IR), Fire-pits 14 and 15
FRANCESCO BERNA

A portable FT-IR spectrometer (Thermo Scientific Nicolet iS5) was brought to Egypt in 2010-2011. Sediment samples were powdered and a few tens of micrograms were mixed with about 50 mg of KBr (IR-grade) and processed into 7 mm pellets by using a hand press (Qwik Handi-Press, Spectra-Tech Industries Corporation). FT-IR spectra were collected between 4000 and 400 cm−1 at 4 cm−1 resolution.

In Figure 62, representative IR spectra of sediment sampled from the different layers of Fire-pit 14 (US 35) are illustrated and contextualized into a photograph of the southeastern microstratigraphic section. The FT-IR analysis shows the absorption of calcite (from wood ash and limestone), aragonite (from fragments of coral reef), quartz and feldspars (from sand), kaolinite (from airborne clay particles and mud-brick material), gypsum (from natural desert crust), and anhydrite (calcium sulfate generally forming irreversibly by heating gypsum at a temperature above 250° C). It is interesting to note that all the above-mentioned components are present in different relative proportions in all the layers despite the dissimilar appearance of the layers. This suggests that the use of Fire-pit 14 led to the mixing of the ashes deriving from the fuel with the natural components. The presence of anhydrite suggests that the gypsum that formed naturally from the evaporation of the marine aerosol was heated.

In Figure 63, representative FT-IR spectra of sediment sampled from the different layers of Fire-pit 15 (SU36) are illustrated and contextualized in a photograph of the south microstratigraphic section. FT-IR analysis shows that the chemical mineralogical composition of the layers varies distinctively between the different layers. The charred material (seeds and wood) shows high aromatic-carbon absorption, indicating that the combustion condition led to effective charring of the wood. The ashy layers 2, 4, and 6 show strong absorption of calcite (a major component of wood ash) and of anhydrite.

In contrast the sediments composing the layers containing uncombusted plant material show strong absorption of gypsum, suggesting that the material was exposed on the surface for some time. Interestingly, in the uncombusted layers calcite is significantly less abundant while in the combusted layers absorption of anhydrite is associated with gypsum, indicating that the fire occurred after the crust was formed.

In Figure 64, representative FT-IR spectra of mud-brick materials sampled from both Fire-pits 14 and 15 are illustrated and contextualized into a photograph of both features.

The FT-IR analysis shows that fresh mud-bricks contain significant amount of kaolinite (absorptions at 3695 and 3620 cm-1). The structure of kaolinite is generally destroyed at temperatures between 420° and 500° C. It is therefore interesting to note that all the mud-bricks, despite being rubefied, show absorption of kaolinite. This suggests that the temperature reached by the mud-brick material was less than 420°-500° C. It is also interesting to note that the kaolinite absorption of the rubefied mud-bricks delimiting Fire-pit 14 is less intense than in Fire-pit 15, indicating different combustion conditions in the two fire-pits.

The presence of anhydrate and reduced kaolinite suggests that in Fire-pit 14 the temperature and the intensity of pyrotechnological activity was probably slightly more intense than in Fire-pit 15.

3.2.c Excavations, western terrace slope, base

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 (WG 19/25/26/27) excavated 2003-2004 to 2006-2007 (Bard and Fattovich 2007: 73-76).

Excavations, Western terrace slope, base, WG 69

Kathryn A. Bard and Rodolfo 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 potsherds were recorded. The excavation unit was oriented in alignment to the terrace.

An excavation trench, 6 m × 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.

The Stratigraphic Units were:

<u>SU1</u>: superficial, sterile stratum of lagoon sediment, ca. 15-20 cm thick, with evidence of potsherds at the base of the SU.

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.

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).

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

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.

The profile on the northern side of WG 69 showed the following stratigraphy from bottom to top (Figure 65):

1) At the lowest level there were coral rocks and many bivalve shells, some still together (i.e., they were not opened and 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 were wadi sediments with few/some mangrove roots, ca. 15-22 cm.
4) SU3 with Middle Kingdom pottery, above which were wadi deposits and no mangrove roots. Thus, through time and use of the harbor by the Egyptians mangrove trees were cut down, used as fuel and for construction, and eventually disappeared.
5) Final episode (SU1) with no more mangrove stands, when the paleo-bay was 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.

Excavations, Western terrace slope, base, WG 70
RODOLFO FATTOVICH

This excavation unit was a test pit, 4 m × 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 × 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.

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.

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.

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, in the northwestern corner of D1. The feature extends eastwards, out of the test pit (Figure 66). Further investigations demonstrated that a large mud brick complex characterized that area (see 3.2.i Excavations, mud-brick structures,WG 70/72/73/76).

3.2.d Excavations, western terrace slope, Cave 2

Cave 2 is one of the group of five galleries discovered in 2004-2005 after a deposit of ca. 2 m of aeolian sand along the western edge of the fossil coral terrace was removed (Bard and Fattovich 2007: 61). 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 has been divided into three sectors: the Entrance Corridor and Room 1, excavated during the 2004-2005 and 2005-2006 field seasons, and Room 2, surveyed in 2005-2006.

Excavations, Western terrace slope, Cave 2/WG 64

Mohamed Abd El-Maguid Mustafa, Cheryl Ward and Chiara Zazzaro

WG 64, opened in 2009-2010, was located within Cave 2. It consisted of a 4 m × 2 m excavation unit, divided into 2 m × 2 m squares (Figures 67-68). 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 preparation remains (Bard and Fattovich 2007: 65).

Two 50 cm × 50 cm test pits that were placed ca. 10.20 m from the entrance revealed evidence of intensive woodworking activities, and WG 64 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 × 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 (see 5.1.c Ship timbers and maritime artifacts, 2009-2010). Excavation unit WG 64 included 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, burnt sandy soil (SU5) extended over an area 2 m × 1 m, suggesting at least one hearth was here. A ca. 2-liter concentration of reeds and leaves was morphologically similar to the giant reed *Arundo donax*. Located along the northwestern and northern limit of the trench (SU3), the deposit may have been the remains of a pallet for sleeping or sitting, or even of rope-making activities (Figure 69). 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 70) and a shipworm-damaged cedar fragment were discovered beside a collapsed block on the north side of the trench. 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, a probable oar loom segment (W960) was collected beneath a layer of rock fall in association with a rope fragment, a retouched stone, and a fragment of a bread mold, while in the center of the trench a second oar loom segment (W961) was associated with probable blade fragments (W963 and W965).

Also the gypsum deposit in WG 64 and a spill of gypsum plaster was found in Cave 3 are possibly related to maritime activities (see 5.1.c Ship timbers and maritime artifacts, 2009-2010).

Excavation unit 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 burnt area we believe indicates at least one hearth.

The finds in WG 64 demonstrate continuity with the early 12th Dynasty occupation levelpreviously identified in the gallery's Entrance Corridor. As there was 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.

Excavations, Western terrace slope, Cave 2/WG 71

CHIARA ZAZZARO

Excavation unit WG 71 was located within Cave 2. It was opened in the area obstructed by rock fall from the ceiling separating Room 1 from Room 2 (much of this deposit was removed during the 2005-2006 field season). The unit, investigated in 2010-2011, included two transects. Transect 1, 4 m × 1 m, was parallel to the southeast wall; Transect 2, 2 m × 1 m, was perpendicular to Transect 1. Excavations in WG 71 were incomplete.

WG 71 revealed evidence of work activities related to ropes, timber cleaning and food processing, so the excavation unit was laid out to determine whether activities there were linked to those previously identified in Room 2. WG 71 allowed documentation of the relationship between the Entrance Corridor, Room 1 and Room 2, and investigation of the arrangement and use of different spaces within the gallery, but additional excavation is needed to fully explore these problems.

The surface in WG 71 was characterized by rock fall from the ceiling (SU1). Within this layer were one or two probable oar loom fragments (W968), ca. 6 cm in diameter, a wood debitage fragment, and jar sherds.

The layer below the rock fall (SU2) included scattered concentrations of organic materials, ship components, rope and debitage. The southwest corner of Transect 2 had a concentration of rope and wood debitage (SU3) lying on a compact stratum of reeds that also included barley seeds, beetles, and other small insects (SU4). This mound, 50 cm × 40 cm and 18 cm thick, was located ca.1 m from the wall and 1.35 cm below the ceiling. The deposit may be the remains of a pallet for sleeping or sitting, or even the remains of rope-making activities.

The condition of the debitage was, in general, good, but most surfaces were moist and soft, lacking detail due to degradation. The wood debitage was likely the result of dismantling, cleaning and modification of ship timbers. The debitage is consistent with the size and types of wood debitage excavated in the Entrance Corridor in 2005-2006 (Ward and Zazzaro 2010: 30-31).

WG 71 also yielded a rich cordage assemblage (see 8.2.b Cordage, 2010-2011: WG 71). The composition of wood debitage in WG 71 and in the Entrance Corridor of this gallery differed significantly from wood debitage collected in the contiguous gallery, Cave 3. The two galleries were most likely in use at different times. The surface and upper layers of Cave 3 are characterized by fastener fragments larger than those in Cave 2 and of different types, including dovetail tenons. Cave 2 was the source of most oar remains (primarily loom fragments), found in the disturbed area in Room 1 of WG 64 as well as throughout WG 71.

The discovery of a thick layer of rope fragments, reeds and seeds suggested that the excavated occupational level in WG 71 was a living area where rope-related activities, food processing and/or food storage occurred. Wood debitage and fragmentary oars attest that woodworking activity also occurred in this area, almost certainly ship dismantling and the subsequent modification of ship components.

The WG 71 Stratigraphic Units were:

<u>SU1</u>: surface layer including rocks fallen from the ceiling. SU1 covered SU2.

SU2: spots with concentrations of organic materials including wood debitage, rope, linen rope, round-sectioned wood fragments and other ficus sycamore-type wood fragments. SU2 covered SU3 and was below SU1.

SU3: concentration of rope fragments of different dimensions and wood debris. The upper layer of this stratigraphic unit was characterized by thicker rope, one of which was made with three strands, 3.3 cm in diameter, and tied at one end. The lower layer included a rope fragment of medium size and ca. 20 cm long. SU3 covered SU4 and was covered by SU2.

SU4: concentration of aligned reeds, 5 cm thick, in the southwest corner of the trench. This stratigraphic unit included barley seeds, beetles and other small insects. SU4 was above SU5 and below SU3. This stratum was been sampled for palaeobotanical analysis.

SU5: sandy soil extending all along the trench. It included one fragment of a dovetail tenon with traces of shipworm damage lying exactly beneath two fragments of rope from SU4. SU5 was covered by SU4.

SU6: very tiny fragments of wood debris associated with the reed concentration in SU4. SU6 was above SU5 and below SU3.

3.2.e Excavations, western terrace slope, Cave 3/WG 39

CLAIRE CALCAGNO, MOHAMED ABD EL-MAGUID MUSTAFA AND CHIARA ZAZZARO

Excavation unit WG 39 consisted of a 22 m × 4 m trench, divided into 2 m × 2 m squares, in Cave 3. Sometime soon after the 2005-2006 field season, thieves entered the cave compound and disturbed the archaeological surface. They dug a deep hole measuring 3-4 m in depth inside Cave 2 near its entrance. They also left several shallow pits (10-15 cm deep) on the floors of Caves 2, 3 and 4a-b.

During the 2006-2007 field season Cave 3 was partially excavated in order to better investigate the original structure of the cave and the activities conducted within this area, as well as to study the relationship between Cave 3 and Cave 2, and between Cave 3 and the settlement outside the caves. Eight squares (A1-2-3-4 and B1-2-3-4) were investigated in the innermost part of the cave, while six squares (A9-10-11 and B9-10-11) were investigated in the shelter area near the cave entrance (Figures 62 and 109).

As noted in the previous field season, the cave walls are cut vertically and the ceiling is vaulted (Bard and Fattovich 2007: 66). The surface (SU1) of the inner area (corresponding to squares A1-2-3-4 and B1-2-3-4) was characterized by a deposit of wood debris, fragments of rope, shells (mostly *nerita*), fish and small mammal bones. Six pits produced by the thieves were recorded on the surface (SU2-SU3-SU4-SU5-SU6). An irregular deposit of sterile windblown sand (SU7, SU9) was found below the surface and covered part of what is presumed to be the ancient floor (SU10). A small, shallow concentration of seeds (see 7.1.a Archaeobotanical investigations, 2006-2007) and insects was found in the western side of squares B2 and B3 and close to the cave's wall (SU8). A splotch of white plaster ca. 15 cm in diameter was also found in the same area, which contained impressions and remains of seeds and insects. A folded strip of copper was recovered in an isolated context in sand (B2, SU9). The piece measured 10 cm in length, 2.3 cm in width and c. 0.1 cm in thickness, and had been folded over five times (making 6 layers). A section of a reworked ship plank (T52) was also recovered in the same square. The cave's presumed floor consisted of compacted sand soil, loose cobbles and rocks, and extended through squares A2-3-4-5 and B2-3-4-5. Although the floor was not investigated completely, it was possible to estimate that the average height in the innermost part of the cave was ca. 1.80 m-1.60 m.

The central part of the cave was characterized on the surface by a large concentration of charcoal, a naturally mummified fish, several fish and small mammal bones, and collapsed blocks and wood debris (squares A5-6-7). Squares B6-7-8 remained inaccessible beneath collapsed rock and were not excavated.

The shelter area deposit (SU1) consisted of an accumulation of windblown sand sloping down from the entrance towards the inner part of the cave. This extended through squares A9-10-11, B9-10-11 and partially within square A8. Concentrations of ash and very shallow hearths (ca. 4-5 hearths, 10-20 cm in diameter) were excavated a few centimeters beneath the surface in squares A9-10-11 and B9, corresponding to SU12. This level covered another more significant deposit of windblown sand extending throughout the shelter area (SU11 and SU13) that included a large concentration of wood debris, reworked timbers, rope and leather fragments of different sizes and configurations, and a few potsherds. A burnt block-like wooden object (ca. 39 cm × 17 cm × 12 cm) covered in what appeared to be leather and filled by sand, was found in A9. These strata were very irregular, sloping downwards from the cave entrance to the inner part of the cave. The maximum thickness was ca. 50 cm; the minimum thickness was ca. 5-10 cm.

A large hearth (SU15) measuring ca. 2.5 m by 1.5 m extended across squares A8-9. A concentration of gravel (likely from a collapsed block of conglomerate) and sand was mixed with some fragments of wood debris in square A9 (SU14). The first (uppermost) level of this hearth was characterized by a concentration of burnt wood, fragmentary timbers, tongue and dovetail tenons and other wood debris. The second (middle) level comprised a concentration of large charcoal fragments and ash that extended into square A8 (SU16). The third (lowest) level was characterized by a reddish sand soil; it was not completely excavated.

An assemblage of reworked ship timbers (T55, T61, T64, T65, T66, T67 and T69) was found lying on a prepared floor (SU18). Several timbers (T61, T64, T66, T67 and T69) were partially covered by collapsed boulders; a deposit of windblown sand discerned between the timbers and boulders indicated that the collapse occurred after this occupation phase. The largest timber (T55), in considerably deteriorated condition, was found just within the shelter entrance. Four timbers were arranged across the cave width and two lay parallel to the cave walls. A preliminary hypothesis suggests that the timbers had been temporarily stored within the cave, and/or reused within the cave structure.

Alongside timber T64, the surface of the floor (SU18) featured concentrations of organic materials including rope, textile fragments and sherds, and significant concentrations of seeds (SU17). A test pit was excavated along one edge of timber T64 in order to better investigate the extension and types of fastening joints featured on the timber edges. The pit measured 15 cm × 30 cm and was excavated to a depth of 6.5 cm. The first recorded level consisted of a stratum of gravel (SU19); beneath this stratum a layer of salt encrustation (SU20) was also recorded but not excavated. A fragment of a basket base or sandal was also recovered in SU19.

Two occupation phases were identified in Cave 3 based on preliminary data. The more recent phase is characterized by a deposit of sand with several small hearths and one large hearth concentrated in the shelter area, and wood debris associated with shells, a few rope fragments and animal bones scattered throughout the cave area. The most significant activity recorded during this phase involved the burning of ship timber parts. The assemblage of timbers placed on the floor characterizes an earlier phase of occupation. Activities recorded during this phase included the reworking of ship timbers, and food processing. This phase was only partially investigated because of the collapsed rocks lying on top of the timbers.

The excavated evidence suggests that Cave 3 was occupied at least twice during different periods, followed by a phase of abandonment during which a deposit of windblown sand formed and portions of the cave roof subsequently collapsed.

3.2.f Excavations, western terrace slope, Cave 8

ANDREA MANZO

Cave 8 consisted of a single chamber, ca. 5 m × 6 m in area discovered in the 2009-2010 field season (Figure 71). The chamber has a rectangular shape, with a SW-NE axis and a 0.8 m wide entrance on the SW side. The floor consisted of the horizontally carved fossil coral rock into which the chamber was excavated, while the roof consisted 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 could be clearly distinguished, while the eastern part was completely covered by salt incrustation. Some of these blocks may have been anchors or parts of anchors. Since this wall consisted of sandstone blocks, the rectangular cave 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 looked 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 × 1 m excavation unit consisting of an east-west row of 1 m × 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.

3.2.g Excavations, southern terrace slope and harbor area
Excavations, Southern terrace slope, WG 37, WG 38, WG 42
TRACY SPURRIER WITH THE COLLABORATION OF ILARIA INCORDINO AND GWENDALINE PLISSON

Excavation of the southern slope of the terrace into the wadi consisted of excavation units WG 37, WG 38 and WG 42. Eight squares were opened during the 2006-2007 field season along a N-S transect, 20 m long, beginning at the base of the slope and finishing to the south where the slope merges with the wadi surface in order to acquire information from the most extreme sides of the area in terms of elevation. The northern edge of WG 38 was approximately 140 cm higher than the southern edge of WG 37. This area had not been fully excavated in the past, although a few test trenches had been dug (one on the slope and one into the wadi). The purpose of these excavations was to determine the ancient use of this area.

The southern slope of the terrace into the wadi was thought to be the ancient harbor area. All trenches were excavated as deeply as possible. In every square, a deposit consistent with beach materials was reached. The composition matched the modern beach deposits found along the Red Sea Coast. In WG 37, beach rock and coral were reached and excavations could go no further. In WG 38, A1, 25 cm was excavated into the "beach" layer and then a geological auger continued for another 60 cm before encountering the water table and rock. In some of the squares, WG 38, A1 and B1, for example, we found Middle Kingdom pottery in the beach layer, suggesting that this was the level of the beach during that time period. In the upper layers of the trenches, much re-worked pottery, which had been moved around and worked by wind, water, and gravity over the years, was found. As the excavations continued farther south, the potsherds became larger. The geologists opened a number of trenches along the boundary between the slope of the terrace and wadi floor. In these trenches, many unworked, large pieces of storage jars were found. This suggests that these sherds had been quickly covered over where they fell by sediments, possibly by a flood, or the sherds rolled down the slope into the wadi when it was already filled with water. This area may have been a marine environment at that time, possibly an inlet of the sea or a lagoon. The sizes and types of shells and coral indicate that there was a much larger body of water present in the past.

There was evidence of much bioturbation throughout the entire WG 37, WG 38, and WG 42 area. In all of the trenches opened, in WG 37, WG 38, and WG 42, there were orange spots in at least one of the stratigraphic layers. These spots were found in deposits of damp, compact, brown/red medium fine sand. These spots were the residue from plant remains (probably decayed mangrove roots). In WG 37, A4, approximately 1 meter down, we discovered a very large live root belonging to a bush approximately 3-4 meters away. In the same pit, and in nearby geological pits, we found root encasings within the first meter of excavation. These root encasings had the same orange color as the spots. Also, in many of the trenches there were very thin roots present suggesting there had been a significant amount of recent plant activity and that the small shrubs scattered throughout the wadi have very large networks of roots. In the profile, rodent holes were also evident (Figure 72).

The presence of the large storage jars indicates that this possible harbor area may have been where the ancient Egyptians were loading and unloading the ships for their expeditions to Punt. They would have been carrying supplies such as beer and grains in these large jars all the way from the Nile Valley. In WG 38, A1 and B1 we found large animal bones (of donkeys?) on the beach layer. This would suggest that the Egyptians were using pack animals to carry the storage jars from the Nile Valley. The abundance of jars supports the idea that the ancient Egyptians were conducting very large-scale expeditions and needed to support all of the sailors and the people who stayed behind at the camp. It is worth mentioning that in WG 38, A4 (a few meters north of WG 37) a small anchor (21 cm × 15 cm × 7 cm) was found lying on the ancient beach (SU7, 1.90 m depth), consisting of a small pebbles and sand (Figure 73).

Excavations, Southern slope, WG 52

This excavation unit was located on the top of the slope along the southwestern wall of the fossil coral terrace at an indentation of the coral wall. A 8 m × 4 m unit was initially opened and was later reduced to a transect, 6 m × 4 m in area, in the center of the unit. On the surface many pieces of wood (cedar?); a large piece of linen cloth, sewn in the center; and a small rope or string were collected. Only the upper stratum of eolian sand, covering the coral terrace, which slopes down toward the wadi to the southeast (SU1), was excavated in this unit. Much wood was found in SU1, but very few potsherds. One small stone bowl was also found in SU1.

Next to the terrace wall was a thick, irregular deposit of salt, ca. +50 cm thick, which had to be hammered through, as there was a clear vertical cut in the wall above and beneath the salt deposit. Many stones of collapsed fossil coral from above were mixed with the salt deposit, but no artifact or potsherd was found in the windblown sand in between.

A small natural cavity was excavated to the south of WG 52, with evidence of sea grass and windblown sand. Two birds' nests were found in this deposit, and ancient rope fragments that the birds had brought there to use as material for their nests.

Excavations, Southern slope, WG 54

This excavation unit, 6 m × 4 m in area, was opened on the western side of the southern slope of the fossil coral terrace, immediately to the north of WG 45, moving into the "harbor area." Excavations were conducted in squares A2, A3, B2, B3, C2, C3.

The top layer of WG 54 consisted primarily of sand and debris deposited by wind from the top of the terrace and nearby areas. The composition of the layers was very similar, except for the salt layer in between SU1 and SU3, and it was difficult to distinguish sediment layers. Given that the salt layer was quite compact, it was decided to continue in only the eastern half of the unit in squares B2/B3. At approximately 1.0 m below the surface was the coral terrace. On the coral terrace surface there were 2 (possibly 3) hearths and one in the baulk profile in the northeast corner. A ceramic bowl with large pieces of charcoal encrusted to it by salt was found in SU3. Also in SU1 was a vitrified piece of a potsherd with some copper attached to it, but it had probably been deposited there later and was not found *in situ* with the hearths. Most of the potsherds excavated were salt encrusted.

A trench, 4 m × 6 m in area, corresponding to squares A1, A2, B1, B2, C1, C2, was opened in the northwestern sector of the unit, and excavation was conducted down to the bedrock. Three Stratigraphic Units were identified in this trench.

A stratum (SU1) was excavated, ca. 90-95 cm thick, with layers of coarse large grain, colluvial sand and thin layers of gravel and pebbles from wadi sediments, mixed with debris from the coral terrace. This stratum overlaid the coral terrace to the west and included some hearths associated with potsherds in WG 54, C1 and WG 54, C2. A hearth was recorded along the edge of B1-C1 and at the northwest corner of B1-C1. Finds included pieces of charcoal and wood, copper, potsherds, bone, and a unique burned potsherd with vitrification on part of it and some copper melted to it. Hearths associated with large potsherds (*in situ*) and wood were also found.

A crust of salt occurred at the base of SU1. A hearth associated with ceramics, pieces of wood and leaves occurred at the interface between SU1 and SU2, over the crust of salt. Two hearths, ca. 1.0 m in diameter, and pottery were also included in the crust of salt.

A stratum of dark brown windblown sand and debris from the coral terrace (SU2), ca. 1.0 m thick, was beneath the crust of salt, with evidence of hearths at the top (SU1/SU2 interface). Finds included much wood debris, charcoal, and a few potsherds beneath the upper layer with hearths. The bottom of a bowl with charcoal cemented to it by the salt was also found. Potsherds were collected beneath the layer with charcoal.

A stratum of compacted sand with a granular texture mixed with small pebbles and a great quantity of sea shells (SU3) was found at the bottom of the excavation. According to Alfredo Carannante, this stratum represents an ancient beach.

Evidence of a small hearth with many fragments of burnt wood, at the interface between SU2 and SU3, was excavated ca. 1.8-1.9 m beneath the present surface.

Excavations, Southern terrace slope, WG 74

Kathryn A. Bard

WG 74 was a 10 m × 5 m excavation unit investigated in 2010-2011 on the southern slope of the western coral terrace, where two (unfinished) limestone anchors are visible on the surface along with large fragments of storage jars. In 2003 A. M. Sayed told Rodolfo Fattovich that this was an important area to investigate.

WG 74 is located in a natural rock shelter, which forms an arch, overlooking the southern part of Wadi Gawasis. A mud-brick platform was constructed within this shelter, on the west side of the shelter (Figure 74). But as the excavations proceeded several huge pieces of collapsed coral terrace appeared, aligned in a straight line/fall. This terrace collapse occurred after the construction of the mud-brick platform, and probably destroyed part of this platform. As a result of this collapse, the rock shelter was abandoned in antiquity and there is no evidence of any cave structure being excavated here.

The WG 74 Stratigraphic Units were:

SU1: windblown sand and very thick deposits of salt that had to be hammered out.

SU2: mud-brick platform construction. The maximum height from the top of this construction to the top of the rock shelter roof was 132 cm.

SU3: deposit within the layer of mud-bricks.

SU4: sterile sand and thick salt deposits beneath the mud-bricks.

Ceramics on top of the mud-brick construction or just outside of it included: many sherds of large storage jars, plus sherds of smaller bowls, a beer jar, and a small whole drinking cup with a hole in it (so it was not used, according to Sally Wallace-Jones).

Artifacts within this same context included: a small limestone stela with no trace of an inscription (a blank, 19 cm × 14 cm at widest × 7 cm), and a basalt grinding stone (just within the rock shelter, on the east side).

Other finds on top of the mud-brick construction or just outside it included: a large bivalve shell (22 cm long) and some smaller shells, some animal bones, and charcoal.

In WG 74, SU3 more potsherds were found, including a black incised Middle Nubian potsherd, and a fragment of a copper strip (ca. 2 cm wide).

The maximum height of the rock shelter is ca. 132 cm from on top of the mud-brick platform to the ceiling of the shelter. Thus, the mud-brick platform was for storage and sitting: the area was too low for workers to stand up. This is also evident by the fact that the mud-brick platform does not continue back into the lowest part of the rock shelter, next to the terrace wall. The mud-brick platform extends for ca. 3.4 m E-W, and 1.4 m from the interior of the rock shelter to the area of rock collapse. Dimensions of two complete, whole mud-bricks are: 33 c × 15 cm × 9 cm, and 36 cm × 16 cm × 9.5 cm.

Excavations, Harbor area, WG 45/46/47/48/49/50, WG 51, WG 52, WG 54, WG 57

RODOLFO FATTOVICH WITH THE COLLABORATION OF TRACY SPURRIER AND ILARIA INCORDINO

In 2007-2008 excavations in the so-called "harbor area" provided firm evidence of the use of this area in the Middle Kingdom. Two main phases of use of this area in the 12th Dynasty were identified. In the earlier phase, part of the area was used as storage for large jars. In the later phase, most of the area was used as a camp with clear evidence of large hearths and many fish remains.

The following excavation units were delimited and partially excavated between the fossil coral terrace and the present bed of the wadi in the southwestern sector of Wadi Gawasis (the "Harbor Area"): WG 45/46/47/48/49/50; WG 51; WG 52; WG 54; WG 57.

Excavations, Harbor area, WG 45/46/47/48/49/50

These excavation units occupied an area of 600 sq. m. at the base of the coral terrace and included the geological test pits T8-A1 and T8-A2 from 2006-2007. The excavation was aimed at: 1) testing the hypothesis that the harbor was located in this area, and 2) identifying possible ancient shorelines (see Bard and Fattovich 2007: 77-90).

The surface in the investigated area sloped gently down from north to south, with a difference in level of about 0.9 m between the northern edge of WG 45/46/47 and the southern one of WG 48/49/50. Two trenches (Trench 1; Trench 2) were excavated within this area, where parts of the ancient seashore were brought to light (Figure 75). The following squares, 2 m × 2 m in area were investigated:

Trench 1: WG 45, E1 (with a northern extension WG 54, E5), WG 46, A1, A2, A3 (with a northern extension WG 57, A5), over an area of 24 sq. m.

Three Stratigraphic Units were distinguished in this trench. The upper stratum (SU1), ca 1.4 m thick, consisted of a crust of salt, ca. 10-15 cm thick, covering a deposit of thin layers of windblown sand alternating with thin layers of gravel from recent wadi activity, ca. 1.1 m thick. Finds included a few shells (1 *Lambis* sp., ca. 45 cm below the surface; 1 *Trinacria* sp., ca. 75 cm below the surface) and some potsherds, ca. 80-110 cm below the surface. At the bottom was another crust of salt, ca. 10-15 cm thick.

Below SU1 a stratum of dark compact wet sand (SU2), ca. 0.6 m thick, was recorded. Some hearths, the largest of which measured 20 cm in diameter, were found at a depth of 1.50 m from the surface in WG 54, E5 and WG 57, A5. Excavation in square WG 57, A5 was suspended at the level of the hearths (the top of SU2). In square WG 54, E5 some fish bones and shells, wooden sticks, charcoal, and a copper strip were associated with the hearths. At the bottom of SU2 small white algae (*Acetabularia*) were clearly visible on the sand, together with small shells and fish bones, suggesting a marine or brackish water environment.

At the bottom of the trench, ca. 1.8 m in depth, a layer of small pebbles and sand mixed with larger shells was found (SU3), suggesting an ancient seashore. At the depth of 1.9-2.20 m a very hard coral rock was found in squares WG 54, E5; WG 45, E1; and WG 46, A1.

<u>Trench 2</u>: WG 46, E1, C2, D2, E2, C3, D3, E3, C4, D4, E4, D5, E5; WG 47 A1, B1, A2, B2, A3, B3, A4, B4, A5, B5; WG 49, D1, E1, D2, E2, D3, E3, D4, E4, D5, E5; WG 50, A1, A2, A3, A4, A5, over an area of 148 sq. m. Squares WG 46, D3 and WG 50, A4 corresponded to the 2006-2007 geological test pits T8-A1 and T8-A2, respectively.

Five strata were recorded in this trench. The upper stratum (SU1) consisted of a light windblown sand alternating with thin layers of gravel from recent wadi activity, ca. 0.9-1.0 m thick. Most of SU1 was sterile, with a few (washed?) potsherds in the upper layers, ca 40 cm below the surface (WG 47, A2; WG 49, E1; WG 49, E2), 50 cm below the surface (WG 47, A2), 70 cm below the surface (WG 46 D4; WG 47 B1), 80 cm below the surface (WG 46, C3), and 90 cm below the surface (WG 46, C4; WG 47, A1). A greater quantity of pottery occurred at the base of SU1, just above the salt crust sealing SU2, ca. 1.0-1.1 m in depth (WG 46 A3; WG 46 C3; WG 47 A2; WG 49 E3; WG 50, A2). One Middle Nubian potsherd was found at the U1/SU2 Interface in WG 49, E2.

A number of hearths were found at the interface between SU1 and SU2 in WG 47, A1, A2, A3, B1, B2, B3, D4; WG 46, E1, E5; [WG 47, A3, B3: a large hearth/FP 1]. Many fish bones were associated with a hearth in WG 46, E1.

Below SU1, a stratum of dark compacted sand (SU2), ca. 60-70 cm deep, was found. This stratigraphic unit was covered at the top (SU1/SU2 interface) with a salt crust, ca. 15-20 cm thick, over the whole trench.[5] SU2 contained many ceramics, which had mostly accumulated at the interface between SU2 and SU3. An alignment of stones delimiting the concentration of pottery to the south was recorded at the SU2/SU3 interface in WG 47, A4, B4; WG 49, D3, E3; and WG 50, A3. Very few fragments of pottery were found to the south of this alignment in WG 49, D4, D5.

Below SU2 a stratum of dark compacted sand (SU3), ca. 40-50 cm deep, was recorded. No pottery was collected in SU3.

SU3 covered a stratum of red/brown sand with many red/orange streaks (SU4, ca. 70 cm deep), most likely the remains of ancient mangrove roots. This SU does not occur in WG 45, E1/WG 47, A1. One fragment of pottery associated with some shells was found in WG 47, A2.

Finally, a stratum of sand mixed with pebbles (SU5) from an ancient beach was found at the bottom of the sequence.

Excavations. Harbor area, WG 50

The excavation unit was delimited in 2007-2008. This trench, 10 m × 4 m in area, was excavated in 2009-2010 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:

<u>SU1</u>: 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.

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

<u>SU3</u>: dark red compact sand beneath the salt crust, with a few ceramics and a large, burnt ship timber at the base (Figure 76).

Excavations, Harbor area, WG 51

Excavation unit WG 51 was delimited at the mouth of a small wadi that drains from the fossil coral terrace into the Wadi Gawasis. Sediments from this small wadi had covered the whole "harbor area" in the southwestern sector of the site. The location of this EU was chosen to test the hypothesis

[5] The salt crust represents an infiltration of water, not an environmental event.

that a straight alignment of bushes perpendicular to the wadi indicated the remains of an ancient feature (possibly a small dam/wall). Excavations in this area, however, did not uncover the remains of any structure.

A transect, 8 m × 4 m in area, was initially excavated across the alignment of bushes, including squares C2, C3, C4, C5, D2, D3, D4, D5. The transect was later extended to the northwest with the addition of square B2.

At the top of the stratigraphic sequence a stratum of light windblown sand alternated with layers of pebbles and gravel from wadi sediments (SU1), ca. 80 cm thick, was recorded. Artifacts occurred mainly at the interface between SU1 and SU2. They included pottery, including some large potsherds and fragments of a large jar, in WG 51, C3, D4; one squared block of basalt and some small pieces of copper in WG 51, C2; and hearths in WG 51, C4, C5.

In WG 51, D3, SU1 covered a stratum of gravel mixed with sand (SU2), ca. 20-25 cm thick. Below it was a stratum of sand and gravel (SU3), ca. 30-40 cm thick, with a few washed potsherds. Finally, a stratum of dark brown, wet and compacted sand (SU4) with evidence of ceramics was recorded at the bottom.

Excavations, Harbor area, WG 63/66

Rodolfo Fattovich and Dixie Ledesma

Three excavation trenches (WG 63, WG 66, WG 50) were opened in 2009-2010 at the base of the southern slope of the coral terrace in the harbor beach ("harbor area") of Wadi Gawasis.

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 × 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. 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 were 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 mudbrick 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 × 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 × 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 77). 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.

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

3.2.h Excavations, production area, WG 19/25/26/27/44

S. Terry Childs and Cinzia Perlingieri

Excavations during the 2006-2007 field season at the production area were aimed at further investigating the types of crafts produced and practiced at the site. The many environmental factors affecting the preservation of the area and the frequent and repeated phases of intense use and abandonment in ancient times caused the structures to be covered and quickly filled with sand, potsherds, and debris. These environmental and human causes resulted in frequent mixing of the various activities that took place in the area and partial mixing of materials deposited in different phases. Fortunately, only the upper stratigraphic levels were heavily compromised; the lower levels were better preserved, which made the study of the area possible. Some evidence of new craft activities was added this field season.

An eastward extension of the excavation area (WG 44) was established at the beginning of this field season. It demonstrated, as was already suspected by the lack of surface findings, that production activities involving fire structures did not extend there. However, evidence of interesting new activities was found. In particular, a concentration of barnacles (several hundred were collected) was found on a sandy living surface (SU106 at 70 cm deep) with few potsherds in the northwestern corner of WG 44. Some of the barnacles had impressions of wood fibers on the back (preliminarily identified by Rainer Gerisch as conifer), while others apparently showed traces of being cut. This evidence seems to demonstrate that maintenance activities of the boats were carried out in this area. Another concentration of barnacles began to appear along the north wall of WG 26 in square D4 on the living surface of SU104.

A large collection of lithic artifacts was found (studied by Giulio Lucarini). The lithic assemblage from the production area is characterized by the presence of many opportunistically made tools (*e.g.*, rough scrapers), together with some more accurately retouched items.

One remarkable find of this season was a complete pot found in a possible fire-pit (SU105) in WG 26 (Figure 78). This feature, approximately 65 cm in diameter at its top, was a concentration of very underfired platter pieces. The complete, red slipped conical-based bottle, approximately 20 cm long, was found on the west side of this concentration. Also, in the general area of WG 26, there were significant amounts of bones and shells found around several fire-pits, suggesting food preparation.

The five phases of occupation, already reconstructed during the 2005-2006 field season, were confirmed this field season. The pottery evidence from all units points to a massive occupation during the second half of the Middle Kingdom, with some evidence of the early Middle Kingdom. The general surface in the whole area investigated was characterized by loose sand with scattered concentrations of wind eroded materials. Phase 1, the latest phase of occupation, is characterized by scattered small fire-pits with a few potsherds. Phase 2 is represented by medium sized fire-pits, and occasional dumps associated with animal bones. Phase 3 and Phase 4 have been distinguished by the presence of medium-sized circular fire-pits associated with living floors and well marked, zoned activity areas with dumps of bread molds and other potsherds. Similarly, Phase 5 is also characterized by well marked, zoned activity areas (the living surface WG 44, SU106).

The evidence suggests that this area was devoted to basic subsistence activities associated with an entire period of a seafaring expedition. These activities included making various objects of clay, food production, minor tool repair or manufacture, gypsum plaster production, and other activities for the camp. The evidence for pottery manufacture used in bread making and brewing beer is particularly compelling, along with the presence of barley and emmer wheat in the area. The presence of wasters and fragments of unfired vessels indicates that pottery was produced at the site on a small scale. Types produced were simple, deep bowls, platters, bread molds, and probably large-size jars, all used to prepare food and drink. No important or prestige products were produced or worked in this area. The "extemporary" character of the production activities also seems to be confirmed by the total absence of elite products and any evidence of goods that could be linked to the expedition cargos.

Editor's note: Although clay was used in the production area, possibly making some limited types of objects, especially associated with bread production, pottery subsequently excavated at the harbor site and identified by Sally Wallace-Jones (2007-2008 to 2010-2011) was imported to the site from the Nile Valley. Imported ceramics include wares for eating and drinking, large storage jars, and water and beer jars. It is also likely that bread molds were imported from the Nile Valley (see 4.1.h Bread molds and platters).

3.2.i Excavations, mud brick structures, WG 70/72/73/76

RODOLFO FATTOVICH AND MARIA IMBRENDA

Excavation units WG 70, WG 72, WG 73 and WG 76 were opened in the 2010-2011 field season at the base and on the lower western slope of the coral terrace at WadiGawasis to the north of Cave 8, between the shore of the paleo-lagoon and the terrace.

Excavation unit WG 70, 10 m × 10 m in area, was an extension of the test excavation in WG 70, A1-A2, B1-B2, excavated in 2009-2010. Twenty-one squares, each 2 m × 2 m in area, were excavated to the sterile basal sand: A3, A4, A5; B3, B4, B5; C1, C2, C3, C4, C5; D1, D2, D3, D4, D5; E1, E2, E3, E4, E5.

Excavation unit WG 72 was an extension, 2 m × 10 m in area, immediately to the east of WG 70. Five squares, each 2 m × 2 m in area, were opened: A1, A2, A3, A4, A5.

Excavation unit WG 73 was delimited immediately to the north of WG 70. Ten squares, each 2 m × 2 m in area, were opened: A4, A5; B4, B5; C4, C5; D4, D5; E4, E5.

Excavation unit WG 76 was delimited immediately to the south of WG 72. Six squares, each 2 m × 2 m in area, were opened: A1, A2, A3; B1, B2, B3.

On the whole, an area of 168 sq. m was investigated in the 2010-2011 field season with about 2 m rise from the west on the side of the paleo-lagoon to east on the slope.

The following SUs have been distinguished during the excavation:

<u>WG 70, C1, SU1</u>: superficial stratum of very compact windblown sand, practically sterile. Only one fragment of copper and traces of a fire.

WG 70, C1, SU2: stratum of very compact sand (mud?), about 5 cm thick, over mud-bricks at the top of Feature 1 (F1: mud-brick structure excavated in 2009-2010).

WG 70, D1, SU1: superficial stratum of windblown sand, about 0.3 m thick, with a salt crust covering a possibly rounded mud-brick structure.

WG 70, D1, SU2: windblown sand covering the top of a few coral rocks to the north of F1. The coral rocks were at the same level as the top of F1.

WG 70, E1, SU1: superficial stratum of windblown sand, about 0.4 m thick, with evidence of a fire-pit and possibly mud-bricks. One timber (T98) was close to the western edge of the square, about 0.4 m deep.

WG 70, C2, SU1: superficial stratum of windblown sand with evidence of fire at the base.

WG 70, D2, SU1: superficial stratum of windblown sand with evidence of a mud-brick wall along a NE-SW axis (F3).

WG 70, E2, SU1: superficial stratum of compact windblown sand, about 0.2 m thick, with disturbed evidence of the mud-brick wall (F3). At the base of the SU there was evidence of a very compact stratum of mud.

WG 70, E2, SU2: very compact stratum of mud sloping down to the southwest.

WG 70, A3/B3/C3, SU1: superficial stratum of windblown sand over some coral rocks.

WG 70, B3, SU3: stratum with evidence of occupation and use (fire) associated with the mud-brick feature (F1).

WG 70, C3, SU2: stratum of mud, about 5-7 cm thick, over a thin stratum of sand covering a possible "platform" of coral rocks.

WG 70, C3, SU3: stratum of soft windblown sand with some evidence of use at the top. One fragment of limestone (an anchor?) at the interface SU2/SU3.Evidence of a huge concentration of charcoal covering a possible "platform" of coral rocks and a mud-brick wall (F1).

WG 70, D3/E3, SU1: superficial windblown sand containing 1 copper strip.

WG 70, D3/E3, SU2: thin stratum of mud covering SU3.

WG 70, D3/E3, SU3: occupation level with evidence of fire.

WG 70, A4, SU1: superficial stratum of compact windblown sand.

<u>WG 70, B4, SU1</u>: superficial stratum of windblown sand covering a possible mud-brick feature.

<u>WG 70, D4, SU1</u>: superficial stratum of windblown sand, containing very small fragments of copper, covering a possible mud-brick feature.

<u>WG 70, C4, SU2</u>: stratum of mud.

<u>WG 70, A5/B5, SU1</u>: superficial stratum of compact windblown sand, about 5-7 cm thick, covering coral rocks and a salt crust.

<u>WG 70, A4/A5 – B4/B5, SU3</u>: stratum of fire associated with a mud-brick feature (F4) extending into C3 and C5.

<u>WG 70, C5, SU1</u>: superficial stratum of windblown sand with evidence of a wall with two rows of mud-bricks at the base.

<u>WG 70, D4/D5 – E4/E5, SU1</u>: superficial stratum of windblown sand.

<u>WG 70, D4, SU2</u>: stratum of mud.

<u>WG 70, D3/D4 SU3</u>: stratum with evidence of fire-pits beneath SU2.

<u>WG 70, D3/D4, SU4</u>: stratum of sterile sand beneath SU3.

<u>WG 70, D4/D5 – E4/E5, SU3</u>: huge concentration of charcoal and wood debris beneath SU2, corresponding to a hearth extending into D3; the hearth was in a stratum of sand, about 0.4 m thick, which covered a mud-brick wall to the southwest.

<u>WG 72, A1-A2, SU1</u>: superficial stratum of windblown sand covering some collapsed coral rocks from the terrace wall and a timber (T105), most likely associated with another timber (T100/104) in WG 70, E1.

<u>WG 72, A3, SU1</u>: superficial stratum of windblown soil covering a very badly preserved mud-brick wall (F3) with evidence of fire.

<u>WG 72, A3, SU2</u>: stratum of mud mixed with potsherds and fragments of wood along the mud-brick wall (F3).

<u>WG 72, A4/A5, SU1</u>: superficial stratum of windblown sand.

<u>WG 72, A4/A5, SU2</u>: stratum of mud with evidence of fire.

<u>WG 72, A4/A5, SU3</u>: stratum of sand with a concentration of bread molds and mud-bricks. Evidence of a ceramic plate with many fragments of bread molds on the top (F5).

<u>WG 73, A5/B5, SU1</u>: superficial stratum of windblown sand with evidence of mud-bricks and fire at the base.

<u>WG 73, A4/A5 – B4/B5, SU2/SU3</u>: evidence of a mud-brick feature which continued into WG 70, A/B/C1: with a stratum of mud (SU2) sloping down to the southwest toward the paleo-lagoon.

WG 73, C4, SU1: superficial stratum of windblown sand, about 0.1-0.2 m thick, mixed with potsherds.

WG 73, C4, SU2: stratum of compact mud with evidence of fire at the top.

WG 73, C5, SU1: superficial stratum of windblown sand, about 0.1-0.2 m thick, mixed with potsherds.

WG 73, C5, SU2: stratum of mud mixed with some charcoal, laid over a stratum of sand (SU3) directly covering F1 in WG 70, C1.

WG 73, C5, SU3: stratum of sand with charcoal and two possible wood posts, mixed with a small fragment of wood, burnt potsherds and 1 fragment of a bread mold, covering a large burned area with ash and charcoal stretching into WG 70, C1.

WG 73, C5, SU4: burned area at the base of SU3, perhaps a burnt mat, and a thin stratum of burnt vegetal material. A combusted feature, maybe a small hearth, about 0.4 m in diameter, associated with fragments of bread molds overlapping SU4 in the southwestern corner of C5.

WG 73, D4-E4, SU1: superficial stratum of windblown sand with evidence of a mud-brick wall (F3) and a stratum of mud beneath it. One fragment of a copper strip from the mud stratum.

WG 73, D5, SU1: superficial stratum of windblown sand.

WG 76, A1/A2/A3, SU1: superficial stratum of windblown sand.

WG 76, A1, SU2: stratum of mud associated with a mud-brick wall (F7) with a northeast-southwest axis and a thin mangrove post.

WG 76, A2, SU3: stratum with evidence of hearths and ceramics.

WG 76, A3, SU3: stratum with an alignment of two thin posts.

WG 76, B1/B2/B3, SU1: superficial stratum of windblown sand.

WG 76, A1/A2/A3 – B1/B2/B3, SU3: evidence of another mud-brick feature (F8), apparently parallel to F7.

At WG 70/72/73/76 four mud-brick features (F1, F3, F4, F7) were recorded. These features were associated with a great quantity of wood debris and hearths, suggesting that carpentry activity was practiced in this area (Figure 79).

F1, F3, F4 and F7 had a similar structure that consisted of mud-brick walls, apparently no more than 0.3 m in height, forming a corner at the end. The walls were oriented along a NW-SE axis and were aligned approximately parallel to the edge of the paleo-lagoon. They were 6 m (F1), 8 m (F3), 4 m (F4) and ~6 m (F7) long. F1 and F3 were built with mud-bricks approximately 15-18 cm wide. F4 and F7 were built with mud-bricks approximately 27 cm wide (Figure 80).

F1, F3 and F7 had evidence of an alignment of thin mangrove poles along the external side of the wall, and delimited areas covered with a stratum of mud, about 5-7 cm thick, sloping down to the shore of the paleo-lagoon. These areas were associated with copper strips and wood debris, suggesting they might have been used to disassemble ships. F1 was located at the base of the slope near the shore of the paleo-lagoon. F3 and F7 were on the slope of the terrace.

F4 consisted of a possible threshold with perpendicular walls, in WG 70, B5 at the edge of the excavation unit. The evidence suggested that this may be part of a mud-brick building close to the shore of the paleo-lagoon.

The chronological sequence of these features is uncertain. On the basis of the size of the mud-bricks, F1 might be contemporary with F3, and F4 with F7.

A small "platform" of coral rocks (F2), about 2 m × 2 m in area and 0.4 m high, was built at the base of the slope between F1 and F4 (Figure 81). This feature might be earlier than F1 as the mud-brick wall of this structure abutted the rocks of the "platform."

A great number of hearths (*e.g.*, F6) and a ceramic plate with many fragments of bread molds at the top (F5) was found beneath the stratum of mud (SU2) (Figure 82). This evidence suggests that the whole area was initially used for specific activities including bread making and carpentry.

The following stratigraphic sequence in the area was outlined:

1) F4 was built directly on the sand of the ancient shore of the lagoon.
2) F2 cut the stratum of sand that F4 was built on, at the base of SU3 with the hearths.
3) F1 was erected on a higher level of the slope, over some hearths, which were excavated in the 2009-2010 field season (see 3.2.c Excavations, western terrace slope, base) and most likely were associated with F4.
4) Hearths were located on the top of the sterile sand forming the slope to the east of F1 and F4 (SU3).
5) The hearths in SU3 were covered with a thin stratum of mud (SU2) associated with F3.
6) F3 was erected at a higher level on the slope on a lower stratum of mud-bricks overlapping the same original stratum of white

sand forming the ancient slope, which also occured beneath F4 and F1.

7) F5 (ceramic plate with bread mold fragments) was associated with the hearths in SU3 beneath F3.
8) F7 and F8 are similar in construction as they are characterized by the occurrence of a pole of unknown function at the northern corner.

3.2.j Geoarchaeology

TRINA ARPIN

Geoarchaeological work was conducted in the 2006-2007 field season and focused on the excavation of two test trenches (WG 41 and WG 43) in the lower slopes below Caves 2-6. These trenches were excavated to explore the nature and depth of the sedimentary deposits and archaeological remains on the lower slopes and to investigate the formation of the slope. Both units were located downslope from WG 17, the unit where two oven-like features were found. Profile drawings and sedimentary descriptions were made of both trenches. All color descriptions were made using a Munsell chart on dry sediments. Below are descriptions of the deposits found in each unit, followed by an interpretation.

Geoarchaeology, WG 41

This was a 1 m × 5 m trench placed to expose a band of reddened sand visible on the surface. The trench was excavated to a depth of 1.5 m before it was deemed too unsafe to continue. The excavation exposed a zone ca. 0.5 m deep that contained layers 1-3, all composed of varying shades of reddened sand (Figures 83 and 84, Table 5). These layers contained both fragments of charcoal (from a few millimeters to a few centimeters in diameter) and varying amounts of very finely ground charcoal. Sporadic patches of halite were found in Layer 3. Potsherds (all typical Middle Kingdom wares found elsewhere in the site) were also found throughout, but no *in situ* features were found in these layers.

The layers 4-7 were strikingly different in color and content. The reddened color ended abruptly and potsherds were much rarer (those that were found were again typical of Middle Kingdom). Layer 4 consisted of a layer of very fine sand; charcoal and pottery were more concentrated in the upper portion of the layer. Layer 5 was first exposed in the northern end of the unit where it appeared as a very dense layer (25 cm thick) of well-rounded cobbles.

Layer 1a	Silt fine sand, common very well rounded gravel cobbles, occasional very well rounded granule size coral fragments, occasional pottery. Color: 10YR 5/6 (yellowish brown).
Layer 1b	Silt fine sand, occasional well-rounded granules. Occasional pottery. No visible charcoal, but sediments have an organic feel and appearance. Color: 7.5YR 4/6 (strong brown).
Layer 1c	Fine sand, rare well-rounded granules. More mica than in 1a and b. 5YR 5/8 (yellowish red).
Layer 2a	Silt fine sand, Common to abundant well-rounded pebbles cobbles. Occasional pottery (often well worn). Occasional laminae of redder sand or darker-brown silty sand at southern end. Color: 7.5 YR 4/6 9strong brown) 7.5 YR 3/4 (dark brown) grades to 5 YR 4/4 (reddish brown).
Layer 2b	Fine sand, occasional well-rounded pebbles, rare cobbles. Rare pottery. Color: 2.5 YR 4/8 (red).
Layer 2c	Fine sand, common well-rounded pebbles, occasional cobbles. Occasional pottery and centimeter-sized charcoal. Color: 5YR 5/8 (yellowish red).
Layer 3a	Silt Fine sand with occasional pebbles cobbles, abundant laminations of dark (charcoal-rich) and yellowish fine sand. Laminations slope down to north (at 10 15%).
Layer 3b	Very similar to 3a but laminations are generally parallel.
Layer 4	Fine sand, rare well rounded cobbles. Occasional charcoal fragments and pottery in the upper portion. Color: 10YR 7/4 (very pale brown).
Layer 5	Layer of well-rounded cobbles (including loosely consolidated fine sandstone, flint, and metamorphic rocks) and coarse sand. Deposit is grain supported. Upper surface of layer was covered with halite at northern end. Cobbles extended as dense layer across northern half of trench but became more sporadic and pinched out in southern half.
Layer 6	Medium to coarse sand, rare small, rounded shell fragments and cm-sized charcoal. Fining upward bedding visible. Color: 10YR 8/4 (very pale brown).
Layer 7	Fine sand. Rare pottery. Two hearths were found at top of this layer. Color: 10YR 7/4 (very pale brown).

Table 5. *Description of layers from WG 41.*

At the northern end of the trench the upper surfaces of the cobbles at top of the layer were covered with halite crystals (although the halite did not form a thick, consolidated layer). The layer sloped down and thinned to the south; in the southern end of the unit it appeared as occasional cobbles rather than a continuous layer.

Layer 6 was noticeably different from both the layers above it and from most of the deposits found on the site. The layer consisted of a very loose deposit of medium to coarse sand (most deposits were diner) and rare, sand-sized shell fragments. Centimeter-thick fining upward sequences were visible throughout the layer. Potsherds were rare, but occasional centimeter-sized charcoal fragments were found throughout the deposit. These were identified as *Acacia nilotica* and *Cedrus libani*. The layer was so loose that it continued to erode out of the profile walls, destabilizing them. Eventually, continued excavation was deemed unsafe.

A few centimeters of Layer 7 were excavated before the unit was closed. This layer consisted of fine sand. Potsherds were again very rare, but the only two *in situ* features found in the unit came from this layer. Two superimposed hearths were found at 3.1 and 2.9 m from the northern end. The upper hearth (Hearth 1; Figure 85) was in a shallow pit lined with large potsherds. A piece of folded copper (approximately 0.5 cm wide and 3.5 cm long) was found in the charcoal-rich interior of the hearth. Charcoal samples from the hearth were identified as *Acacia nilotica* and *Cedrus libani*. The lower hearth (Hearth 2) consisted of charcoal and sediments within a shallow pit but without and pottery fragments. Charcoal from this hearth was also identified as *Acacia nilotica* and *Cedrus libani*.

Geoarchaeology, WG 43

A second test trench measuring 1 × 2 m was excavated 2 m north (upslope) of test unit WG 41 (Figure 86, Table 6). This unit was placed to test for the continuation of the cobble layer found in WG 41. The deposits on the surface at the southern end of this unit were slightly reddened and upon removal of 3-5 cm of surface deposits the reddened sand deposit (Layer 10) could be seen across the unit. The lower portion of the unit was heavily consolidated with halite.

Layer 11 was composed of fine to medium sand with occasional pebbles and pottery sherds. A thick band of very hard halite cut through

Layer 8	Poorly sorted granule small (well-rounded) cobbles, less than 50% matrix (silt fine sand). Rare pottery sherds. Color: 10YR 7/4 (very pale brown).
Layer 9	Fine sand, looks slightly enriched in charcoal. Color: 10YR 5/4 (yellowish brown).
Layer 10	Fine sand, occasional granules. Lower portion was loosely consolidated with halite. Color: 5YR 5/8 (yellowish red).
Layer 11	Silt medium sand, abundant well-rounded granules small pebbles, including cm-sized orange and grey, loosely consolidated sandstone. Color: 10YR 7/4 (very pale brown).
Layer 12	Poorly sorted layer of well rounded cobbles pebbles (some stones have sandy matrix adhering to them, the loosely consolidated sandstone cobbles found in other layers are very rare.). Layer of halite cut across northern half of layer. Fines are less than 50%, silt fine sand. Color: 10YR 6/6 (brownish yellow).
Layer 13	Silt very fine sand, rare pebbles gravel inclusions (but not loosely consolidated sandstone). Color: 10YR 6/6 (light yellowish brown).
Layer 14	Cobble pebble fining upward sequence, 50% fines (silt very fine sand). Cobbles at base include flint and metamorphic rocks, transitions rapidly to very loosely consolidated very fine sandstone with mottles of orange and grey. Very gradual transition to layer 6. Matrix color: 10YR 6/4 (light yellowish brown).
Layer 15	Medium coarse sand, rare sand-sized shell fragments. Fining upward bedding visible. Color: 10YR 8/6 (yellow).

Table 6. *Description of layers from WG 43.*

this layer, making excavation extremely difficult. Layer 12 was a thick layer of well rounded cobbles, very similar to the layer found in WG 41. The rock types included both metamorphic types and flint nodules. Some had a hard sandy matrix (remains of the original matrix from the parent material) adhering to them. On the north end of the unit the band of halite continued across the upper portion of this layer. The layer had a maximum thickness of 25 cm. The cobbles were a mixture of metamorphic rock, flint, and loosely consolidated sandstone that were often mottled orange or grey. The layer sloped dramatically to the south of the unit.

The underlying Layer 13 was a thick layer of silt and very fine sand. This unit, which also sloped down to the south, did not appear in WG 41. The unit transitioned very gradually into Layer 14. This layer contained a high percentage of cobbles but had a much higher percentage of fines (50%) than Layer 12. Rock types included metamorphic, flint, and a loosely consolidated sandstone (similar to the pebbles found in Layer 11). Many of the sandstone cobbles had mottles of orange and grey. Below this layer was Layer 15, a medium to coarse sand with rare, sand sized shell fragments and fining upward bedding layers. As in WG 41, this layer easily eroded out of the profile walls, destabilizing them and excavation had to be discontinued.

Geoarchaeology, interpretation, WG 41 and WG 43

The layers uncovered in WG 41 and WG 43 have revealed much about the formation of the lower slopes. The cause of the reddened sand layers found at the surface of both units remain unclear, but their apparent appearance only in this area of the site indicates that they are the result of an anthropogenic process. Thin bands of reddened sand have been found at the base of hearths in WG 19/26 and red sand was found surrounding the ovens found in WG 17, so it seems possible that the red sand found in WG 41 and 43 are the result of heating. Given the lack of *in situ* features in these units it appeared that the sediments were not altered *in situ*. The heating may have occurred in the ovens found in WG 17 or there may have been similar installations elsewhere on the slope. It is not clear why this sand was removed from where it was heated and then redeposited here. The laminated sediments found in 3a were likely water lain, the limited scope of these layers again indicates that they were formed by anthropogenic activity.

The cobble layers found in both WG 41 (Layer 5) and WG 43 (Layer 12) could have been natural or the anthropogenic, but the sandy matrix still adhering to some of the cobbles in WG 43 is very similar to the matrix of the caves and the cobbles may have originated from in or around the caves. The sorting visible in Layer 14 indicates that it may be a natural deposit, although these cobbles may also have originated around the caves.

The medium to coarse sand layer found in both units is coarser than most units found at the site and is much too coarse to have been windblown. It could have been deposited either by flowing water or it could be part of a relict beach deposit, but the limited exposure of the unit makes it difficult to interpret.

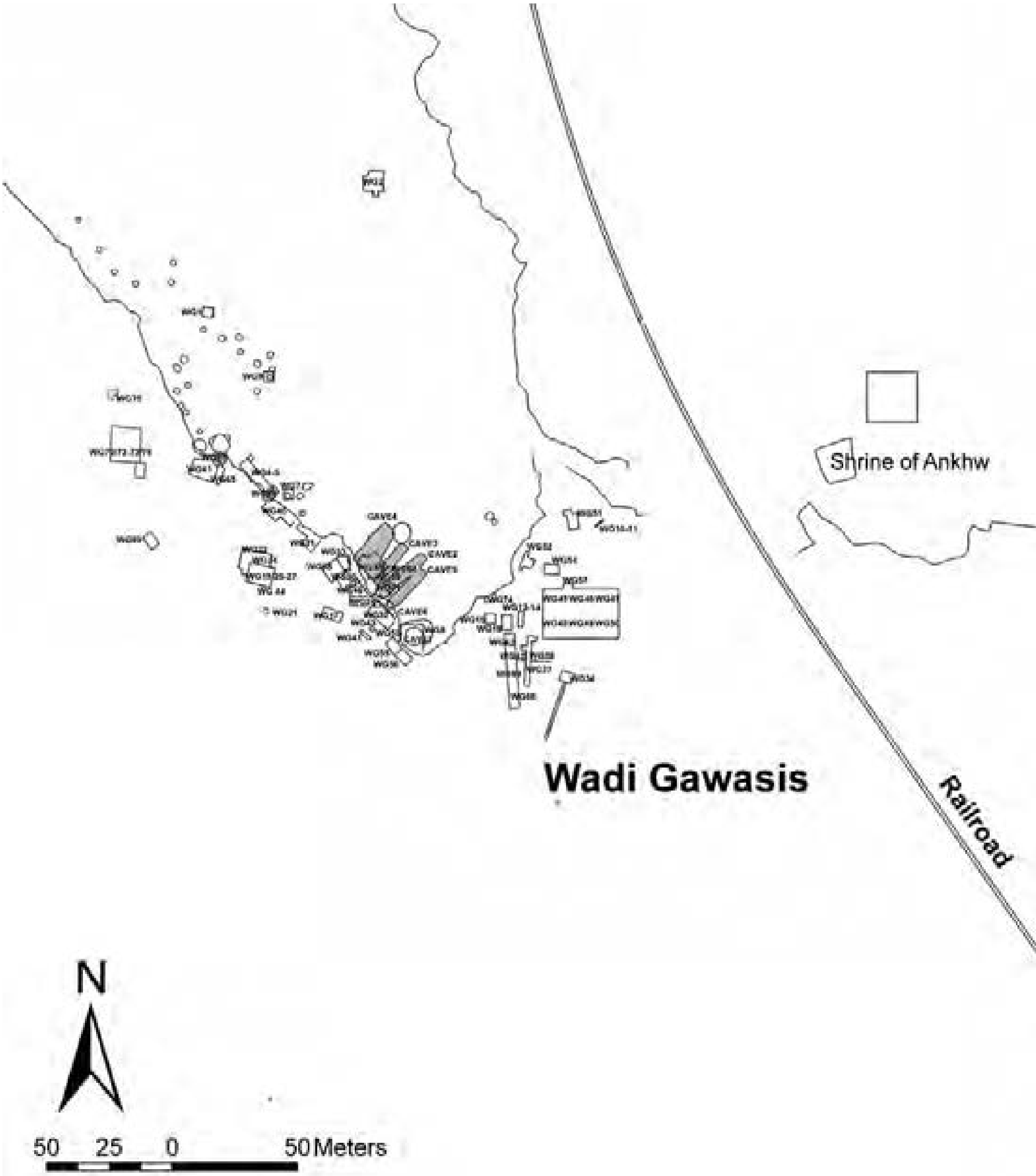

Shrine of Ankhw
Wadi Gawasis
Railroad
N
50 25 0 50 Meters

Figure 30. *Plan of excavation units at Mersa/Wadi Gawasis.*

Figure 33. *WG 58-59, Feature 10, general view from east after excavation.*

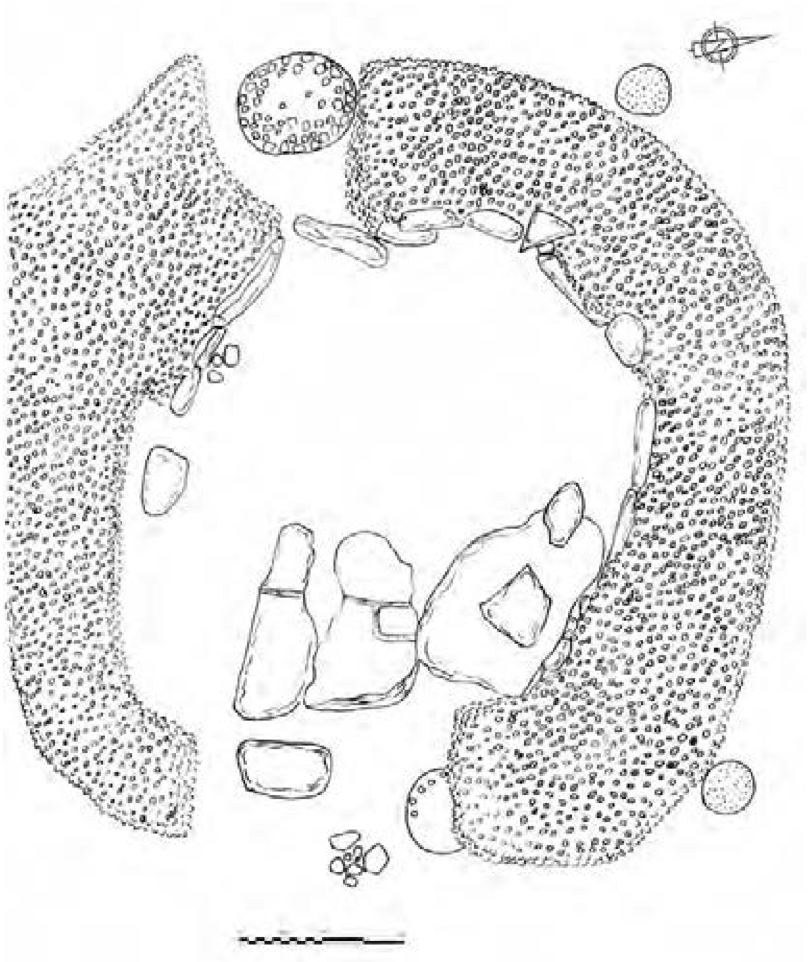


Figure 34. *WG 58-59, Feature 10, general map.*

Figure 35. *Engraved panel including a possible cartouche on the smooth surface of the upper part of the southern slab within a panel, ca. 0.5 m x 0.4 m in size, framed with a groove. Other signs, including a long horizontal zig-zag, were engraved to both sides of the panel.*

Figure 36. *Concentration of limestone chunks SU6, in squares WG 58, A5-B5, beneath structure SU2 and above coral terrace SU3.*

Figure 37. *Disarticulated and badly disturbed skeleton in burial at the bottom of pit SU4.*

Figure 38. *WG 60, Feature 7, general view from West after excavation.*

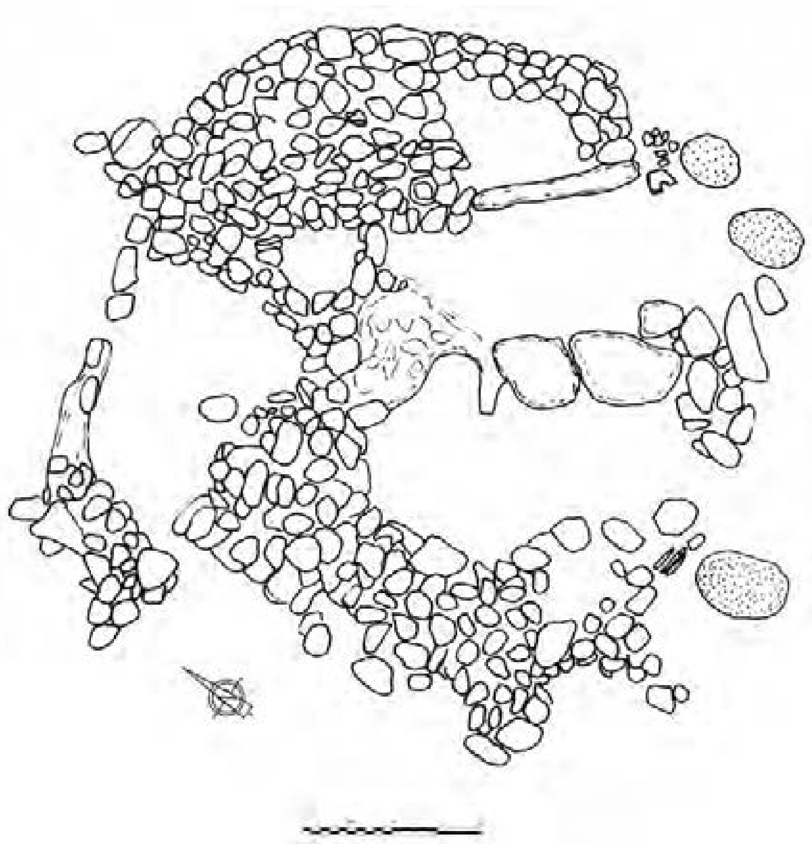


Figure 39. *WG 60, Feature 7, general map.*

Figure 40. *WG 60, Feature 7, fragment of the top of limestone anchor A28 on top of SU19.*

Figure 41. *Ongoing excavation of the concentration of wood boxes at WG 32.*

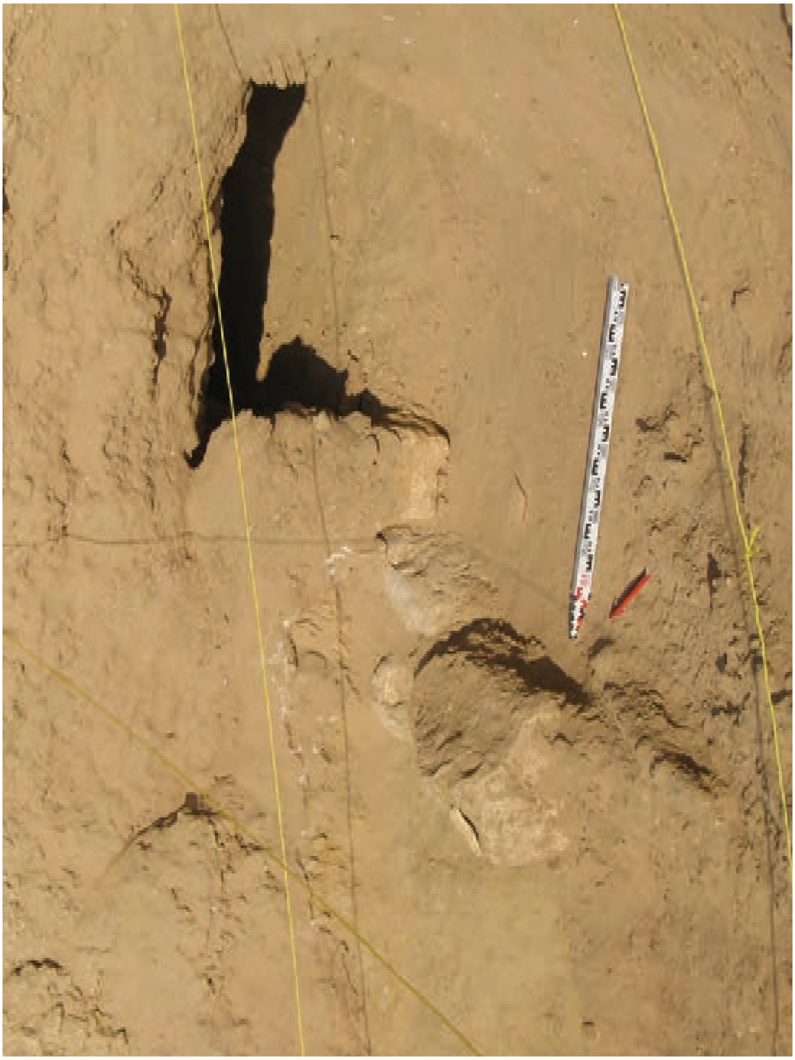


Figure 42. *The entrance of Cave 6 in WG 32/53 before the excavation of salt concretion SU38.*

Figure 43. *The small niche ca. 2 m east of the two large stela niches.*

Figure 44. *Unfinished limestone anchor and a limestone stela lying face downward in the sand associated with the niches.*

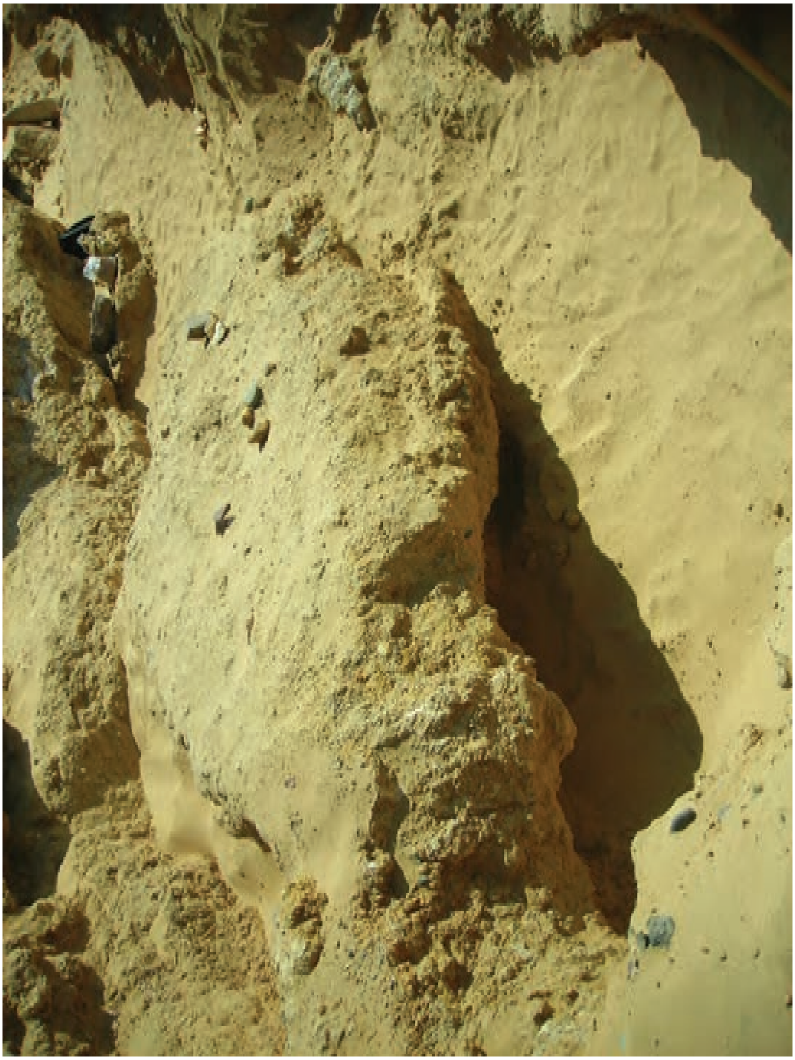


Figure 45. *WG 33, huge coral rock on the western side of the excavation unit.*

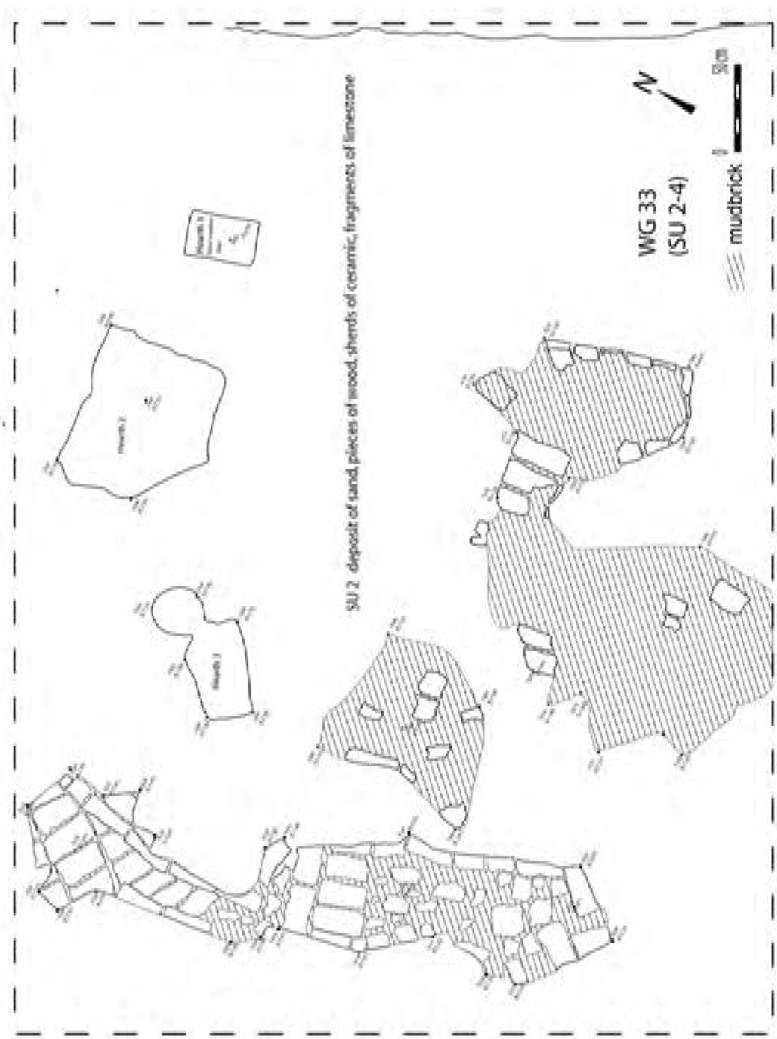


Figure 46. *WG 33, remains of a mud-brick platform and three hearths.*

Figure 47. *WG 55, the entrance of Cave 7 after its partial clearing, with timber T57.*

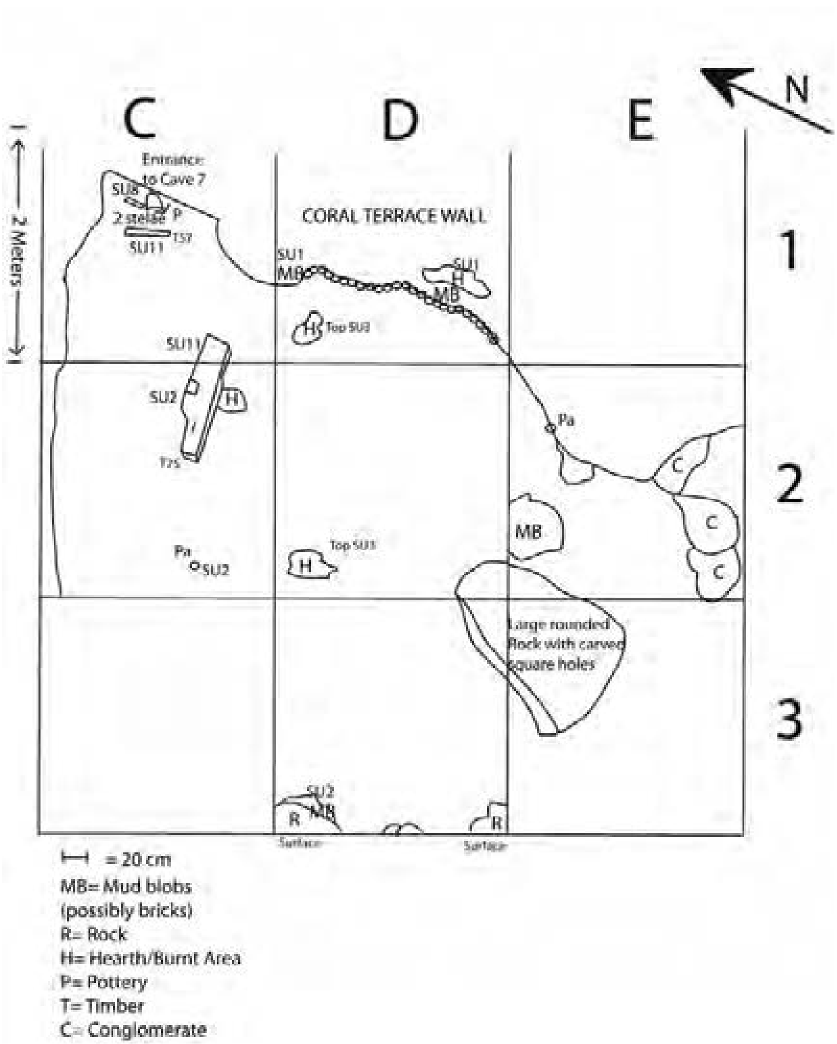


Figure 48. *WG 55, general map showing the main features and finds outside the entrance of Cave 7.*

Figure 49. *WG 55-56, the "alcove shrine", a structure composed of four boulders, associated with an opening carved into the wall terrace, and with a large curved wall cut into a natural stratum of cobbles.*

Figure 50. *WG 55-56, map of the area around the "alcove shrine".*

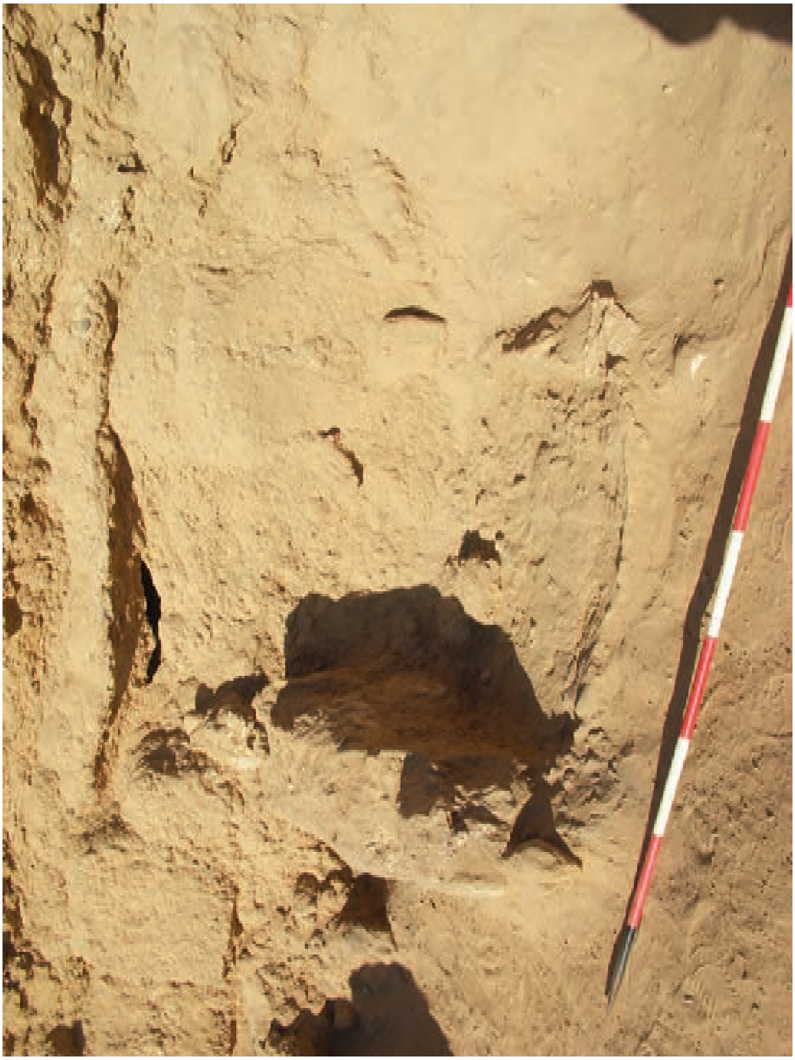


Figure 51. *WG 61/65, entrance of Cave 8 before excavation of the opening.*

Figure 52. *WG 61/65, general view of the mud-brick structures outside Cave 8.*

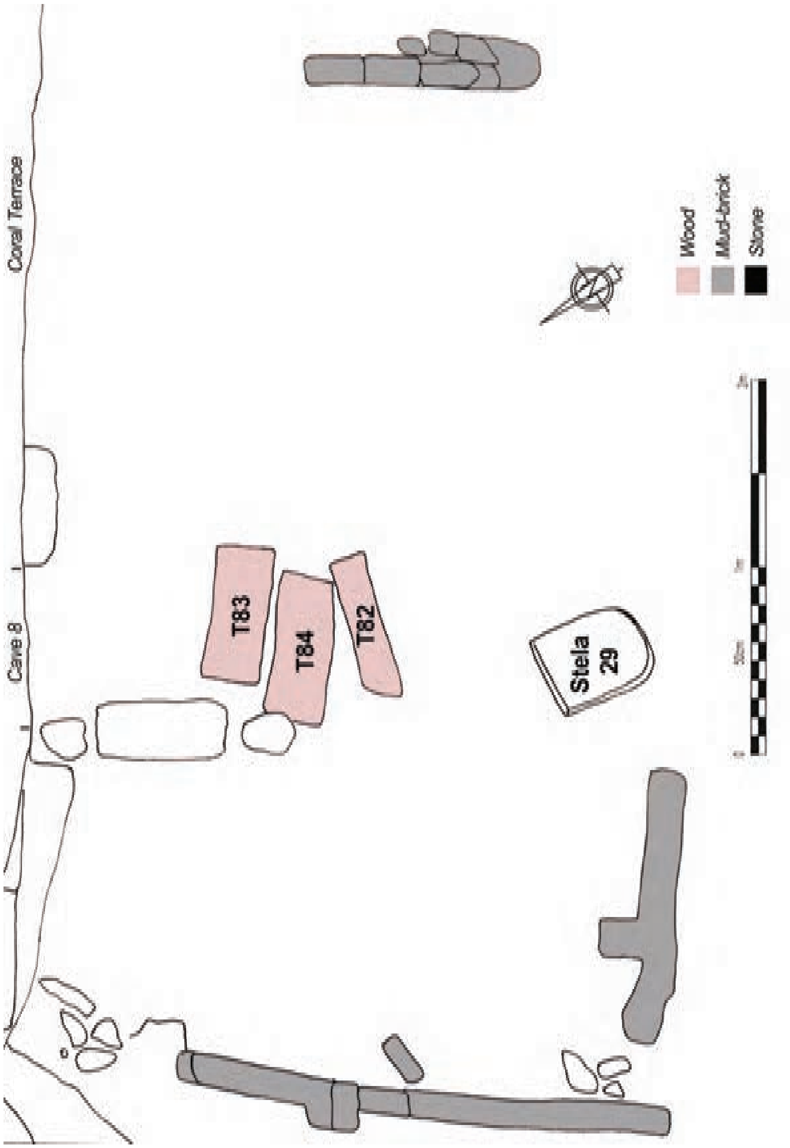


Figure 53. *WG 61/65, map of the mud-brick structures.*

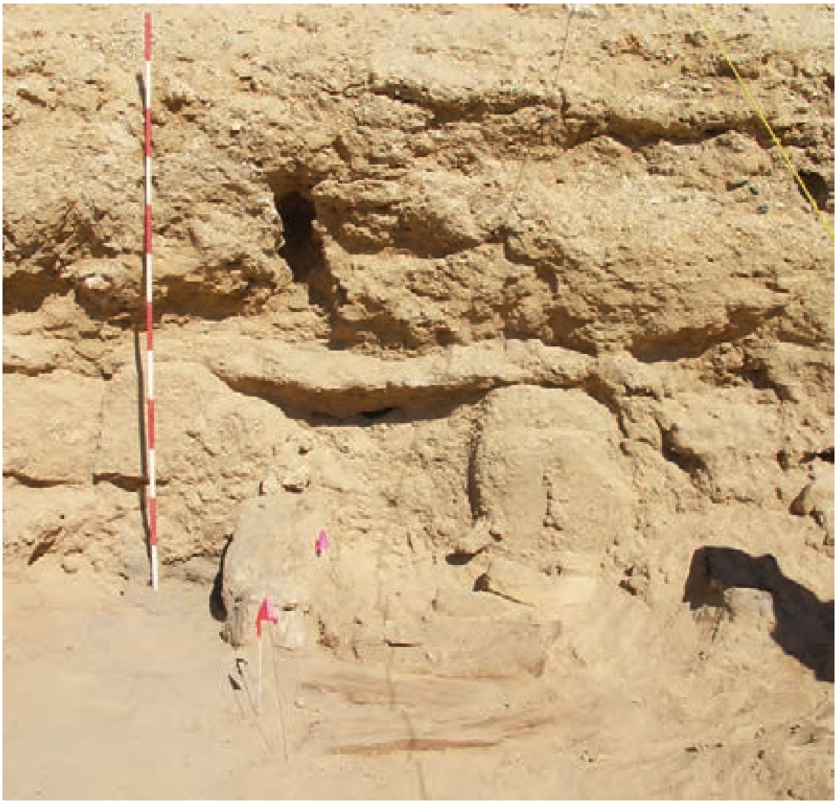


Figure 54. *WG 61/65, timbers T82, T83 and T84 paving the access to Cave 8.*

Figure 55. *WG 61/65, Fire-pit with the remains of thousands of burnt barley seeds.*

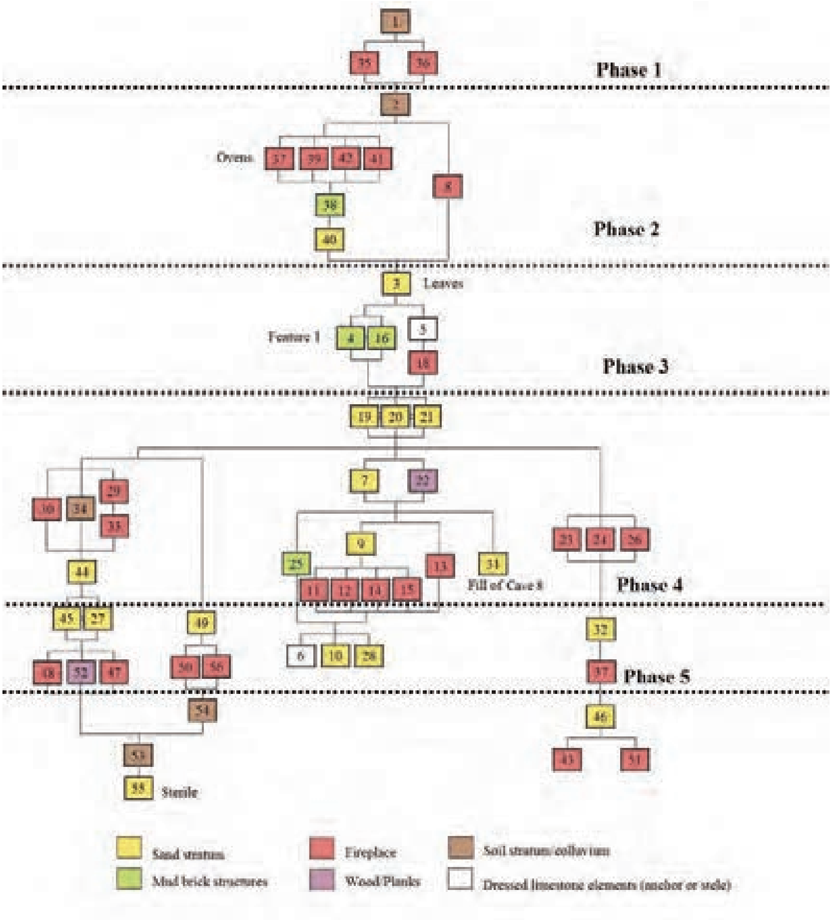


Figure 56. *WG 61/65, stratigraphic matrix.*

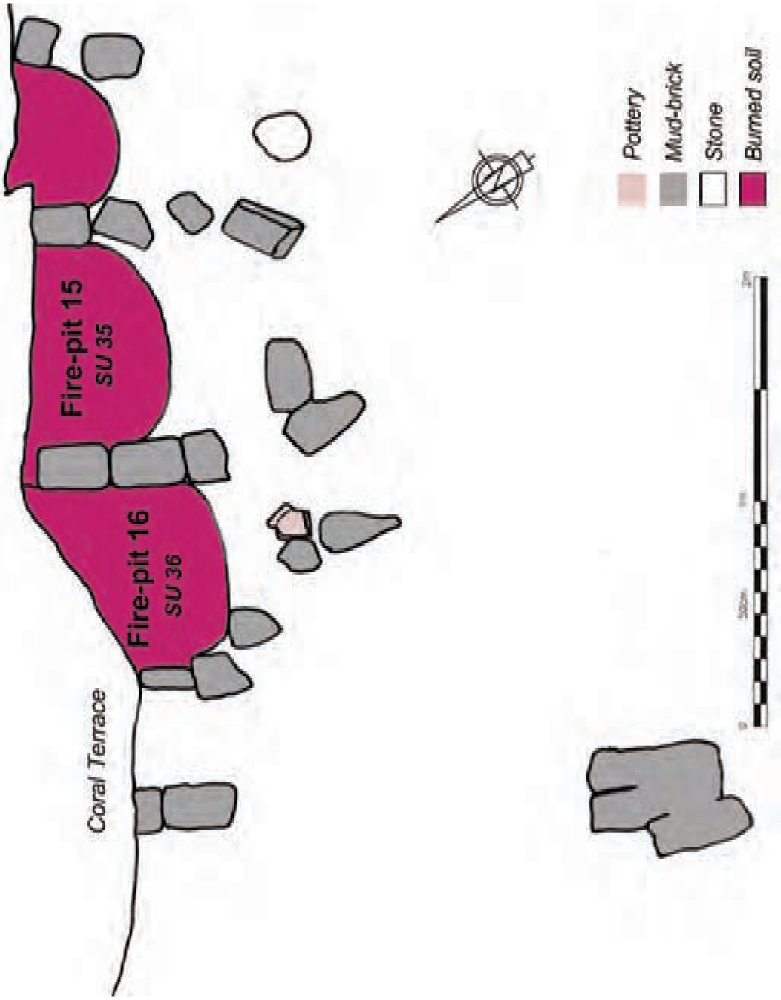


Figure 57. *WG 65, map of fire-pits 14 and 15.*

Figure 58. *WG 65, general view of fire-pits 14 and 15 before excavation.*

Figure 59. *WG 65, square C3, SU35 and SU36 after microstratigraphic excavation.*

Figure 60. *WG 65, fire-pit 14, SU35, eastern microstratigraphic section characterized by a 5 cm-thick layer of uncombusted plant material underlaying the ash and sand layers.*

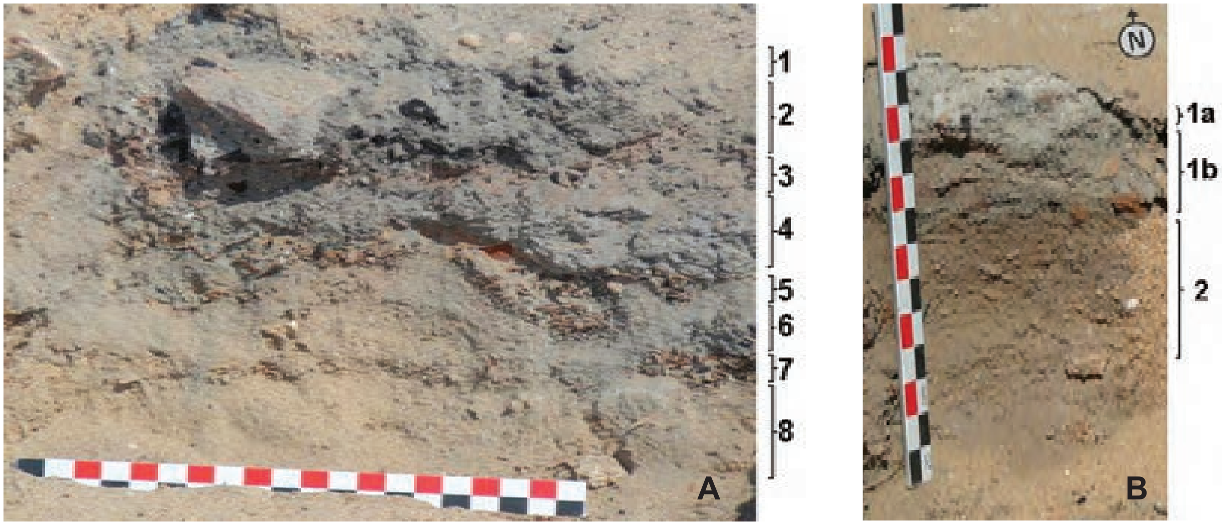


Figure 61 A. *WG 65, fire-pit 15, SU36, microstratigraphic section with subdivision in several cm-size layers*. B. *WG 65, fire-pit 14, SU35, microstratigraphic section characterized by a single cm-thick layer of ashes overlaying eolian sand mixed with fine charred material, and by a mm-size crust at top most of the ashy layer.*

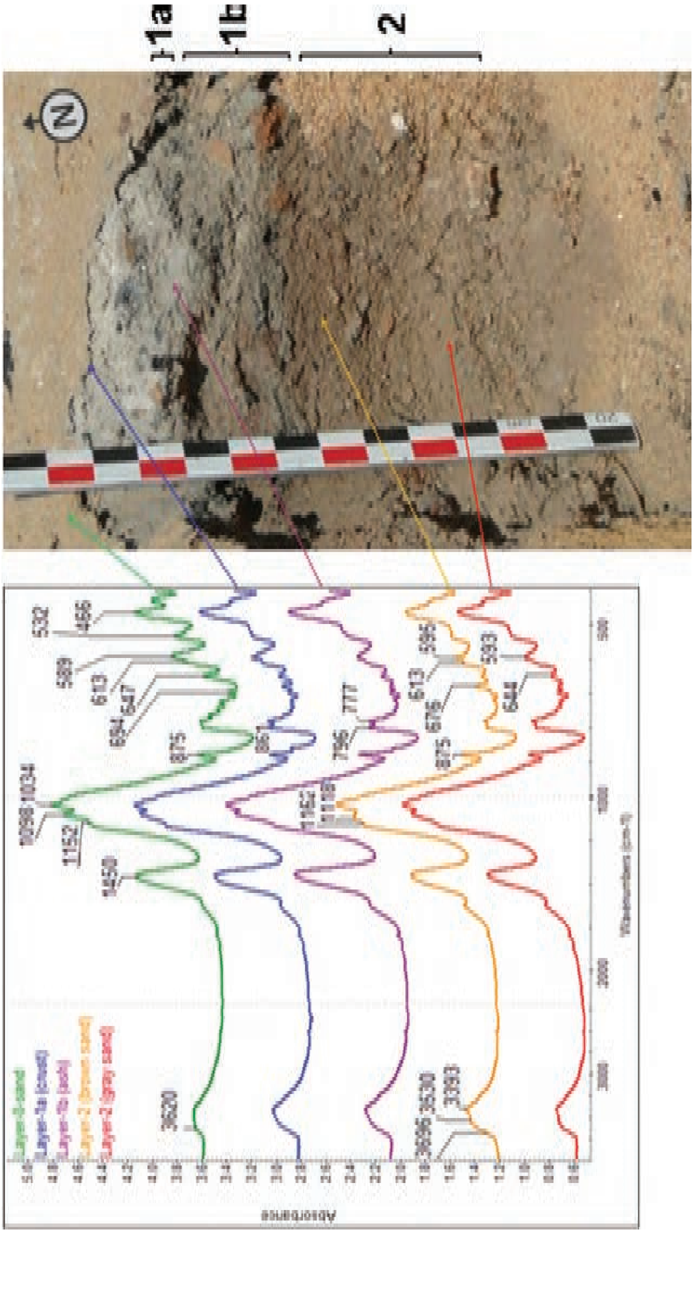


Figure 62. *WG 65, fire-pit 14, SU35, representative FT-IR spectra of sediments sampled from the different observable layers.*

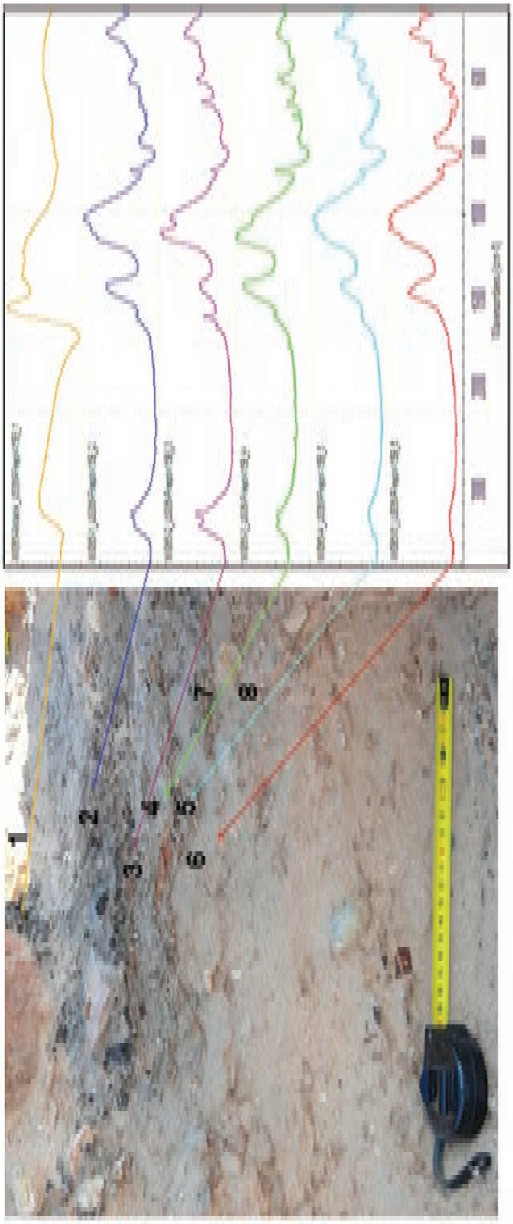


Figure 63. *WG 65, fire-pit 15, SU36, representative FT-IR spectra of sediments sampled from the different observable layers.*

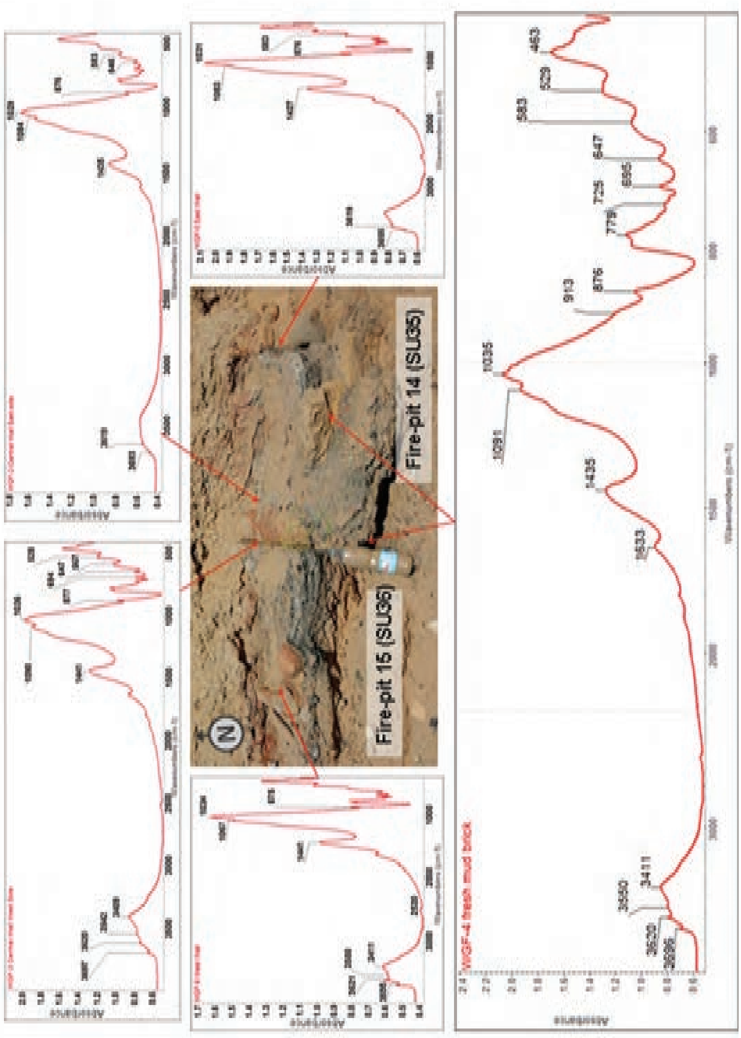


Figure 64. *WG 65, fire-pit 15, SU36, representative FT-IR spectra of different mud-brick materials.*

Figure 65. *WG 69, profile on the northern side of the excavation unit.*

Figure 66. *WG 70, large mud-brick structure in the northwestern corner of square D1.*

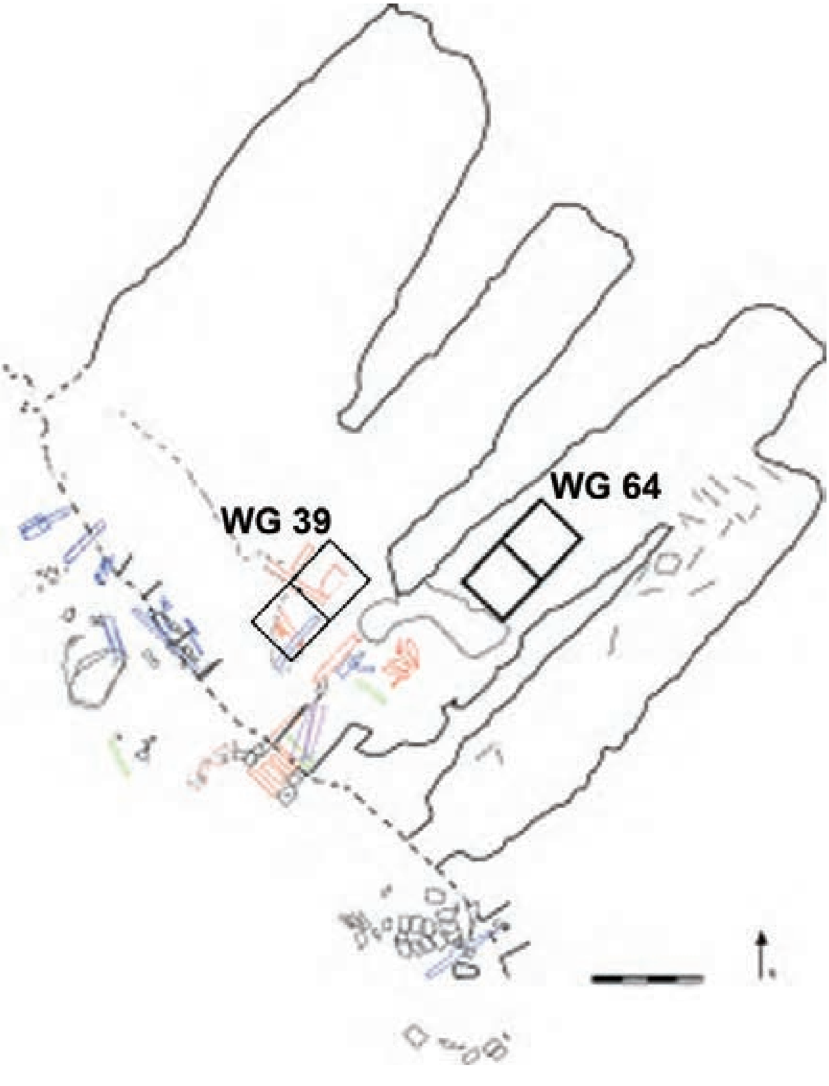


Figure 67. *WG 64, location of the excavation unit in Cave 2.*

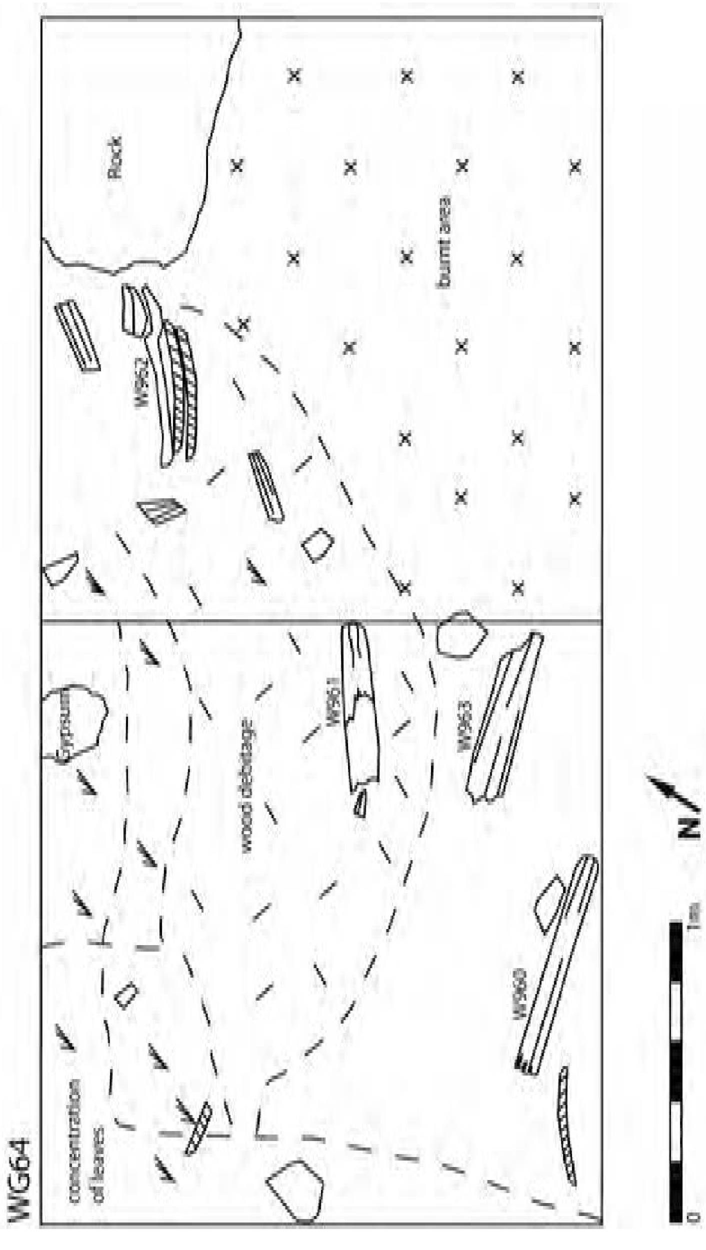


Figure 68. *WG 64, general map.*

Figure 69. *WG 64, the remains of leaves and stems of Arundo donax indicating an activity area, possibly for rope-making.*

Figure 70. *WG 64, adze tool handle made of local mangrove and a shipworm-riddled cedar plank fragment abandoned without its blade near the wall of Cave 2.*

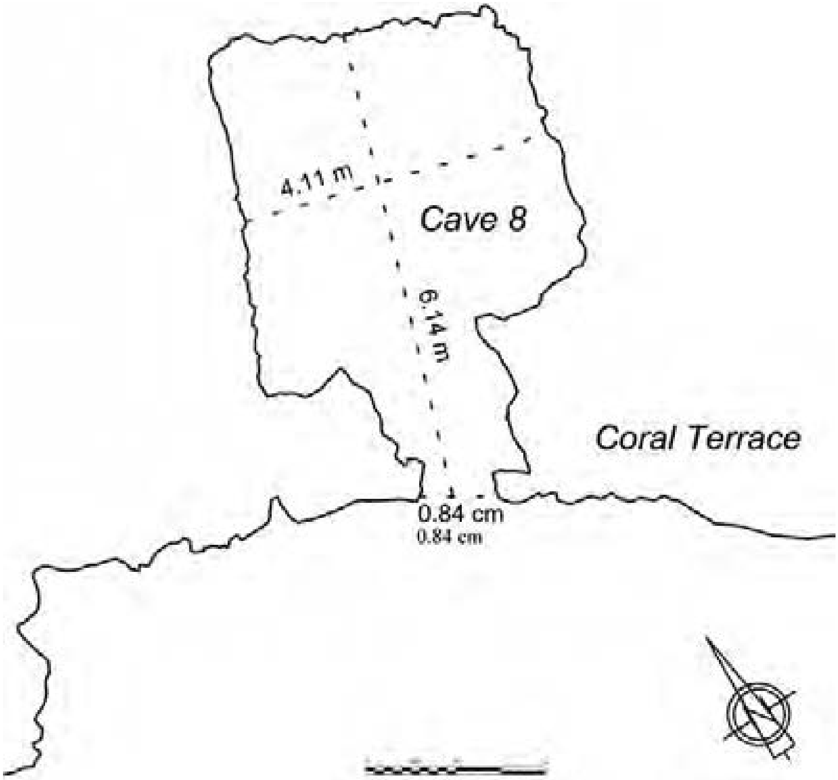


Figure 71. *Cave 8, general map.*

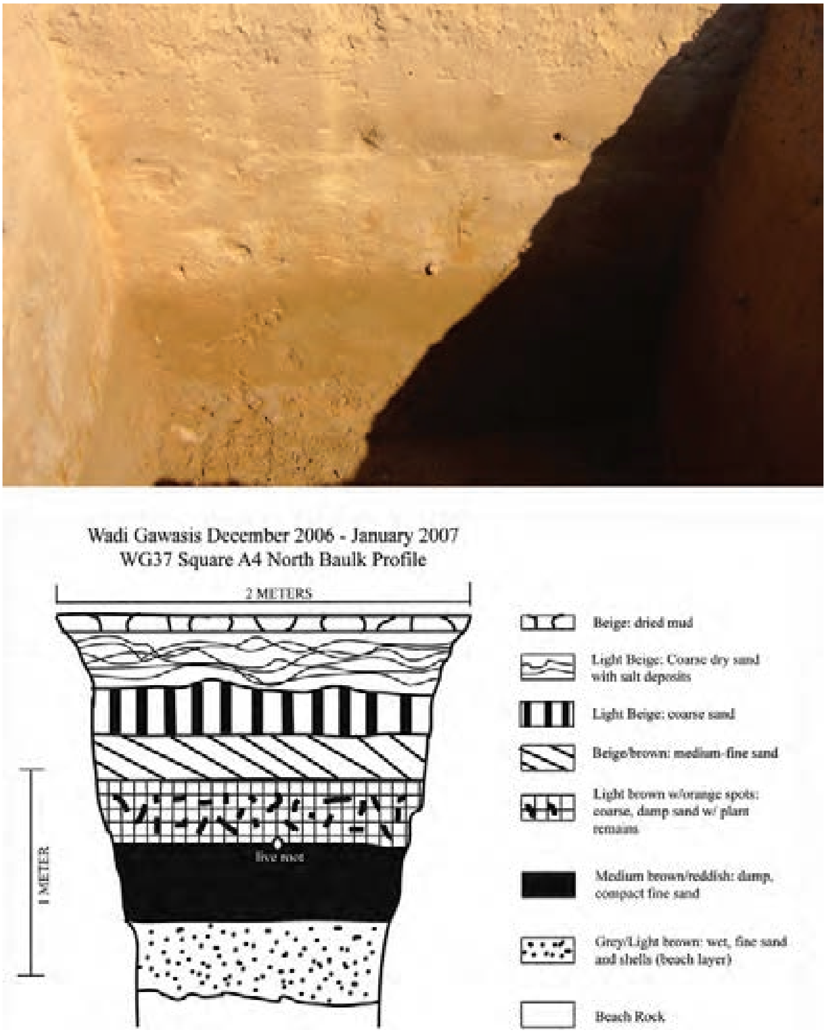


Figure 72. *WG 37, north baulk profile of square A4.*

Figure 73. *WG 38, small anchor (A24) in situ in square A4.*

Figure 74. *WG 74, remains of the partially destroyed mud-brick platform.*

Figure 75. *WG 45-50, general view of the "harbor area"*.

Figure 76. *WG 50, SU3, lower interface, large, burnt ship timber.*

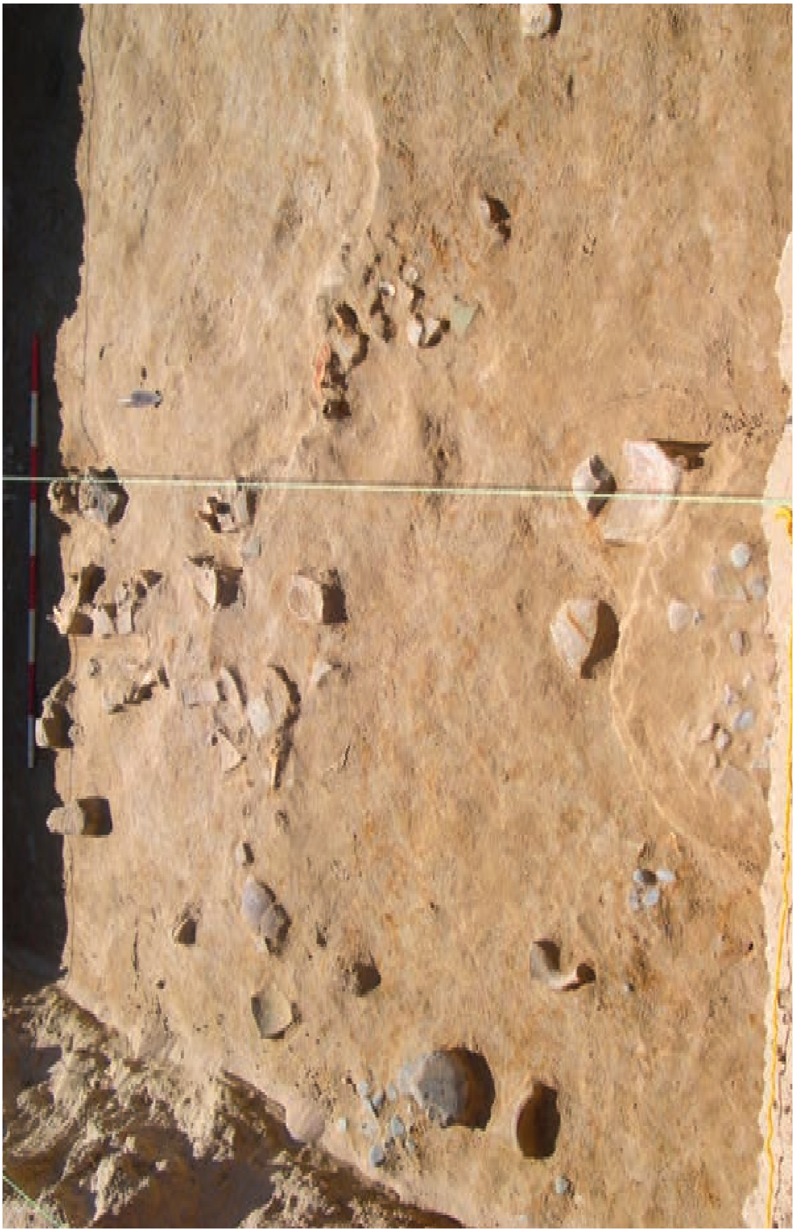


Figure 77. *WG 66, SU2, upper interface with pottery, fragments of large storage jars and animal bones.*

Figure 78. *WG 26, SU105, concentration of underfired platter pieces with a complete, red slipped conical-based bottle.*

Figure 79. *WG 70, 72/73, 76, general view of the excavation unit with mud-brick structures seen from East.*

Figure 80. *WG 71, general map of the mud-brick structures.*

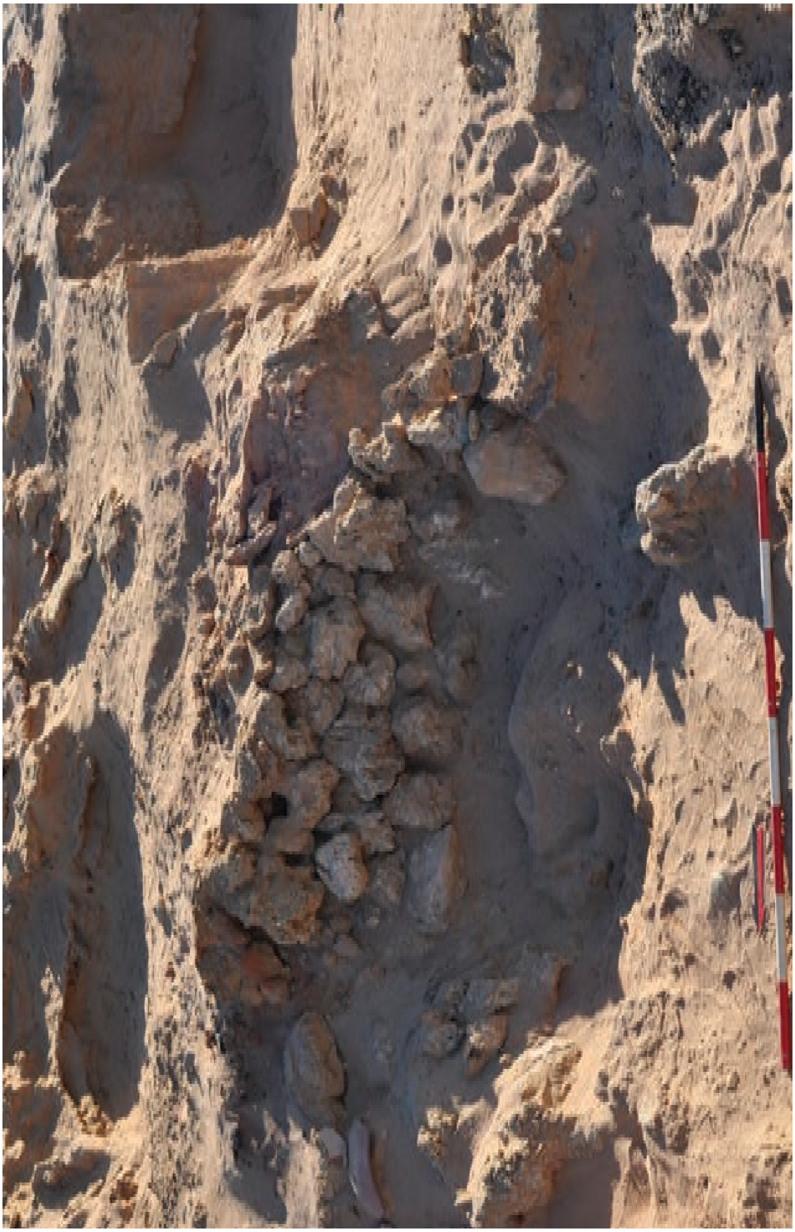


Figure 81. *WG 70, C3 SU2, concentration of coral blocks forming a kind of platform.*

Figure 82. *WG 72, A4-5, SU3, Feature 5, ceramic plate with concentration of fragments of bread molds on the top.*

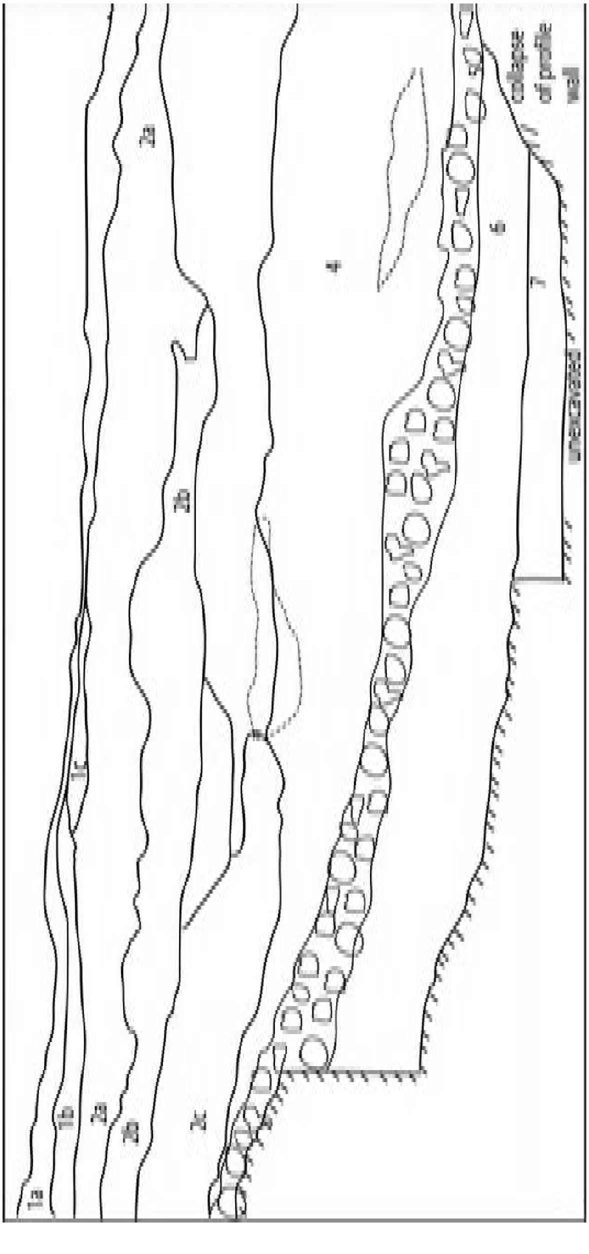


Figure 83. *WG 41, profile drawing. Dotted line indicates halite impregnations.*

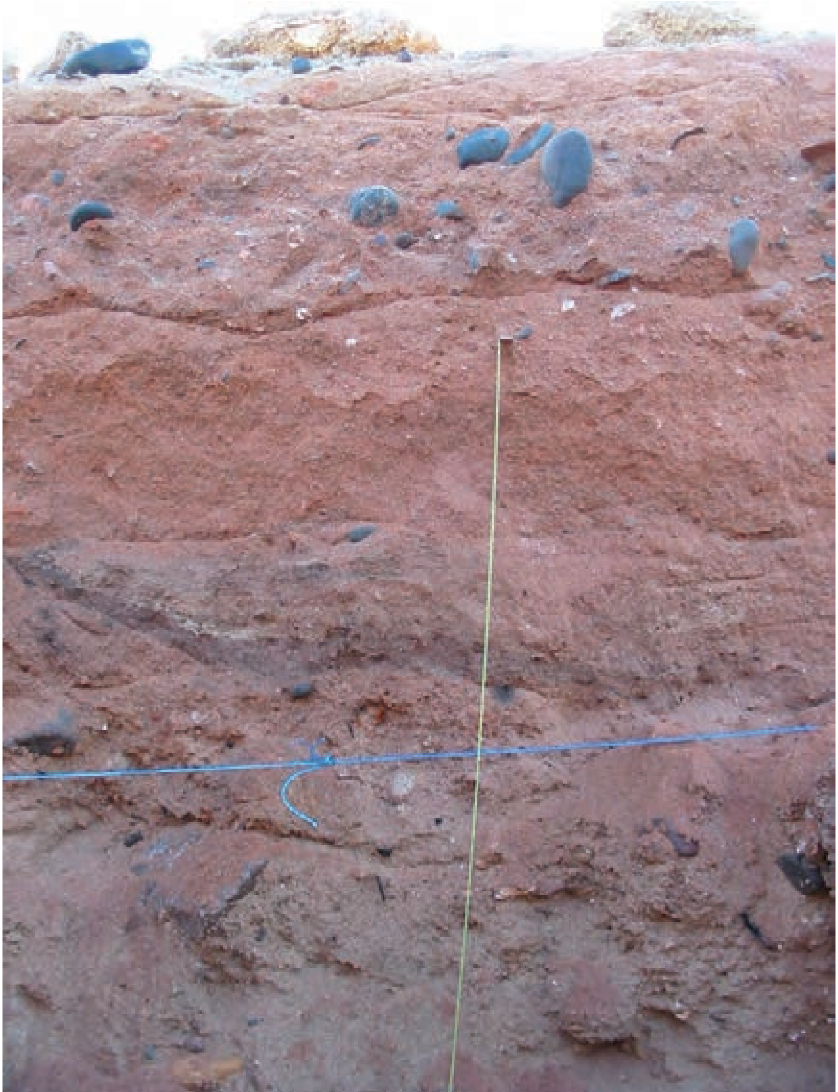


Figure 84. *WG 41, photograph of northern end of WG 41 showing reddened layers 1-3.*

Figure 85. *WG 41, pottery found at base of Hearth 1.*

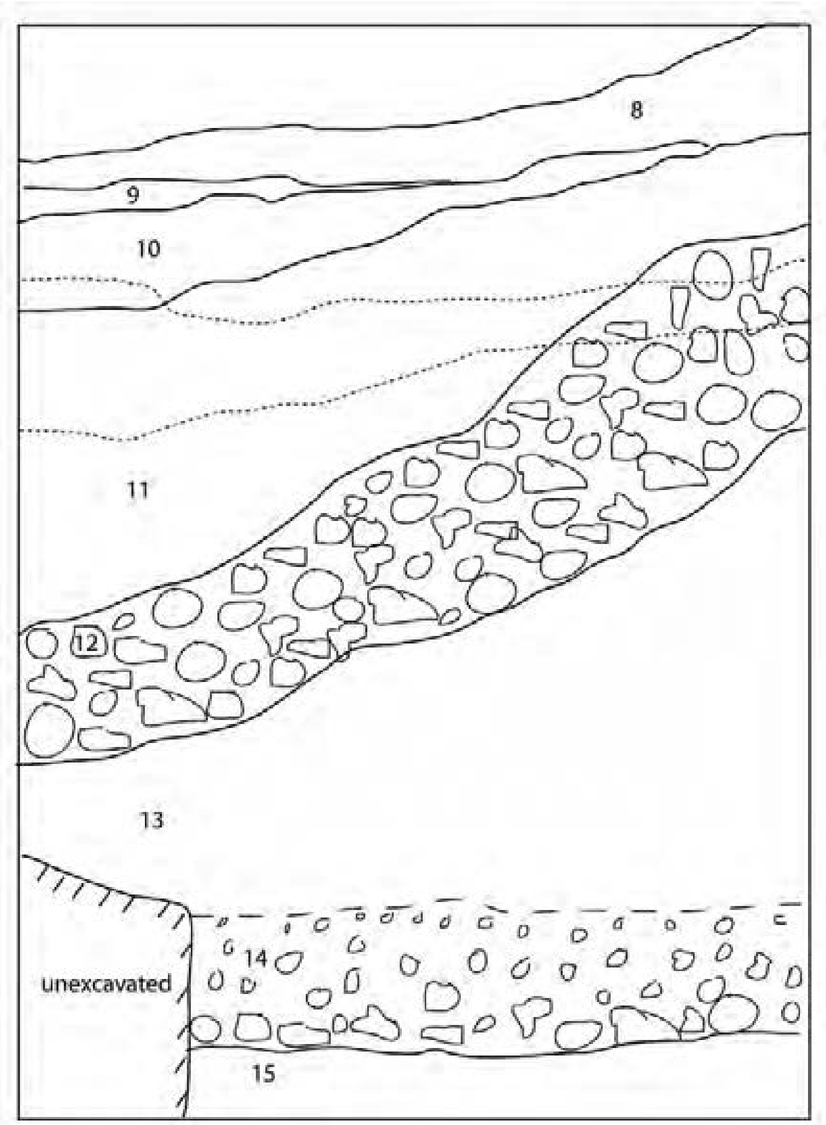


Figure 86. *Profile drawing of WG 43. Dotted line indicates halite impregnations; dashed line indicates gradual transition between layers.*

Chapter 4
Ceramic Finds at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011

4.1 Egyptian Pottery

4.1.a Egyptian ceramics, 2006-2007

CINZIA PERLINGIERI

Most of the ceramics from all 2006-2007 excavation and Stratigraphic Units are Middle Kingdom in date, from the early 12th to late 12th-13th Dynasties.

Pottery from excavation units WG 37/38/42 and all geological test pits consists mainly of large fragments of early 12th Dynasty bag-shaped storage jars, Marl C and rare Marl A3 wares. Pottery from these units is exceptionally well preserved. A few later collared jars with flat rims, dating to the late 12th and 13th Dynasties, were also found in these units (see Bader 2001: 160-163).

Pottery from excavation units on the upper western terrace slope (WG 32, WG 33, WG 40) and from the interior of Cave 3 (WG 39) is consistent with a dating to the late 12th and 13th Dynasties. Marl C ovoid/globular jars with a corrugated neck are common; they can also be found during the Second Intermediate Period, but there is very scarce evidence for such a late date (see Bourriau 2004: 8-11; Arnold 1982: 11:7). Marl C large storage collared jars, with a direct rim with a flat termination, may also date to the late 12th-13th Dynasties, based on parallels with the ceramics from Tell el-Dab'a (see Bader 2001: 160-163). Nile Silt small unrestricted hemispherical "drinking" bowls and small- to medium-sized plates are common in these assemblages.

A large assemblage of Marl C, with some Marl A3, medium-sized round bottomed plates were found in WG 32, SU31, piled at the entrance of Cave 6. Medium- and large-sized jars were also found in the same assemblage. Thirty-three complete plates and many large sherds of plates have been found on the whole (Figure 87). The plates have a diameter of ca. 16-19 cm. Many of them carry pot marks (single or multiple "commas"), which were engraved before firing. The outside of the bottom of all plates was hand-finished. This type of plate is well documented in the whole Middle Kingdom and later. Similar plates were found in different deposits at the

South Pyramid and the cemetery at Lisht, where they have been interpreted as jar stoppers because of the occurrence of lumps of the mud used to seal the jars still adhering to some plates (Arnold 1988: 110). Unfortunately, the plates from WG 32 were covered with a crust of salt, and no possible trace of sealing mud was preserved.

The pottery from WG 19/25/26/27/44 (the production area) confirms the two main chronological phases of use, already identified in the previous field seasons. The earlier phase of use dates to the early 12th Dynasty, as can be inferred from the occurrence mainly of large size, restricted necked jars ("bag-shaped" *zirs*), which are very common in early Middle Kingdom (Arnold 1988; Bader 2001: 160-163). The later phase of occupation dates to the late 12th-13th Dynasties. This attribution is based mainly on the massive presence of ovoid/globular jars with a corrugated neck (a type common during the late 12th and 13th Dynasties).

A complete Nile B2 carinated necked jug with thickened everted rim and conical base was found nearby a possible fire-pit (WG 26, D4-C4, SU105), laying on its side. The vessel is 25 cm. high with a maximum diameter of ca. 11 cm. This shape occurs in Middle Kingdom assemblages, although it is not a very common type. Similar jugs were found at Lahun (Kelley 1976: Pl. 40.5, nos. 13P, 13S), Kahun (Kelley 1976: Pl. 40.12, no. 73), and Harageh (Kelley 1976: Pl 44.3, no. 13M[1]).

A typological/functional analysis of the forms is in progress. At present, we can state that the pottery assemblages from WG 19/25/26/27/44 are characterized by utilitarian coarse ware, with a high percent of locally made pottery. Conical bread molds, platters/ovens, large plates and large- and medium-sized jars in Nile B2 and Nile C wares are common. Pottery from units WG 37/38/42 and geological test pits consists mainly of storage vessels made of wares from the Nile Valley. Pottery types from all phases on the upper western terrace slope (WG 32, WG 33, WG 40), mainly jars, bottles, drinking bowls and small- to medium-sized plates, in association with other evidence for administrative activities (seals, sealing fragments, cargo boxes), seems to suggest that the area

[1] This vessel is dated to the reign of Mentuhotep II of the 11th Dynasty, but the height/maximum diameter ratio is much greater than the Mersa/Wadi Gawasis sample.

outside the caves was largely used for organizational and administrative purposes.

4.1.b Egyptian ceramics, 2007-2008

Sally Wallace-Jones

All of the ceramic material from the site, including both body sherds and diagnostics, was examined and as this represents a considerable corpus of material certain typical areas of the site have been selected for detailed analysis here. In particular, WG 32, WG 49, and WG 51 are discussed in depth here because they are very representative of other WG units on the site. Finds within other WG units are also discussed when they have particular significance. The overall chronological profile of the site is clear and uniform, dating to the 12th Dynasty with occasional indications of the early 13th Dynasty, especially in the development of ceramic technology. Many jars show a typical Middle Kingdom combination of turned upper sections with a hand or coil made base scraped on the outer surface (Arnold and Bourriau 1993: 56).

The profile of cups is generally rather shallow, suggesting an earlier rather than later Middle Kingdom date, whilst the technology used for bases shows evidence that wheel turning was becoming important. A number of cups have bases which were cut to shape on the exterior surface; one in particular from WG 47 showed clear internal rilling lines, whilst the exterior was rather clumsily cut to shape. There are also several round bases from small jars which show clear internal evidence of turning, having a spiral in center interior; these along with small plates also have evidence of scraping on the exterior. Of the ring bases at the site at least one in Marl A3 is clearly wheelmade and applied to the vessel, and one in Nile B1 appears to have used some hand modelling. All of this evidence supports a date of 12th to early 13th Dynasties with the emphasis more on a 12th Dynasty date. The cupped rim usually found in Marl C fabric and very typical of Mersa/Wadi Gawasis is not well known at other sites in Egypt; however, it can be dated with confidence to the period between the mid-12th and early 13th Dynasties because it is always found in combination with a few other rim types, and in particular Bader type 46 corrugated rims and Bader *zir* rims of types 2 and 3 (Bader 2001: 129-131 and 158-161 respectively).

The difference between WG 49 and areas such as WG 32 and WG 51 form an interesting comparison since WG 32 and WG 51 reflect one trend at the site, and WG 49 another. WG 32 and WG 51 illustrate areas where a wide range of forms and fabrics is present, representing an eclectic mix of vessels, technology and functions, whilst WG 49 represents areas containing only large storage vessels in limited numbers of shapes and mainly in Marl C and its variants. WG 51 may be compared to areas such as WG 32 and WG 33 and also WG 55 around the mouth of the caves, whilst WG 49 forms a parallel with WG 45, WG 46 and WG 47. This in turn would suggest that the area around WG 49 identified as the "harbor area" had a clearly defined storage function (see Figure 88), whilst the areas defined by WG 32, WG 51, etc. have a much more complex and wide ranging set of functions.

WG 32, Body sherds

Clays have been defined using the Vienna system. (Bourriau 1981; Arnold and Bourriau 1993):

Marl A3: from several medium and large jars with clear evidence of rilling lines on the interior surface and hand making marks on pieces from lower sections, between 6 mm and 15 mm thick; also pieces from a number of different shallow profile cups varying in thickness between 2 mm and 5 mm, as well as several small plates. One piece of fine quality from the neck of a small bottle is wheel-made and finely finished with a thick burnish on the whitish cream firing surface. This represents a finely made high quality vessel. There were also 3 pieces from the shoulder of a fine wheel-made jar about 5 mm thick, possibly from a small drop pot. Three pieces of this fabric from the body of a large jar were considerably coarser than the rest with a high proportion of sand inclusions, which could almost fit the profile for Marl A4.

Nile B1: many body sherds from small fairly shallow cups and also flatter, more plate-like profiles with interior evidence of rilling, but clear exterior scraping. Body thickness varies between 3 mm and 6 mm.

Nile B2: evidence of a number of medium and large closed vessels, as well as some open forms, including a large platter with a red inner coating and body thickness of ca. 9 mm. There are sherds from jars, including a large jar of about 19 mm in thickness with a red outer coating, as well as some body sherds from smaller bottle type vessels, both plain and red-coated, some with traces of burnishing. There is also evidence of some small cups of body thickness 4-6 mm.

Nile C: 8 pieces of very thick (20 mm) body material from one large jar, covered on the outer surface with a red wash. There are also pieces from a large platter.

Marl C: many sherds from a variety of large and medium jars with wall thicknesses between 6 mm and 15 mm.

Marl C compact: many sherds from a variety of large jars. As with other contexts this fabric appears quite regularly and in unusually large quantity.

Marl C2: many sherds from a variety of large jars.

Nile E: 1 piece of heavily smoke-stained body, probably from a cooking pot. This fabric seems to originate in the Eastern Delta and has particular prominence at Tell el-Daba.

Bread mold: a number of sherds of coarse, sandy, tubular bread molds were also found. There was also a small quantity of non-Egyptian material some of which seems likely to be Middle Nubian (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics).

WG 32, Diagnostics

As would be expected, the diagnostic sherds from WG 32 represent the range of styles indicated by the body sherds. Notable in this context are a large number of Nile B2 and Marl C rims of Bader bottle types C and D, and also type 7B dating to the late 12th and early 13th Dynasties, as well as large rims with diameters up to 27 cm of Bader type 2 and 3 zirs, dating to the mid-12th Dynasty (Bader 2001: 160-161). Also in Marl C are some flat bases and examples of the cupped rim, which is very typical of Mersa/Wadi Gawasis, but unusual elsewhere (Janine Bourriau personal communication). A number of very typical plates and plate rims occur from vessels with diameters around 16 cm. These are always of Marl A3 and have characteristic rilling lines at the rim, but a scraped finish on the exterior of the base. Such vessels occur quite commonly at the site and may have been used as a standard size ration plate, and may also have had a function as lids. There are also many fine cup rims in both Marl A3 and in Nile B1, and to some extent in B2. One Marl A3 rim is of an interesting funnel shape, resembling a 12th Dynasty water jar but much smaller than the usual size of these vessels, having a diameter of only 6 cm and a vessel wall thickness of about 2-3 mm (see 4.1.g Model vessels). It is clear from the material found in WG 32 that this area of the site was being used for a wide range of activities and that as a result the ceramic profile is very rich and varied. The same is also true of WG 51.

WG 51, Body sherds

Marl A3: from a number of different jars including one large vessel with wall of 13 mm thickness and one of 15 mm. Also one from a smaller jar with wall of 10 mm thickness, and from fine cups with thicknesses of 2-4 mm.

Nile B1: 3 sherds probably from the same vessel: a small cup with red slip inside and out and hand trimming on the base. 6 mm at base, tapering to 2 mm toward the rim.

Nile B2: body sherds from several large closed vessels; one up to 19 mm thick with some evidence of red slip on the outer surface. Other pieces are uncoated. A few pieces are probably coarse enough to classify as Nile C.

Marl C: a large quantity of body sherds from storage jars varying between 5 mm and 9 mm in thickness.

Marl C compact: a large quantity of body sherds from big jars up to 14 mm thick and one

smaller jar up to 6 mm thick. There was a surprisingly high proportion of Marl C compact at the site, representing up to one-third of all Marl C storage vessels.

Marl C2: a small quantity of Marl C2 body sherds all from large closed vessels.

Nile E: 2 body sherds from a closed vessel and one probably from a large open form with coarse interior burnishing.

Five pieces of tubular bread mold in a coarse straw-tempered silt fabric without coating. This may be a local clay, but has close affinity with Nile Silt B2/C.

In addition, there were some foreign sherds, a number of which appear to be Middle Nubian, which are the subject of further study by Andrea Manzo (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics).

WG 51, Diagnostics

Three folded Marl C *zir* rims from bag-shaped jars ca. 24 cm in diameter, wall thickness 12 mm, and a similar rim but in Marl C compact.

These reflect types found at Tell el-Daba in the 12th Dynasty, Bader type 1 (Bader 2001: 158).

Three Marl C rims from vessels of Bader type 46 and of late 12th Dynasty date (Bader 2001: 129-131).

A small folded rim from a Marl C compact jar (8 cm in diameter) and also a flat base of Marl C from a large *zir*. Also, one cup-shaped rim of Marl C, which is the most commonly found shape at Mersa/Wadi Gawasis.

A Marl A3 rim from a small water jar, 11 cm in diameter, of early-mid 12th Dynasty type, and at least 6 different Marl A3 cup rims, between 2 mm and 5 mm thick, tapering to very fine rims, one of the rims being notched before firing.

A large rim from a Nile B2 platter with a red coating inside and out, and one similar but uncoated.

A Nile B1 cup rim with a shallow profile tapering to 2 mm at the rim.

Two pieces of Fine Nile B2 (almost B1 but with some large straw pieces) with red slip and burnishing inside. The form is a large open vessel, which is too wide and flat to be a cup.

Clearly, both units WG 32 and WG 51 contained a wide range of vessels in many different fabrics and forms, suggesting that these areas had a very mixed use that probably combined small-scale storage with food consumption and preparation. The collection and storage of water or other beverages may also have formed an important activity in this area as a number of bottle type vessels are attested there. The presence of foreign ceramics, including Middle Nubian sherds and probably material from farther south and east, is also of interest, and these sherds have been studied by Andrea Manzo (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics).

WG 49, Body sherds

This unit contains only a huge number of rim and body sherds of Marl C compact, Marl C, and Marl C2, all of which come from large jars. Marl C is the most commonly occurring fabric accounting for about 70% of the Marl C material; about 25% is of Marl C compact and 5% Marl C2, which is often very coarse. There is also a significant quantity of Marl A3 in use for large storage jars. This material is comparable with types found in the Nile Valley and the fabric is known to be of Upper

Egyptian origin. Therefore, it must have been brought from the Nile Valley to Mersa/Wadi Gawasis. In addition, there is a small but significant quantity of large jars, both plain and red coated, made in Nile B2, again likely to have been imported from the Nile Valley.

WG 49, Diagnostics

Rims of Marl A3 from bag-shaped jars, Bader rim type 2 (Bader 2001: Abb. 43, Typ 2).

A large number of Marl C type 47 rims with diameters around 12 cm.

Many rims of cup type typical at Mersa/Wadi Gawasis in Marl C.

Many rolled type jars, rims in Marl C and C1, of Bader types 1 and 2 (Bader 2001: Abb. 43, Typ 1 and Typ 2).

There is no variation in the material from this context and judging from the size and quantity of both body sherds and rims from this area, it is quite clear that it was the location of a significant number of storage jars, mainly of Marl C and its variants, but including small but important quantities of Marl A3 and Nile B2. There are no other vessel types in this unit and it seems that there is also a limited number of types of jar rims present, confined to Bader rim types 1 and 2 of rolled type, corrugated rims of type 46/47 (Bader 2001), and the most commonly found cupped type, which is common at Mersa/Wadi Gawasis, but unusual elsewhere. Therefore, it would appear that the range of jar shapes was limited to a few types and that these had a specific storage function. The few bases discovered in these areas are large and flat and the technology of these jars is typical of the Middle Kingdom, having wheel-made upper sections with clear rilling lines joined to coiled and hand-made lower sections with the outer surface scraped and trimmed to shape (Arnold and Bourriau 1993).

Remarks

Excavation units WG 45, WG 46 and WG 47 are very similar in their composition and closely resemble WG 49, although WG 47 was also found to contain a number of bottle type rims with a kettle-shaped profile Bader type 7b (Bader 2001: 152-153), dating to the early 13th Dynasty. These were quite uniform, being made from Nile B2, some uncoated and some with red exterior wash and all of about 9 cm in diameter. However, these could also be consistent with a storage function in this area. Also from WG 47 were a number of foreign sherds, possibly both

Middle Nubian and South Arabian, which are being studied by Andrea Manzo (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics). One handle from this area appears to be from a Canaanite jar (see 4.2.b Exotic ceramics, Canaanite). The dark brown paste is clearly different from both Nile and Marl clays, being extremely coarse and very gritty with a considerable quantity of black particles. The paste, form and technology all suggest a Canaanite jar (Janine Bourriau personal communication). This would not necessarily be inconsistent with a storage area, since the jar may well have been imported as a container for its contents and could also have been re-used. It is the first Canaanite jar known from the site but the presence of wood such as oak and cedar at the site seems to confirm the likelihood of contact with this region (see 6.2 Identification of wood and charcoal). A further interesting rim from WG 47 is that of a large cooking pot made from Nile E fabric which is very typical of those found at Tell el-Daba. It is one of the only sherds from this area which is not a storage jar. However, other pieces of Nile E have been found at the site and its presence is not, therefore, a particular surprise as a single rim could easily have been deposited in this area without changing its essential storage function in any way. What is more interesting is the presence of a fabric known to originate in the Eastern Delta, alongside the handle of a Canaanite amphora.

Amongst items of significance at the site are three very small sherds which may, in some way represent miniatures or model vessels (see 4.1.g Model vessels). Two of these were excavated in 2007-2008, and the third was found in 2006-2007.

A large number of pot marks was identified in 2007-2008, almost exclusively on jars of Marl C and related fabrics with a few from Marl A3 (see 4.1.e Pot marks).

Also found at Mersa/Wadi Gawasis are a number of wooden and pottery discs that had tentatively been identified as gaming pieces, net floats, etc. However, the discs are not pierced, and in 2007-2008 it was noted that these discs may have been used as jar stoppers (see 4.1.f Ceramic and wooden discs).

The foreign material known from previous field seasons continued to be well represented and it is clear that Middle Nubian pottery forms a small but significant part of the assemblage along with material from eastern Sudan, Eritrea and Yemen. It is worth noting that WG 33 produced a large and unusually high concentration of foreign material found together in association with a large number of pieces of Nile B2 platter, Marl C jars, Marl A3 and Nile B1 cups, Nile B bottle necks of Bader type 6 and 7 and rims of Bader type 46 (Bader 2001: 129-131), in other words, a mixed assemblage typical of the material from this area of the site with a date of late 12th to early 13th Dynasties.

One foreign sherd which is of especial interest was found in WG 55 in association with a mixed range of fabrics and forms similar to the assemblages from WG 32 and WG 51 and dated to the mid-12th to early 13th Dynasties. The tiny, very fine piece of ceramic is coated inside and out with a dark slip and has a fine burnish. The vessel wall is no more than 1 mm thick and the visible rilling lines are also extremely fine. The paste is hard and has very little in the way of inclusions. It was immediately clear that this was not Egyptian and it has now been confirmed that it is from a Minoan cup of pre-Palatial Kamares ware from Crete.[2] It is an exciting addition to the foreign material from Mersa/Wadi Gawasis (see 4.2.c Exotic ceramics, Minoan).

Conclusions

Work in 2007-2008 has shown that different areas of the site were used for different functions and that the range in the ceramic material found at different areas of the site reflects these varied functions. It is clear that storage was an important activity at the site and that the range of jars used for this was limited to a few types in Marl A3 and Marl C. It is also clear that a whole range of Middle Kingdom ceramics is present at other areas of the site, which were more likely to be associated with living activities. These include a range of plates, platters, bottles, jars and cups, a few of which appear to be of very fine quality. A considerable quantity of the material must have been brought from the Nile Valley, especially the Nile fabric material and that in Marl A3, which came from Upper Egypt. Other material was brought from further afield, such as the Eastern Delta in the case of Nile E, and also from outside Egypt.

[2] I am grateful to Janine Bourriau and Dr. Laura Preston of the MacDonald Institute for Archaeological Research in Cambridge for their help in identifying this sherd.

It also seems likely that the cupped rim which occurs very frequently at Mersa/Wadi Gawasis was made in a particular workshop which supplied the site. No doubt the site was supplied by different workshops allied to the state and pharaoh, but this rim form is common at Mersa/Wadi Gawasis and is rare elsewhere, suggesting that it may be the product of one particular workshop. However, the range of rims present suggests that this would not have been the only source of supply. The presence of some pieces of large low fired platters in a friable buff clay also continues to support the theory that some ceramic material was produced locally.

4.1.c Egyptian ceramics, 2009-2010

Sally Wallace-Jones

Ceramic material from all the main areas of excavation was examined during this field 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 excavation units WG 61/65, and WG 63 on the western coral terrace outside Cave 8. Across the wider site, material covers the 12th Dynasty with some evidence for continuation into the 13th Dynasty.

WG 61/65

These excavation units were 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. 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 (see 4.1.a Egyptian ceramics, 2006-2007); 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 Dashur in tomb groups dated between Senusret III and Amenemhat III (Susan Allen personal communication). There is also a significant amount of bread molds 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 (see 4.1.a Egyptian ceramics, 2006-2007), 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 Nile 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: 56). 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 had 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 (Figure 89 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 of Egyptian Archaeology, the profile being very similar although the Petrie Museum cup is listed as having a wavy rim[3] (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 2001: 129-131, 145). 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

[3] Having examined the Petrie Museum vessel, I believe the wavy rim to be an accidental bulge rather than a deliberate design feature.

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 of 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 1898: 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 (UC1848823).

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 1898: 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 (Figure 90 A) 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 (Figure 90 B). A third sherd from this area also had traces of 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 1898: Pl. XV, No. 26). The lozenge design also has a parallel from Armant currently in the Manchester Museum (10614),[4] 24, which is also dated to the 12th Dynasty. These are not the only incised sherds to be identified at the site and further incised material will be discussed below.

A small number of sherds from WG 61/65 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

[4] View an image at the Virtual Kahun pages: http://emu.man.ac.uk/webmmtest/ pages/ common/ imagedisplay.php?irn=69069&reftable=ecatalogue&refirn=1 04159.

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.

Editor's note: The contents of this jar were analyzed in 2010 by Orion Analytical (Williamstown, MA) using a portable Fourier transform infrared microspectroscopy (FTIR), which detected wax, with a best match for beeswax (James Martin personal communication). It is highly likely that quantities of beeswax, which could be obtained in the Nile Valley, were brought to the harbor site to be used as caulking for the ships.

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 (Figure 91). 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 smoke stained and was 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.

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 and on the forms of beer jar rims (Bader 2001: 129-130, 156, Abb. 43; 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, 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[5] 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 (see *e.g.* Gallorini 1998: 44). 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 wear, whilst the shape and scale of the 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.

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

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 personal communication). 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.

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 are 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 92). 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.

Incised pottery

WG 55, C2, SU2 produced three incised sherds, one rim from a carinated bowl on which the decoration is quite extensive, possibly resembling the decoration on an 11th Dynasty bowl from Dendera (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 the "alcove 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.

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 UC1842226, 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 from El-Kab (Quibell 1898, 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.

Discovery and identification of Canaanite material

In the 2007-2008 field season a number of sherds of small jars with distinctive flat, ridged rims was discovered. These have been identified as Canaanite (see 4.2.b Exotic ceramics, Canaanite). WG 33, SU3 contained 24 sherds from at least 5 different vessels. During the 2009-2010 field season some further examples were recognized in WG 32, B4, SU5.

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. Other pieces of similar fabric, form and technology have also been identified in WG 33, WG 47 and WG 54. This evidence would suggest that there were at least three amphora type vessels present at the site along with a number of smaller jars (see 4.2.b Exotic ceramics, Canaanite).

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. WG 55 is the excavation unit located next to where the "alcove shrine" was excavated in WG 56.

In the 2009-2010 field season a further Minoan sherd was identified, again from WG 55, C2, SU2 (see 4.2.c Exotic ceramics, Minoan).

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 Nile B2 jar; 9 pieces of Nile B1 hemispherical bowl representing one or two vessels; also one Nile B1 bowl base, which had been scraped to shape, along with a piece of red-burnished inside and out Nile B1 cup body; the almost complete rim of a Nile 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 (Figure 93). 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 prefiring 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. It has been ruled out as coming from Crete or Cyprus, nor does it seem to belong in the Levant. Andrea Manzo (personal communication, 2010) feels that it is unlikely to be of southern origin and the paste and form are also unlikely to be Canaanite. Irmgard Hein (personal communication, 2010) 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 (personal communication to K. A. Bard, 2010) 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 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. 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.

4.1.d Egyptian ceramics, 2010-2011

Sally Wallace-Jones and Maria Imbrenda

In the 2010-2011 field season work continued on sorting and recording the ceramic material. Following the usual methodology, the material was washed then sorted by fabric and surface treatment. All the body sherds were examined and all diagnostic sherds were drawn and catalogued. The most significant ceramic items were photographed by Easton Selby of Coastal Carolina University. The authors gratefully acknowledge his work and the support of a grant from The Antiquities Endowment Fund of ARCE supported by USAID, which made it possible to produce a very thorough photographic archive of the ceramic finds from the site.

Work done this field season work confirms the findings of previous years, in that the material continues to date firmly to the Middle Kingdom with a bias towards the 12th Dynasty. There is, however, evidence of material from the early 13th Dynasty, especially in the forms of jar rims in both Marl C and Nile B2 clays, which show a transition from shapes typical of the 12th Dynasty into the kettle mouthed form known from the 13th Dynasty (Aston 2005).

A wide range of clays and vessel types continues to be represented at the site. Whilst large storage jars of Marl C and Marl C1 predominate, representing up to two-thirds of all material, there is also a significant proportion of large Marl A3, Nile C and Nile B2 jars and of Nile B2 and Nile B1 cups represented in every context. A typical context contains a mix of large jar material with smaller quantities of sherds from Nile B2 and Nile C bottles, plates and large platters, and fragments of smaller jars and plates of Marl A3 and Nile B2. Also present in most contexts but in smaller quantities are bread mold fragments and pieces of small Marl A3 bowls. Less frequently represented are forms and fabrics such as Nile B1 and Nile B2 carinated cups, small cookers of Marl C and Nile clays. Occasional decorated vessels occur, exclusively in Marl A3. There are also some rare pieces of Nile E cooker, and very occasionally special forms such as a tiny, thin walled, vessel of Marl A3 found this season, which could resemble the form of a pomegranate. This vessel has a faded and partly broken away inscription in hieratic and appears to be some kind of special vessel possibly for unguents. Also discovered this field season was a finely made and finished vessel of Marl A2 (an unusual find on this site), with a burnished surface and wheel-made ring foot, which had been added to a wheel-made but hand finished base. This was clearly a vessel of some status. Such vessels seem to be special and may have been personal possessions brought to the site by individuals. Finally, there are the sherds of foreign material which occur infrequently but regularly. Dominant amongst these is the Nubian and Eritrean material, but there is an increasing body of material which is Canaanite and also a few sherds of Minoan material. Further Canaanite sherds were identified this year from WG 31, SU1.

Two important questions arise from studying the wide range of material present at the site: one being how the distribution of material can illuminate what activities were taking place, and the second being the question of how much material was brought in and whether there was any material being produced *in situ*. Answering these questions has been a major focus of study this field season. The explanation for the wide range of ceramic material present at Wadi Gawasis must be that the site experienced a wide range of uses relating to and in support of its main function as a base for foreign trade. It was necessary to bring in supplies vital to maintain the operation; it was crucial to feed the personnel, to maintain the sea going vessels, to fulfill cult activities and to be prepared for all eventualities. The ceramic material represents all these functions, especially domestic activity. It is also clear that the huge amounts of raw materials required to fulfill the needs generated by each expedition had to be transported to and from the site, and it is equally clear that this was frequently achieved through the use of large jars. Jars found at the site all have very clear and definite rim types, all of which we can now say are well known and documented in the Nile Valley and Delta in the same period, making it very likely that the jars were produced away from the site itself, probably in state controlled workshops, and were brought in as required containing all manner of vital supplies.

The jars themselves came to the site with a primary function as containers and that function almost certainly continued to be their main role, storing and transporting vital raw materials. Jars were probably used and re-used, sometimes even after being broken as we can see from WG 70, A1-2, SU3, which produced over 30 counters which had been re-cut from sherds of Nile B2 jars. It is also common to find sherds which have been reworked and used as fan-shaped or pointed scrapers and there is some evidence that fire-pits might sometimes have been lined with the broken bases of large jars as there are several occurrences of large, blackened jar bases being found at the bottom of such pits. The effort of getting so much material to so difficult a location meant that nothing could be wasted.

What is interesting is that we can also say with some certainty that the majority of vessel types, other than jars which were present at the site, were also brought to the site, either being provided by the state or in a few cases as prized personal possessions. The large open forms and smaller jars, plates, platters, cups, bowls, and cookers are all of types well known and documented in the Nile Valley, for example at Lisht and Kahun, and they all appear to be made from clay types in use in the Nile Valley during the Middle Kingdom. It is probable that the vast majority of ceramic material at the site, including that used for food preparation and serving, and small items of personal value, were brought to the site from the Nile Valley. The scale of this operation, given the fragility or in some cases size and weight of some of the vessels involved, is difficult to imagine. Nevertheless, it appears that the forms and fabrics of the majority of vessels on the site are forms and fabrics which originated in the Nile Valley. So we can be confident that much of the ceramic material was made off site and brought in, even to the extent of bringing huge, heavy plates and small very breakable hemispherical cups.

There is a growing number of small cooking vessels in Marl C and Nile B fabrics which show clear evidence of use and heavy smoke staining, and which come from contexts with heavy domestic bias, such as WG 70, WG 74 and WG 40. These vessels are too small to have been used for mass catering and growing evidence for their quite extensive presence suggests that some of the site's inhabitants may have brought or been provided with their own, personal vessels and that food may in some cases have been prepared by individuals or small groups, perhaps in small official sub-divisions or work gangs.

Having established that much of the ceramic material is likely to have been imported into the site, the question now arises whether any ceramic material might actually have been produced at the site. This is a very difficult question to answer despite some scanty evidence for a low level of possible ceramic production at WG 19 (Bard and Fattovich 2007: 101, 107). The site itself seems to be a very unpromising area for the large-scale production of pottery, which would have required access to a variety of reliable clay sources and considerable, regular supplies of fuel and fresh water, none of which would seem to be readily available. To have produced on site the quantity of ceramic material found to date would have required workshops of industrial scale and there is no evidence of production on this scale. It also seems unlikely that clay and other raw materials would have been brought to the site in order to produce vessels *in situ*, and this would have had to be the case for the majority of vessels which are indisputably made from marl clays and Nile alluvium and not from local material.

It would certainly seem, therefore, that a significant proportion of material could not have been produced at the site and that vessels were brought in ready-made, in some cases as valuable personal possessions, but more usually for specific often domestic use or as containers for other materials. Even the tubular bread molds, which are present in considerable quantity on the site, appear to be made in a technique and from a material very similar to that found in the Nile Valley, and although it seems unlikely they may well also have been brought to the site (see 4.1.h Bread molds and platters).

The pottery from recent excavation continues to add to the picture of varied domestic activity on the site. WG 40 had very clear evidence of this, being a very mixed assemblage of jars, cups and plates in Marl C, Marl A3, Nile B1 and Nile B2, and especially noteworthy are three large Nile C dishes all of a diameter over 40 cm and with typical Middle Kingdom technology of scraped exterior bases with red wash on the interior. These three plates, like much of this deposit, showed smoke blackening and evidence of cooking. The deposit included a number of small blackened Marl C cookers, one with a diameter of 10 cm suitable only for one or two portions rather than catering on a large scale. The deposit also contained a piece of Nile D from a small basin with a rolled rim and red wash on the outside. Nile D is almost never seen at Wadi Gawasis.

WG 74 also showed the usual wide range of domestic material from large Marl C jars to small Nile B1 and Nile B2 cups. It also included some pieces of a large bread platter, as described above, probably of local manufacture. Many vessels showed definite smoke staining from cooking. There was a complete hemispherical bowl in Nile B1 fabric with a shallow profile, which had clearly been scraped too hard by the potter when finishing the exterior of the base. There are obvious signs of a hole which had been patched with wet clay before firing, leaving the potter's fingerprint and also a small hole remaining in the vessel wall. That the vessel remains whole and intact may be due to the fact that it leaked from first use and was discarded whilst still complete. The assemblage is dated late 12th to early 13th Dynasties on the basis of the range of Marl C jar rims present. This context also contained the Marl A2 jar referred to above. This was of extremely good technical manufacture with a wheel-made ring foot applied to a rounded scraped base. The exterior of the vessel had been finely burnished and although the top and rim of the vessel were missing, making it difficult to match it to an exact type, it was obvious that this was a very fine piece of pottery in which the new technology using a ring foot was being employed, again suggesting a later Middle Kingdom date.

Other areas of the site which were excavated in 2010-2011, including WG 64, WG 65, WG 71, WG 75 and WG 70/72/73/76, all date to the Middle Kingdom and their material reflects what is known to be representative of the site. A number of pre- and post-firing pot marks were again recorded and these will be the subject of a separate study. One which is of particular interest was incised post-firing and the signs *kA nb mh* can be distinguished. Of particular interest amongst the vessel types identified, is a sandy Nile B2 water jar from WG 70, which has a red outer coating and a flared rim and which is of a very typical 12th Dynasty form, and also two pieces of Marl A3 vessels with wavy line decoration, one from WG 75 and one from a carinated bowl in WG 71, which has close parallels at Kahun and which was found in association with the type of corrugated rim defined by Bader as type 47 and dated to the early 12th Dynasty (Bader 2001: 145). This early material in combination with other evidence from the site helps to confirm that the site was occupied over a considerable period of time beginning in the early 12th Dynasty and extending into the 13th, whilst the wide range of material is beginning to show that the ceramics from the site had a huge range of functions and that activities of many types were taking place, especially in the context of food provision, storage and production.

Table 7 summarizes the distribution of types/classes dating to the early-mid 12th Dynasty, to the late 12th-early 13th Dynasty, and to the 13th Dynasty in ceramic assemblages investigated at Mersa/Wadi Gawasis from 2006 to 2011. All the other investigated assemblages can be dated in general to the Middle Kingdom. Appendix 1 provides more specific information on the composition of the different ceramic assemblages.

4.1.e Pot marks

Sally Wallace-Jones

A large number of pot marks was identified at Mersa/Wadi Gawasis (see also Bard and Fattovich 2007: 106). They occur almost exclusively on jars of Marl C and related fabrics with a few from Marl A3. Some of these appear to be related to quantity or counting (see *e.g.* Figure 94 3-4), whilst others may represent different and as yet unclear meanings. Many of the large Marl C storage have pot marks perhaps related to "governmental distribution of supplies across expanding territory" (Shaw 2009: 76). They were all made before firing with few exceptions.

Early-Mid 12th Dynasty Types	WG 26 SU95; WG 32 SU10; WG 32 SU25; WG 32 SU33; WG 32 SU46; WG 33 Radim; WG 36; WG 43 SU1; WG 43 SU2; WG 45 SU1; WG 45 SU2; WG 46 SU1; WG 46 SU2; WG 47 SU1; WG 47 SU2; WG 49 SU1; WG 49 SU2; WG 50 SU1; WG 50 SU2; WG 51 SU1; WG 51 SU2; WG 51 SU3; WG 52 SU1; WG 53 SU1; WG 53 SU25; WG 54 SU1; WG 55 SU1; WG 55 SU2; WG 55 SU4; WG 55 SU8; WG 56 SU1; WG 57 SU1 SU2 Interface; WG 61 Surface; WG 61 Fire pits; WG 61 SU2; WG 61 SU7; WG 61 SU10; WG 61 SU19; WG 61 SU21; WG 61 SU32; WG 61/WG 65 SU19; WG 61/WG 65 SU32; WG 61/WG 65 SU45; WG 63 SU1; WG 63 SU2; WG 65 SU2; WG 65SU3; WG 65 SU20; WG 66 SU2; WG 66 SU3; WG 67 SU31; WG 70; WG 70-72-73 SU2; WG 71 SU6
Late 12th Dynasty-early 13th Dynasty Types	WG 32 SU1; WG 32 SU10; WG 32 SU25; WG 32 SU33; WG 32 SU46; WG 33 Radim; WG 33 SU2; WG 33 SU3; WG 36; WG 43 SU1; WG 43 SU2; WG 45 SU1; WG 45 SU2; WG 46 SU1; WG 46 SU2; WG 47 SU1; WG 47SU2; WG 49 SU1; WG 49 SU2; WG 50 SU1; WG 50SU2; WG 51 SU1; WG 51 SU2; WG 51 SU3; WG 52 SU1; WG 53 SU1; WG 53 SU10; WG 53 SU25; WG 54 SU1; WG 55 SU1; WG 55 SU2; WG 55 SU4; WG 55 SU8; WG 55/56 SU2/SU7; WG 56 SU1; WG 56 SU2; WG 57 SU1 SU2 Interface; WG 61 Surface; WG 61 SU2; WG 61 SU10; WG 61 SU21; WG 63SU1; WG 63 SU2; WG 65 SU2; WG 66 SU2; WG 66 SU3; WG 67 SU31; WG 69 SU1; WG 69 SU2; WG 69 SU3; WG 70; WG 70-72-73 SU2; WG 70 SU3; WG 71 SU5; WG 74 SU1
13th Dynasty Types	WG 32 SU1; WG 32 SU10; WG 32 SU25; WG 32 SU33; WG 33 Radim; WG 33 SU2; WG 33 SU3; WG 45 SU1; WG 46 SU1; WG 46 SU2; WG 47 SU1; WG 47 SU2; WG 49 SU2; WG 50 SU2; WG 51 SU3; WG 52 SU1; WG 53 SU1; WG 55 SU1; WG 55 SU2; WG 55/56 SU2/SU7; WG 65 SU2; WG 67 SU31; WG 69 SU1; WG 69 SU2; WG 69 SU3;WG 75 SU1

Table 7. *Distribution of types of different chronology in the ceramic assemblages.*

4.1.f Ceramic and wooden discs

SALLY WALLACE-JONES AND CHIARA ZAZZARO

A number of wooden and pottery discs have been found at Mersa/Wadi Gawasis. Despite the fact that they had tentatively been identified as gaming pieces, net floats etc., they are discussed here because their function may be directely related to the ceramic assemblage. Indeed, the discs are not pierced, although they do have a distinctive groove in mid-circumference and in many examples this groove has had string fitted into it (Figure 95). One of the discs also appears to have been marked with a geometric shape. It was noted during the 2007-2008 season that these discs may have been used as jar stoppers, with the string acting as a kind of seal whilst the disc fitted into the top of a jar or bottle to prevent the sealing mud from falling into the contents. Many of the bottle and jar rims have a cupped internal ridge and a fairly standard diameter, and this is especially true of the cupped rim seen most frequently at Mersa/Wadi Gawasis where the diameter is often around 15 cm. Bottle rims also seem to have diameters which are fairly consistently sized around 9 cm.

There are two sizes of discs at Mersa/Wadi Gawasis: a smaller one often made of a cut down potsherd and a larger size which seems to occur mostly in wood. When tried, the smaller size fitted well into a variety of bottle necks, whilst the larger size fitted the cupped rim very well. Therefore, it is proposed that these discs were used in the necks of jars and bottles to give a better and more effective seal, which might have been of great significance if goods were being provided for long sea voyages.

Similar objects are also found in the Petrie Museum of Egyptian Archaeology, London, and have been interpreted as netting reels (UC7440), reels for thread (UC7472), and lids (UC71380).

4.1.g Model vessels

Sally Wallace-Jones

Amongst other items of significance excavated in 2007-2008 are two very small sherds which may, in some way represent miniatures or model vessels. One of these, from WG 32, is a Marl A3 rim of an interesting funnel shape, resembling a 12th Dynasty water jar but much smaller than the usual size of these vessels, having a diameter of only 6 cm and a vessel wall thickness of about 2-3 mm. Its function remains uncertain although it could be a miniature.

Another, from WG 55/WG 56, is a tiny Marl A3 rim, 1-2 mm thick and with a diameter of 45 mm (Figure 96). It was found in the entrance to Cave 7 and appears to be similar in form to the ridged rims of Bader types 46 and 47 (Bader 2002), although it is significantly smaller. It was clearly wheel-made and finished very carefully and finely. Its size makes it likely that it is a miniature jar, and its context, next to the "alcove shrine," suggests an offering.

A third example, of Marl C fabric, may be a model of a *zir*. It was excavated in the 2006-2007 field season in WG 38, the southern slope of the terrace into the wadi in the "harbor area," where the "beach" layer was encountered along with sherds of large storage jars. This is 9 cm in diameter with a typical folded rim and has every appearance except its size of being a large storage jar. It is without parallel at the site.

Miniatures are known from early times in ancient Egyptian history and occur at many sites where they were used as offerings, in foundation deposits and similar contexts, as is suggested by the sherd of a model vessel from WG 55/WG 56. But the find contexts of the other two model vessels is quite different.

4.1.h Bread molds and platters

Sally Wallace-Jones

Tubular bread molds have been a matter for my concern, as the loaves produced in them are not of great size and despite the large number of pieces found on the site and in the industrial area around WG 19/25/26/27 (Figure 97), at the base of the western slope, they seem somewhat inadequate for the production of such an important staple as bread on any kind of sensible scale, especially as the molds often have to be broken to release the bread, making them very labor intensive.

It was felt when WG 19/25/26/27 (the "production area") was excavated (2003-2004 to 2006-2007) that it represented an industrial area where ceramic production may have taken place (Bard and Fattovich 2007: 73-76, 108-110), and I would like to suggest that this is possible but that the production could have been linked specifically to bread mold manufacture and possibly to bread production rather than general ceramic manufacture. The tubular molds found at WG 19/25/26/27 are described as having been pre-fired and lined with a thin layer of clay (Figure 98), which is much as one would expect from bread molds excavated in other parts of Egypt. However, there are also many examples of tubular bread molds from the site which are made in a coarse, sandy, low fired clay and which often lack the lining of fine clay slip. It is possible that tubular bread molds were stored in this industrial area ready for use and that if and when it became necessary, more bread molds could have been produced on site from local materials, which could have been resourced as required. It would have been difficult to achieve anything other than relatively low firing temperatures in the dump-type kilns suggested by the evidence, but this would have been sufficient for bread mold material. The lining may also have been omitted if technology or resources were limited by the constraints of the site.

Furthermore, I believe that there is evidence that ovens like the one found in WG 17 (Bard and Fattovich 2007: 69), which also resembles the evidence found in WG 19, may have been used for bread production rather than for firing clay. In such ovens platters could have been used as bases for domed ovens, taking the form of large, very low fired, thick, clay platters, of which there are a number of examples from the site (including some from the 2010-2011 field season). These are often found in association with burnt organic material and in WG 19 the 2005-2006 report mentions that "of significant interest was a fire-pit with a fragmentary partially fired platter still *in situ*" in WG 27, B5, SU48 (Fattovich and Bard 2006: 30). This could have been used for baking rather than firing, the platter being inside the oven not to be fired but to be used as a platform for bread baking. Platters of this type could well have been produced and fired at the site in a very limited way using local clay and very low firing temperatures to produce oven bases, which could then be used for baking large round loaves similar to the *eish shamsi* produced in Upper Egypt in modern times. Low firing of the platter in WG 27 goes some way to explaining why the bases appears only partially fired, whilst subsequent reheating during baking could explain why the platter had fragmented as a result of thermal shock. This is known to happen to the bases of clay bread ovens of the type used in Egyptian villages, which periodically need to be replaced. It would make good sense to produce such large, fragile items of pottery as locally as possible. Bases could then be replaced as necessary through local production and the ovens could be used over and over again to produce sufficient bread for daily consumption.

The clay used for the platter bases is very low fired and has a reddish to greyish brown color often with a dark grey core. The material is open in texture, softer and more crumbly than is usual in any Nile material. The matrix contains a considerable amount of coarse straw and straw voids in a random arrangement. Straw is not always burnt out and pieces up to 4 mm in width have been recorded. The clay also contains a considerable amount of rounded sand grains and other mineral particles, including small stones of up to 5-6 mm in diameter. Bases are very thick, usually between 6 and 7 cm, and are hand-made. The paste is well prepared and the bases are well shaped, made and finished, but the unusual texture of the clay and the low firing do point to the possibility of a local manufacture, whilst the hand-shaping of these items would also eliminate the need to bring specialist equipment such as a wheel to the site. I therefore think that it is possible that some clay production may have been taking place at the site, but with limited technology and resources and for a very specific need.

On the bread molds see also Appendix 2.

4.2 Exotic ceramics

4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics

Andrea Manzo

The study of the materials from Nubia and the regions of the southern Red Sea already demonstrated its relevance for a better understanding of the organization of the Egyptian expeditions to Mersa/Wadi Gawasis and Punt and of the broad network extending all over the Red Sea and neighbour areas in the early 2nd millennium BC (Manzo 2010a, 2012a, 2018b). In the field seasons from 2006-2007 to 2010-2011 58 sherds of exotic type ascribable to known classes from Nubia and the regions of the southern Red Sea have been discovered at Mersa/Wadi Gawasis, in addition to the 29 ones discovered in from 2001 to 2005 (Bard and Fattovich 2007: 126). They can be distinguished into two main categories, sherds related to Nubian cultures (C Group, Pan-Grave, and Kerma), and sherds imported from the regions of the southern Red Sea, both from the African and the Arabian side. Finally, a few other atypical sherds were discovered. The description and, when possible, the typological classification of these materials follows.

Sherds of Nubian type

1) WG 61 D-E 2 SU45: rim sherd of small dark brown, reddish brown or grey ware closed bowls with direct or slightly everted rim decorated with horizontal incised lines on the body and sometimes small impressed notches on the top of the rim (Figure 99) (see also Manzo 2010a: 441, n. 1, Fig. 2 a, 2012a: 48, Fig. 6:2 a, 2012b: 214-215, n. 1, Fig. 2 a, 2018b: 128-129, n. 1, Fig. 150 a).

In Egypt similar vessels but apparently without notches were recorded in a 12th Dynasty assemblages of the C Group and perhaps Pan-Grave cemeteries at Hierakonpolis in Upper Egypt (see Friedman 2007: Fig. 2 m and de Souza 2019: Fig. 39 b respectively), and in First Intermediate Period-11th Dynasty assemblages at Elephantine (Seidlmayer 1991: 343-344, Abb. 1, 8). This kind of vessel also occur in Second Intermediate Period-early New Kingdom Pan-Grave cemeteries in Lower Nubia (Bietak 1968: Taf. 16, type P 13), but it was nevertheless regarded as more typical of the C Group than of the Pan-Grave culture (de Souza 2019: 47). In the Second Cataract fort of Askut vessels decorated with parallel horizontal grooves were considered as related to the Pan-Grave culture, although similarities with materials from the C Group assemblage at Wadi es-Sebua East were also remarked (Smith 1992: 33, Fig. 2, c). Vessels of this type were common at Wadi es-Sebua East, in a C-Group domestic context, where they were used as cooking-pots but, as they were rare in other C-Group sites, they have been considered a possible Pan-Grave element (Gratien 1985: 52-53, type NT 8, Fig. 12). The date proposed for the Wadi es-Sebua settlement is from the very end of the 12th Dynasty to the Second Intermediate Period (Gratien 1985: 54-55). The fact that similar vessels were also occurring in phases later than the Middle Kingdom is confirmed by the fact that in the fort of Mirgissa they are labelled as *Kerma classique* materials (Gratien 2006-2007: 159, Fig. 2, a-b), and they also occur in the SJE concession area at sites 18 C and 176, dating to the Second Intermediate Period-first half of the 18th Dynasty (Säve-Söderbergh ed. 1989: Pl. 37, 8, 176/76:0 from site 176, and Pl. 163, 6 from site 18 C).

At Kerma, in the sector of the Western Deffufa, this kind of vessel was recorded in assemblages dating from the second half of the 3rd millennium BC (Privati 2004: 174, Fig. 137, 15, 178, Fig. 139, 8). Similar vessels were also collected in the *Kerma moyen* cemeteries in the Fourth Cataract region (Kołosowska and Mahmoud el-Tayeb 2006-2007: 212, Fig. 8, b, Fig. 9, b, Braddock 2003: 53, Fig. 3.4, 29 and perhaps also Emberling and Williams 2010: Fig. 26, d), while they are absent in other Upper Nubian Kerma assemblages, where sherds which may recall our type, considered as a possible Pan-Grave element, are not characterized by the notches on the lip, and also the incised lines on the body seem to be less regular than in our case (Welsby Sjöström 2001a: 247 Fig. 5.65, decoration D58).

Similar types were recorded at site D 5, in the Wadi Allaqi region of the Eastern Sudanese Desert and roughly dating from 2500-1500 BC

(Sadr, Castiglioni, and Castiglioni 1993: 32, Fig. 4.2), in other sites of the Sudanese Eastern Desert,[6] and in the Eritrean-Sudanese lowlands, in Middle to Late Gash Group (ca.2000-1800 BC),[7] where they are considered imports and/or imitations of Nubian types (Manzo 1997: Pl. 4 c), and Jebel Mokram Group assemblages (ca. 1800-800 BC) (Sadr 1990: Fig. 5, v).

2) WG 47 E 2, SU1 lower interface; WG 49 D 4, SU2; WG 55 E 3, SU4; WG 66 D-E 3, SU3; WG 70 D5, SU3; WG 74, SU3: body sherds of dark brown or grey organic and/or mineral tempered ware open or slightly closed bowls with oblique incised and/or crossing bands of incised lines covering the upper part of the body (Figure 100) (see also Manzo 2010a: 441-442, n. 3, Fig. 2 c, 2012a: 48-50, Fig. 6:2 c, 2012b: 217-218, n. 3, Fig. 2 c, 2018b: 129-130, n. 3, Fig. 150 c).

Sherds of vessels with this decoration always interpreted as cooking-pots were discovered at Ballas, near Thebes, in a domestic context associated with *Kerma classique* and Egyptian pottery going back from the late 17th to early 18th Dynasty (Bourriau 1991: 131, Fig. 1, 2), like at Aswan, where similar vessels are dated to the early 18th Dynasty (Forstner-Müller 2012: 63, 78, Fig. 14, 29-30). Nevertheless, this is a widely occurring type, also recorded in settlement sites dating from the late Middle Kingdom to the Second Intermediate Period at Tell Edfu (Ayers and Moeller 2012: 107, 111, Fig. 4, b 2280, Fig. 8, 2547 N. 1), Memphis (Bourriau 2012: 149-150, Fig. 1, Fig. 4, b-f, Fig. 5, d-f), Qasr el-Sagha (Arnold 1979: 34-36, Abb. 21, 1, 2; Śliwa 1992: Abb. 3, 3), in the Kharga oasis (Manassa 2012b: 133, Fig. 6, a-b), and at Tell el-Daba (Aston 2012: 167-170, 172, Fig. 1, 9014F, 9014H, 9024B/9242S, Fig. 2, 8964J; Forstner-Müller and Rose 2012: 188, 191, 193-194, Fig. 20, 1-2, Fig. 22, 1, Fig. 27, Fig. 28). Also in the Pan-Grave cemetery at Hierakonpolis (de Souza 2019: Fig. 38 c, Fig. 40 b, Fig. 41 a, Fig. 42 b;

[6] These are the sites AN, ED6, R56, RD19, investigated by CeRDO (Research Center on the Eastern Desert) in the field seasons 2004-2008. The systematic study of these materials is presently in progress.

[7] The absolute chronology of the Gash Group and Jebel Mokram Group assemblages adopted in this paragraph is based on a recent review of the available evidence, see Manzo 2018a.

Giuliani 2001: 41-43, Fig. 11, a-e, i, Fig. 12, a-b, e), in the cemeteries in the Wadi Kubbaniya, northwest of Aswan (Gatto and Giuliani 2006-2007: 123-124, Fig. 7), of Sheikh Mohamed and Nag el-Qarmilla, near Aswan (Gatto, Gallorini and Roma 2012: 93-95, Fig. 7 f, Fig. 9, 4, 7, 9, Fig. 10, 5), of Moalla (Manassa 2012a: 123, Fig. 6b, d, Fig. 8) similar vessels, considered as cooking pots, are associated to Egyptian pottery dating from the late Middle Kingdom to very beginning of the Second Intermediate Period.

In the Second Cataract fort of Askut this kind of vessels, most probably used as cooking pots, were collected in Middle Kingdom (late 12th-13th Dynasty) and late Second Intermediate Period-New Kingdom assemblages, and were ascribed to the Pan-Grave culture (Smith 1992: 28, 33, Fig. 1, b, Fig. 3, a-b, 1995: Fig. 3.16, B, Fig. 4.10, A-B). At Mirgissa, where sherds of this type were originally labelled as Pan-Grave or C-Group, they are now ascribed to the late *Kerma moyen*- *Kerma classique* culture (Gratien 2006-2007: 155-156, Fig. 2, g-h). Therefore, the same can be proposed for the sherds of this type from Askut, because there they are associated with a consistent amount of Kerma materials (Smith 1992: 28-33).

Vessels of this type were recorded also at Sayala (Bietak 1966: Taf. 25-26 Grab B/1 # 76001, 76002, and 76003/a, Taf. 27, Grab B/3, # 76020, 76015/b, Taf, 30 Grab B/10, 76046/b, Taf. 31, Grab B/12, 76052/a; type P 8/9 of Bietak 1968: Taf. 16) in a Second Intermediate Period-early New Kingdom Pan-Grave cemetery (Bietak 1968: 149-157), and at sites 47 and 193, two Pan-Grave cemeteries dating from the Second Intermediate Period and early New Kingdom in the concession of the Scandinavian Joint Expedition (Säve-Söderbergh ed. 1989: 166-174, 218-219, Pl. 20, type PI c2, 47/A, and type PI b4 47/1:1, 47/121:1, 47/51:1, and 193/3:1). Indeed, this type of decorated vessels should be regarded as very distinctive of the Pan-Grave culture (de Souza 2019: 47).

Similar vessels were recorded also in the Kerma cemetery of Ukma West, in assemblages ascribed to a component of the population considered more related to domestic commitments, dating from 1800-1550 BC (Vila 1987: 262, 264, Fig. 42, 4, Fig. 94, 5, Fig. 170, 1, Fig. 173, 3), in *Kerma moyen* (2050-1750 BC) assemblages in the area of the Western Deffufa at Kerma (Privati 2004: 163, 166, 178,

Fig. 128, 12-13, Fig. 129, 9, Fig. 130, 12-13, 170, Fig. 133, 8, 180, Fig. 139, 10, 12, Fig. 140, 11), and in other *Kerma moyen* assemblages in Upper Nubia (Welsby Sjöström 2001b: 350, Fig. 6.2, BU 5.2; Welsby Sjöström 2001a: 330, Fig. 5.62, decoration D40.1, D40.9), as well as in the Fourth Cataract area (Emberling and Williams 2010: Fig. 25, a-i).

In the Eritrean-Sudanese lowlands this kind of vessel was recorded in Classic and Late Gash Group assemblages (ca. 2000-1800 BC) (Manzo 1997: 79), and in the Pan-Grave component of the Jebel Mokram Group culture (ca. 1800-800 BC) (Sadr 1987: 273, Fig. 5, Fig. 10, 1990: Fig. 5, u).

Finally, this type was also recorded in surface collections from sites in the Sudanese Eastern Desert presumably dating from the 2nd millennium BC.[8]

3) WG 33, SU1: gray ware body sherd, with smoothed gray internal surface, gray external surface, and small sized mineral inclusions. The external surface is characterized by a sector filled by crossing incised lines and delimited on two sides by impressed bands consisting of a thick wavy pattern formed by triangular impressions (Figure 101 A) (see also Manzo 2010a: 443, n. 10, Fig. 2 h, 2012b: n. 8, Fig. 2 h, 2018b: 131, n. 8, Fig. 150 h).

The decoration recalls some potsherds from Kerma sites in the Fourth Cataract region dating from the first half of the 2nd millennium BC (Kołosowska, Mahmoud el-Tayeb and Paner 2003: Pl. 6, Kołosowska and Mahmoud el-Tayeb 2006-2007: 212, Fig. 8, c; Wolf 2004: Pl. 4, see also Emberling and Williams 2010: Fig. 26, j, Fig. 28, e-f; Sidebotham, Thomas, and Harrell 2010: 95, Fig. 21, 17), materials from sites probably dating from the 2nd millennium BC in the Sudanese Eastern Desert,[9] and from sites in the Eritrean-Sudanese lowlands, especially in the region of Agordat, ascribed to the Gash Group and to the Jebel Mokram Group (Arkell 1954: Pl. VI, 6, VII, 4, VIII, 5).

4) WG 55 D 3, SU2: A gray ware rim sherd of a bowl or cup with gray smoothed external surface characterized by red spots and wiped internal

[8] Sites AL, ED16, RD14, RD15.

[9] Site R49.

surface. Mineral tempered paste. Decoration consists of irregularly arranged horizontal, vertical, and oblique bands of parallel incisions delimiting undecorated sectors on the external surface. A band of crossing notches is on the top of the lip (Figure 101 B) (see also Manzo 2012a: 48, Fig. 6:2 b, 2012b: 220-222, n. 9, Fig. 3 a, 2018b: 131-132, n. 9, Fig. 151 a).

The decoration and shape recall Pan-Grave types with irregularly decorated external surfaces, like the ones from Lower Nubian cemetery 47, close to Debeira East, in the concession of the Scandinavian Joint Expedition, dating from the Second Intermediate Period-early New Kingdom (Säve-Söderbergh ed. 1989: 166-174, Pl. 20, type PI a5 47/65:3). The decoration with crossing notches on top of the lip also recalls sherds from the C Group II settlement 18 C, again in the concession of the Scandinavian Joint Expedition, whose pottery was also considered to be characterized by similarities with the Pan-Grave one (Säve-Söderbergh ed. 1989: 261-262, Pl. 163, 4), but for the rest the triangular, zigzag and parallel oblique incised patterns on the external surface from 18 C are more regular and different from that of the sherd from Mersa/Wadi Gawasis.

Also at Wadi es-Sebua, in domestic C-Group assemblages dating from the very end of the 12th Dynasty to the Second Intermediate Period (Gratien 1985: 54-55), bowls, considered a Pan-Grave intrusive element (Gratien 1985: 52), often have notches on the lip, but they are not crossing and the incised decorations on the external surface appear to be more regular than in the case from Mersa/Wadi Gawasis (Gratien 1985: 51, 53, types NT7 and NT9, Fig. 11, 314, 352, Fig. 13, 264-265, 221, 223, 311).

At Kerma, in the area close to the Western Deffufa, *Kerma moyen* assemblages are characterized by bowls with notches on the lip which are always associated with a pattern of regular incised triangles on the external surface (Privati 2004: 168, Fig. 130, 8, Fig. 131). On the contrary, crossing decorations on the lip of bowls with a profile similar to the one of the bowl from Mersa/Wadi Gawasis were recorded in Upper Nubian Kerma assemblages, where types reminiscent for the irregular external decoration the sherd from Mersa/Wadi Gawasis also occur (Welsby Sjöström 2001a: 324, Fig. 5.55, decoration D1.13-14, 265, Fig. 5.34, shape D16.7, see also 265, Fig. 5.34, B18.3 for a similar association of decorations on the lip, and on the body of a bowl). Types characterized by similar decorations on the top of the lip and on the external surface were also recorded in Kerma assemblages from the site of El Kab in the Fourth Cataract area (Sidebotham, Thomas, and Harrell 2010: 107, Fig. 34, 1).

5) WG 46, E4, SU1-2; WG 49, E5, SU2: gray ware rim sherds of bowls, with smoothed gray surfaces and small and medium sized mineral inclusions. The lip is modeled, slightly everted and thickened. The external surface is characterized by vertical or oblique incised lines crossing other horizontal to slightly oblique parallel lines (Figure 102) (see also Manzo 2012a: 50, Fig. 6:2 d, 2012b: 222, n. 10, Fig. 3 b, 2018b: 132, n. 10, Fig. 151 b).

The decoration and shape recall Pan-Grave types, both from Egypt (see *e.g.* Giuliani 2001: Fig. 11, c and d) and Lower Nubia (see *e.g.* Bietak 1966: Taf. 30, Grab B/11, 76047/c), but also some fragments in domestic C-Group assemblages at Wadi es-Sebua dating from the late Middle Kingdom-Second Intermediate Period (Gratien 1985: Fig. 14, 260). In particular the modelled shape of the rims should be regarded as a distinctive trait of the Pan-Grave culture (see de Souza 2019: 28, Fig. 28 M1-5).

Sherds with similar decoration and also recalling the shape of the rim from Mersa/Wadi Gawasis were recorded in surface collections from sites in the Sudanese Eastern Desert probably dating from the 2nd millennium BC,[10] and in Eastern Sudan in Jebel Mokram Group assemblages dating from ca. 1800 BC to the early 1st millennium BC (Sadr 1987: 272-273, Fig. 5).

6) WG 68, SU1; Cave 2, B2, SU76: body sherds of gray to brown micaceous ware bottles or flasks with mineral tempered paste homogeneous in color, gray polished external surface and gray smoothed internal surface (Figure 103) (see also Manzo 2012a: 50, Fig. 6:2 e, 2012b: 222, n. 11, Fig. 3 c, 2018b: 132, n. 11, Fig. 151 c).

Most likely these sherds can be ascribed to black polished *Kerma moyen* (Privati 1999: 47, Fig. 13, 7) and *Kerma classique* flasks (Reisner 1923: 374-381, Fig. 255-258) from Upper Nubia. Few similar sherds were recorded in the Eritrean-Sudanese lowlands, where they are considered imports or imitations of Nubian types, in Late Gash Group assemblages (ca. 2000-1800 BC) (Manzo 1997: 79, Pl. 3 b).

[10] Site ED16.

Other hand made sherds probably to be ascribed to Nubian types on the basis of their fabric, but too small to be ascribed to specific classes were collected in WG 31, SU1; WG 33, SU1 (3 fragments); WG 42, A2, SU1; WG 42, A2, SU2; WG 46, E1, SU1; WG 46, E1, SU1; WG 46, E5, SU1 interface with SU2 (3 fragments); WG 47, A5, SU2; WG 49, A2, SU2 (5 fragments); WG 51, SU1 interface with SU2; WG 51, C2, SU1 (3 fragments); WG 55, C1, SU8; WG 55, D1-3, SU2; WG 61, C2-3, SU49; WG 61-65, SU32 (2 fragments); WG 61-65, SU45; WG 65, A/B 2-3, SU2 (2 fragments).

Sherds from the regions of the Southern Red Sea

1) WG 56, A2, SU8: fragmentary shoulder of mineral tempered brown ware jars with burnished surfaces (Figure 104 A) (see also Manzo 2010a: 443, n. 1, Fig. 4, a, 2012a: 50, Fig. 6.3 a, 2018a: 133, n. 1, Fig. 151 g). Moulded decoration consisting of two parallel vertical ledges in a case also associated with some horizontal ledges.

This type of vessels might be compared to jars with everted rim and a similar moulded decoration on the shoulder from the site of Ma^{c}layba, in the Yemeni coastal region, found in disturbed assemblages and, therefore, of unclear chronology (Buffa 2007: 145, Pl. 39, 244-245; Vogt and Buffa 2005: 439, Fig. 2, 8).

2) WG 32, A5, SU39: fragmentary everted rim of a mineral tempered reddish brown ware flask with gray spots, smoothed surfaces (Figure 104 B) (see also Manzo 2012a: 50, Fig. 6.3 b, 2018b: 133, n. 2, Fig. 152 a).

The shape of this rim and its ware reminds of types discovered at Ma^{c}layba, in the Yemeni coastal region, in assemblages of phase 1B of the site associated with a radiocarbon date to 1780-1610 BC (Buffa 2007: 140, 169, Pl. 36, 223). Nevertheless, the burnished bands characterizing the type at Ma^{c}layba are not visible on the rim from Mersa/Wadi Gawasis.

3) WG 47, B2, SU1; WG 33, SU3; WG 65, A-B2-3, SU2: rim sherds of dark gray mineral and/or organic tempered closed bowls (Figure 104 C) (see also Manzo 2010a: 443, Fig. 4 b, 2012a: 50, Fig. 6.3 c, 2018b: 133, n. 3, Fig. 152 b). Sometimes, several horizontal or oblique burnished lines occur on the surfaces (Figure 104 D).

Both the shape and the burnished decoration of these sherds are similar to materials from Ma^{c}layba, in the Yemeni coastal region, in assemblages of phase 1A, dating to the first quarter of the 2nd millennium BC (Buffa 2007: 56, Pl. 28, 173, 138).

4) WG 26, C4, SU97; WG 31, SU1; WG 32, A5, SU39; WG 32, B4-5, SU25; WG 52, SU1: rim sherds of reddish brown ware bag shaped jars or bottles, with homogeneous in colour mineral tempered paste, reddish brown external burnished surface, smoothed internal surface (Figure 104 E) (see also Manzo 2012a: 51-52, Fig. 6.3 e, 2018b: 133, n. 5, Fig. 152 d). Sometimes burnished oblique lines were remarked on the externals surface.

Just one of these bottles was recorded at Mal^{c}ayba in the Yemeni Tihama in an assemblage of phase 1B, dating to ca. 1850-1600 BC (Buffa 2007: 64, 140, Pl. 40, 251), some of them were collected in pre-Aksumite assemblages of unspecified chronology at Adulis, on the Eritrean Red Sea coast (Manzo 2010b: 32, Fig. 4 a), while bottles of this type are very common in the Ona sites of the Hamasien plateau.[11] Therefore, despite the fact that the available radiocarbon dates for the Ona sites go back to the 1st millennium BC (Schmidt, Curtis and Zelalem Teka 2008: 156-158), an earlier phase of this culture in the first part of the 2nd millennium BC cannot be excluded on the basis of the chronology of the sherds collected at Mersa/Wadi Gawasis and of the sherd from Mal^{c}ayba. Moreover, a connection between the Ona sites the still badly known earliest phases of Adulis cannot be excluded.

5) WG 65, A4-5, SU46: a brown micaceous mineral tempered ware body sherd with smoothed surfaces. The external one is characterized by a band of parallel impressed lines most likely obtained with the edge of a shell (Figure 105 A) (see also Manzo 2012a: 50, Fig. 6.3 d, 2018b: 133-134, n. 6, Fig. 153 a).

The decoration may be compared to a technique recorded in sites of the Djibuti region dating to the first half of the 2nd millennium BC (Gutherz, Joussaume, Amblard and Guedda Mohammed 1996: 273-279, Fig. 9; Joussaume 1995: Fig. 12, 1-2; Poisblaud 2002: 209-210, Fig. 16; Poisblaud 2004-2005: 119). The decoration also reminds of the still undated

[11] Comparison with unpublished drawings of materials from the Asmara region by G. Tringali kept in the Laboratory of the Oriental Museum “Umberto Scerrato” of the University of Naples “L’Orientale”.

pottery from the deepest levels of the Eritrean site of Adulis presently kept in the National Museum, Asmara (Manzo 2010b: 29-30, Fig. 1).

6) WG 39 Cave 3 A 10, SU11: gray ware body sherd, with dark gray polished internal surface, reddish brown external surface, and medium sized mineral inclusions. Incised and impressed decoration on the external surface consists of parallel grooves covered by comb impressions (Figure 105 B) (see also Manzo 2010a: 443-445, Fig. 4 c, 2018b: 134, n. 7, Fig. 153 b).

Sherds characterized by similar decorations were recorded in the Eritrean-Sudanese lowlands at Agordat (Arkell 1954: 58-59, Fig. 27, Pl. VI, 4). This type also reminds of the early to mid-2nd millennium BC Gash Group basket ware from the Eritrean-Sudanese lowlands.[12]

Finally, three sherds characterized by a decoration consisting of burnished lines which is typical of the Yemeni coastal region (see Buffa 2007: 34-35) but too small to be ascribed to specific types were collected in WG 33 SU3 hearth 3. Considering the fact that the archaeological exploration of the regions of the southern Red Sea is still in its infancy, also two atypical sherds from WG 19 A 5, SU106 and WG 26 C 4, SU97 (see Manzo 2018b: 134) may have been imported from those areas.

Final remarks

In general, the materials of Nubian type and the ones from the regions of the southern Red Sea are characterized by a chronology ranging from the mid 3rd millennium BC to the mid 2nd millennium BC (see also Manzo 2010a: 446, 2012a: 52, 54, 2012b: 223-224, 2018b: 134), therefore roughly fitting with the absolute chronology of the associated Egyptian materials and with the phases of use of the harbor (Bard and Fattovich 2007: 241-242).

Also the typological remarks proposed elsewhere remain valid (see Manzo 2010a: 446, 2012a: 54, 2012b: 224-225, 2018b: 134). The only imported containers for storage are represented by the fragments of shoulders of jars with modeled decoration and by the fragments of bag-shaped bottles from the southern Red Sea, while among the Nubian sherds the only ones to be identified as fragments of a vessel for storage are the ones from small black polished Kerma flasks.

[12] R. Fattovich, A. Manzo direct remarks on the Gash Group materials.

The large majority of the vessels of Nubian type can be interpreted as cooking-domestic vessels, and most of the represented types belong to the classes of domestic vessels shared by several Nubian cultures, as it often happens with assemblages from settlements (Manzo 2012b: 224). Also the sherds of vessels from the Eritrean-Sudanese lowlands, from the Fourth Cataract area, and several of the sherds of South Arabian origin can be easily ascribed to these functional classes (cooking and serving) (Manzo 2010a: 446, 2012a: 54).

The occurrence of the sherds of domestic exotic vessels at the site of the harbor may be explained by the presence there of groups of people from Nubia (or from Nubian communities in Egypt), the Eastern Desert, and the southern Red Sea: they may have interacted with the Egyptians during the maritime expeditions and on the land route(s) to Mersa/Wadi Gawasis, as suggested elsewhere (Manzo 2010a: 447-448, 2012a: 54-55, 2012b: 225-226, 228-229).

Finally, the origin of the imported materials from the southern Red Sea may suggest that in the Middle Kingdom times the network involving Egypt and Punt may have extended on both sides of the Red Sea (see also Manzo 2010a: 449, 2012a: 55, 2018b: 135).

4.2.b Exotic ceramics, Canaanite

SALLY WALLACE-JONES

In the 2007-2008 field season a number of sherds of small jars with distinctive flat, ridged rims

were discovered. They all have flat bases and thin walls with a finely raised, ridged pattern, probably made during production. The paste is full of mineral inclusions.

WG 33, SU3 contained 24 sherds (including rims and bases) from at least 5 medium-sized bottles with lightly everted grooved rim and flat base (Figure 106). In one case the rim is thickened and triangular in section. These vessels are wheel-made, with reddish-brown mineral tempered paste, and have been identified as Canaanite by Manfred Bietak.[13]

[13] Manfred Bietak personal communication to K.A. Bard, March, 2008.

During the 2009-2010 field season some further examples of sherds from Canaanite vessels (small jars with flat, ridged rims) were recognized, in WG 32, B4, SU5.

A number of pieces of Canaanite amphora were also identified in 2009-2010, 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 from 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 a parallel at Tell el-Daba (Aston 2004: 296, Fig. 33e, group 33).

Other pieces of similar fabric, form and technology have also been identified in 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.

4.2.c Exotic ceramics, Minoan

Sally Wallace-Jones

In 2007-2008 a tiny sherd of Minoan pottery was identified from WG 55, C2, SU2 (Figure 107). It has since been closely identified as being characteristic of Proto-palatial pottery.[14] 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 of the site (next to the "alcove shrine") had special status and it is possible

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

that the pottery is another example of a precious item of heirloom which was brought to the site.

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 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 108).

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.

Figure 87. *Complete Marl C plates from WG 32, SU31.*

Figure 88. *Example of Marl A variant 3 storage jar from WG 49.*

Figure 89. *Mis-shapen Marl A variant 3 vessel from WG 65, D5, SU2; outside (A) and inside (B) surface of the base.*

Figure 90. *Marl A variant 3 sherds with incised decoration from WG 61/65.*

Figure 91. *Marl C cooking pot from WG 63, D3, SU2.*

Figure 92. *Large, mostly complete Nile C pot stand from T10, A2.*

Figure 93. *Atypical fragmentary handled juglet from WG 67.*

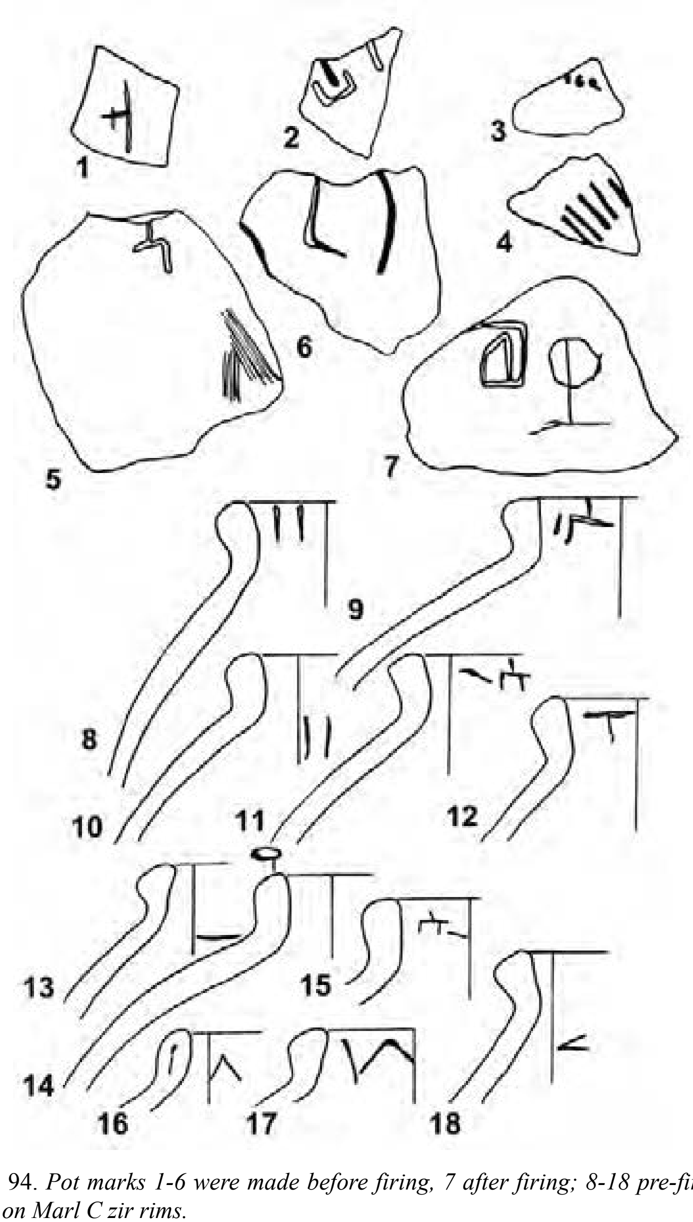


Figure 94. *Pot marks 1-6 were made before firing, 7 after firing; 8-18 pre-firing pot marks on Marl C zir rims.*

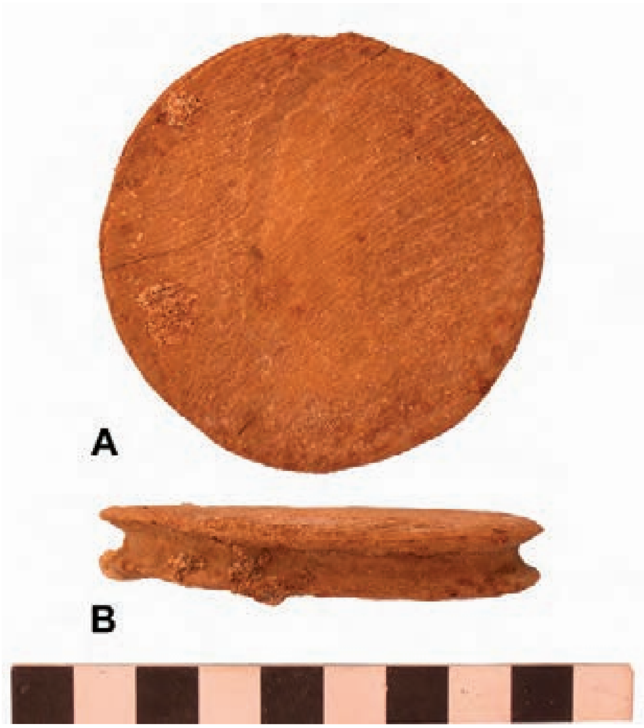


Figure 95. *Wooden disc with groove in mid-circumference from WG 32, B5, SU25, A top and B side view.*

Figure 96. *Rim of a Marl A variant 3 model vessel from WG 55/56, E2/A2, SU2/7, entrance of Cave 7.*

Figure 97: *Fragments of broken tubular bread mold in a fire-pit lined with sherd in excavation unit WG 19.*

Figure 98. *Detail of a fragment of broken bread mold lined with a thin layer of clay from Mersa/Wadi Gawasis.*

Figure 99. *Rim sherd from WG 61, D-E2, SU45.*

Figure 100. *Body sherd from WG 66, D-E3, SU3.*

Figure 101. *A, body sherd from WG 33, SU1; B, rim sherd from WG 55, D 3, SU2.*

Figure 102. *Rim sherd from WG 46, E4, SU1-2.*

Figure 103. *Body sherd from WG 68, SU1.*

Figure 104. *A, fragment of shoulder of jar from WG 56, A2, SU8; B, rim sherd from WG 32, A5, SU39; C, rim sherd from WG 47, B2, SU1; D, body sherds from WG 33, SU3; E, rim sherd from WG 52, SU1.*

Figure 105. *A, body sherd from WG 65, A4-5, SU46; B, body sherd from WG 39, Cave 3, A10, SU11.*

Figure 106. *Sherds of Canaanite jars from Mersa/Wadi Gawasis.*

Figure 107. *Fragment of Minoan White-banded Style Kamares pottery from WG 55, C2, SU2, A external surface, B internal surface.*

Figure 108. *Rim sherd of Minoan Fine Buff Crude Ware pottery from WG 55, C2, SU2, A external surface, B internal surface.*

Chapter 5
Nautical evidence at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011

5.1 Ship timbers, ship components, functional elements and fastenings, wood debris and debitage, and maritime artifacts

Nautical evidence collected at Mersa/Wadi Gawasis from 2006-2007 to 2010-2011 included ship timbers, ship components, functional elements and fastenings, wood debris and debitage, and maritime artifacts.[1] Five main different types of ship timbers have been identified, they are described as it follows in Table 8.

5.1.a Ship components, 2006-2007

Claire Calcagno and Chiara Zazzaro with the collaboration of Mohamed Abd El-Maguid Mustafa

During the 2006-2007 field season significant amounts of wood material with evident nautical associations were recovered from Wadi Gawasis, including recycled ship timbers, joint elements and wood debris generated as a by-product of timber reworking.

Timber type	
Type 1 - Transverse timbers	Transverse structural timber (e.g. deck beam, framing element)
Type 2 - Hull-planks	Ship hull planks, cedar, including gribble and 0.65-2.25 cm thick deep mortise-and-tenon joints
Type 3 - Deck-planks, chamfered	Short cedar planks (75-90 cm long x 20-35 cm wide x 5 cm or less thick, with chambered ends on lower face)
Type 4 - Planks with ligatures	Acacia planks with shallow mortise-and-tenon joints less than 0.5 cm thick and ligatures
Type 5 - Auxiliary equipment	Steering components, oar looms, stanchions, crutches and other ship equipment
Other planks, undetermined and lacking identifiable features	Fastenings and debitage Tenons and dovetail tenons, wood debris from reshaping and cleaning timbers

Table 8. *Key to timber type (after Ward and Zazzaro 2009).*

[1] For a complete list see Appendix 3.

Ship timbers

Twenty timbers were identified as ship components during the 2006-2007 field season. Ship timbers examined microscopically by Rainer Gerisch were identified as native acacia (*Acacia nilotica*) and imported cedar (*Cedrus lebani*). The condition of the wood ranged from soft, spongy and crumbling, to hard and salt-encrusted or burnt. Some pieces survived only as traces in the sand; several were too decayed for recovery. A number of timbers are considerably reworked, such that their original nautical function is difficult to determine.

The ship timbers had been recycled at the site in various ways. Four timbers were recovered outside the cave entrances. Three appear to have been reutilized in walkways to the cave shelters, including T19 and T58 outside Cave 2, and T53 within the entrance to Cave 6 (WG 32). Timber T71 was found loose in the accumulated sand deposit outside of what may have been the entrance to Cave 4 (WG 33). One timber (T51) was located in Cave 2, Room 1, in a context recently disturbed by thieves. It was most likely associated with a previously studied assemblage of four timbers from that area which formed a walkway (Bard and Fattovich 2007: 63).

Cave 3 (WG 39) contained 14 timbers. The orthogonal disposition of six of these suggests a deliberate arrangement. Several fragmentary timbers were also found loose in the windblown sand deposits, or associated with hearths. Four timbers (T61, T64, T66, T67) remain partly wedged beneath collapsed cave rock and could not be examined in their entirety this field season.

Eight timbers were provisionally interpreted as hull planks based on the presence of shipworm damage and/or their fastening patterns. These include two small thick timbers beveled at one end (T62, T63) which Mohamed Abd El-Maguid suggests could have functioned as stealers.

Timber T64 is a thick, heavily reworked timber that is also likely to have originally functioned as a hull plank (Type 2). It is 87 cm long, at least 46 cm wide and 22 cm thick. It features gribble on one face, a complex variety of joints (see below), and a possible scarf cut. Blocked beneath a cave collapse, it was not fully excavated.

Two timbers (T51, T65) with beveled ends on one face might correspond to deck planks (Type 3). However, T65 (measuring 86 cm × 27 cm × 6 cm) might have originally functioned as a hull plank: it has been intensely reworked, features a mortise-and-tenon fastening, and contains large knots.

While timbers T66 and T67 were not fully excavated, they could be identified as deck beams (Type 1) as both feature a longitudinal raised central section on one face. Timber T66 can be compared to the deck beam identified last year (T32; Bard and Fattovich 2007: 146).

Three poorly preserved but distinctive timbers (T55, T68, T70) may not belong to the hull structure itself, based on their particular shapes and lack of gribble or typical hull timber fastenings. The largest (T55) is curved, thick (max. 20 cm by 40 cm), features a square hole and peg and extends over 370 cm in length (although only ca. 130 cm was found in a structurally sound condition) (Figure 109). Timber T68 is a short round-sectioned pole tapered at both ends. Timber T70 is pronged at one end and has a flat rectangular section. These timbers could be related to a vessel's superstructure, or otherwise have another function related to maritime activities at the site.

Four timbers (T54, T56, T58, T69) are in extremely poor condition, and their identification remains problematic.

Ship fastenings and tenons

Several forms of fastening were recorded this season, including single and paired mortise-and-tenon joints, dovetail mortises, pegs, and one lashing channel, in addition to dozens of loose tenons.

Type 2 Timber T64 is remarkable for its variety of joints (Figure 110). On one edge it features two pairs of double mortise-and-tenon joints that average 10 cm in width and 2 cm in thickness. A through mortise containing traces of copper is carved through the plank thickness, and connects to a lashing channel that penetrates diagonally into the through mortise from the plank edge. Two pegs on the plank's visible wide face might also be associated with edge fastenings, although their function remains to be clarified following complete excavation of the timber. Especially noteworthy are two dovetail mortises cut into opposite sides of the wide face. They measure up to 14.5 cm in length, between 3.4 and 6.5 cm in width, and up to 3.8 cm in depth; thus they correspond in dimensions to the range of loose dovetail tenon halves recovered in Cave 3. Significantly, these mortises constitute the first indisputable evidence of dovetail joints utilized in an Egyptian ship timber in ancient times.

Like T64, Type 2 timber T65 is also mortised through its thickness. In both cases, the mortise contains traces of copper which are likely to be remnants of metal ligatures such as those first noted in the 2005-2006 field season (*e.g.*, T34; Bard and Fattovich 2007: 147). It is hypothesized that these copper 'staples' may have been used for their antifouling properties to protect the fastening exposed on the immersed side of the hull.

A total of 52 loose tenons varying in size, condition and features were recovered, primarily in Cave 3, and a few in WG 32. Intact tenons range in length between 8 cm and 27 cm, and in width between 4.2 cm and 8.5 cm.; thicknesses generally range between 1 cm and 1.5 cm. Six tenons feature pegs and peg holes (or partial holes) which vary in diameter between 1 cm and 1.5 cm. All tenons analysed are of *Acacia nilotica* wood (see 6.2 Identification of wood and charcoal).

Twelve dovetail tenon halves were recovered this field season: 10 from WG 39, 1 from WG 24, and 1 from WG 32. Most show adze marks where they were broken in half at their narrowest point. Dimensions generally range between 11 cm and 18.5 cm in length, between 4.4 cm and 6 cm in width, and between 2.8 cm and 4.8 cm in thickness. Analyzed dovetails are of *Acacia nilotica*.

Wood debris

Wood remains that could not be clearly identified as ship timber parts included joint elements (loose tenons and dovetail tenon halves), fragments of worked wood and collections of wood debris (lots W167-W377). Wood debris and joint elements were recovered in quantity in trench WG 39 (in Cave 3), as well as in trenches WG 32, WG 33, WG 40, WG 41 and WG 42. Most of these materials are likely related to ship dismantling and careening processes (see Bard and Fattovich 2007: 145).

The greatest concentrations of wood debris (almost two-thirds of the total collected) occurred in Cave 3, in a surface collection, SU1, and in SU11. Wood species identified among samples of wood debris in this trench included acacia, sycamore and cedar (see 6.2 Identification of wood and charcoal). Noteworthy is the recovery from within the cave of several pieces of oak (*Quercus* sp.): a wood fragment (W376), and an assemblage of related charcoal pieces (A9, SU12), which may be related to other nautical material found in the area.

The debris includes a number of pieces with significant traces of gribble, attached barnacles, and evidence of tool marks and surface stripping. A small number of wood fragments bear traces of what appears to be copper (*e.g.*, W229, W280), while others associated with hearths recorded in Cave 3 show evident signs of burning.

Among the remaining wood fragments are several with distinctive features. These include five similarly fragmentary round-sectioned pieces whose estimated original diameters range between 4.5 cm and 8 cm (although none survives with more than c. 60% of its original diameter).

5.1.b Ship timbers and nautical artifacts, 2007-2008

CLAIRE CALCAGNO AND CHIARA ZAZZARO

Ship timbers, description and preliminary analysis

During the course of the 2007-2008 field season, a total of five ship timbers were identified; two were fully excavated while three were initially recorded and left *in situ*. Two ship timbers were found during excavations in WG 55 lying across the entrance of Cave 7, to facilitate access to the cave, as in Cave 2 (Bard and Fattovich 2007: 65). Unfortunately, excavation was interrupted in this area due to safety concerns, and the two timbers were only partially recorded.

One large plank (T57; ca. 14 cm thick), covered by a thick layer of salt encrustation, was found in the windblown sand deposit filling the cave entrance (SU10, bottom). As the condition of the wood was quite poor, the most fragile part of the plank was removed and stored in Cave 3. The other plank (T74) was found on the floor, lying horizontally across the entrance to Cave 7, ca. 150 cm below the top of the cave. It is 4.5 cm thick and features a small notch on the exposed face; the condition of the wood is good. No further apparent diagnostic features were visible after superficial examination.

A dismantled and reworked Type 2 hull plank (T75) was found in the same context. The plank shows features suggesting it was originally a larger hull plank that was subsequently reworked and reduced in thickness (Figure 111). It is 93.5 cm long and tapers in width from the jagged end, which was split off, to the opposite end, which was sawn. Wood conditions are generally good. The plank features a shallow rectangular channel (9 cm × 7.5 cm × 1.2 cm) between the plank edge and a through-mortise, with trace impressions of five copper strips (1.5 cm in width) originally held in place within the channel by a rectangular wooden stopper

(8.5 cm × ca. 1 cm) inside the mortise. Chisel marks are distinctly visible within the channel. On the same original outer face not far from the channel, another through-mortise was started and not completed; the unfinished recess measures 8.4 cm in width, while the actual perforation is only 4.3 cm wide. A peg (1.1 cm in diameter) located between two lashing holes (see below) is also attributable to the plank's first phase of use.

When the plank was recycled, its outer face was partially stripped off to remove gribble and re-used as the plank's inner face. On the opposite face gaps in the through-mortises were filled with white plaster. Two lashing channels on this face and a mortise and tenon fastening through one edge are also attributable to the plank's second phase of use. The lashing channels are characterized by two holes (1 cm in diameter) and related grooves for the lashing passages, and are associated with remains of a dripped dark substance which might have had a waterproofing function. The edge mortise is broken and its tenon is partially missing (6 cm × 1 cm). Several tool marks are visible close to one end of the plank, possibly attributable to hull cleaning activities.

Three large shallow cuts, including two smaller adze marks (3 cm and 4 cm wide), can be discerned on the opposite face of the plank (corresponding to the outer face during the plank's second phase of use). They appear to have been made in order to adapt the plank to the hull shape. Chisel marks are also visible all around the peg and in the grooves carved for the lashing channels on this face. This plank is comparable to other planks previously found at the site, which Cheryl Ward identified as possibly belonging to small boats (see Bard and Fattovich 2007: 139, Fig. 59).

In WG 32, an assemblage of large ship timbers was found outside Cave 6 aligned toward the cave entrance and covered with a thick encrustation of salt, which covers an area of ca. 2.30 m × 1.0 m. The outlines of at least three long timbers could be discerned molded beneath this salt deposit, which has permeated the surface of the wood. One timber (T72) was identified as the upper part of a steering oar blade (Figure 112). Fragile conditions precluded full excavation of these timbers until further assessments could be completed, so they were left *in situ* and covered with sand. Only the upper part of this steering oar blade was exposed and recorded; the wood was soft and breaks off fairly easily. The investigated portion of this timber is very similar in shape to the steering oar blade T1 (Bard and Fattovich 2007: 150-153), and has been identified by Gerisch as *Faidherbia albida* as in the case of blade T1. The upper end of the blade is rounded; several saw marks (or smoothing tool marks) can be discerned where the end was shaped into a curve. A mortise measuring 8.5 cm × 1.5 cm, is located on the blade's exposed edge. A hole for rope (7 cm in diameter) was also recorded on its exposed face. The internal timber edge is concave (ca. 18 cm in diameter) where the blade was originally connected to the central loom. The estimated length of the blade is 210-220 cm, 10-20 cm larger than T1.

A plank (T73, 69.2 cm × 23.4 cm × 4.8 cm) was found in WG 33 in a layer of windblown sand close to the terrace wall. Its dimensions and shape are comparable to other timbers identified as deck planks found at the site during previous field seasons. This plank was possibly reworked since the remains of two lashing channels are visible at one end.

See also: 6.2.c Identification of wood and charcoal, 2007-2008.

Wood debris

In the 2007-2008 field season 91 lots, comprising wood debris and branches collected by archaeologists, were inventoried. Most of the debris includes a number of pieces likely related to ship dismantling and hull cleaning, some with evidence of tool marks and surface stripping, significant traces of gribble and traces of red paint.

The greatest concentration of wood debris (54 lots) occurred in excavation unit WG 55, in squares corresponding to the entrance of Cave 7. The deposit of wood debris in this area is very similar to that found at the Cave 2 entrance and can be interpreted as the result of ship dismantling and hull cleaning activities that took place at the entrance of the cave. The adjoining unit WG 56, with the area of the "ceremonial" stone structure, only yielded nine lots of wood debris, also resulting from ship dismantling.

Wood debris from other excavation units is more poorly preserved, and it is often difficult to distinguish debris resulting from ship dismantling from fragments of broken boxes or other wooden objects.

See also: 6.2.b Identification of wood and charcoal, 2007-2008.

Functional elements

Wood debris also included fragments of functional elements such as ship equipment, fastenings and fragmentary timbers (see also 6.2.b Identification of wood and charcoal, 2007-2008), found in excavation units located on the slopes below the fossil coral terraces (WG 32/WG 53, WG 52 and WG 55). These were inventoried separately from wood debris and given W numbers.

A total of 16 (or possibly 17) tenon fragments were identified in the wood debris deposit. Their thicknesses vary from 0.9 cm to 1.4 cm. In addition, 3 dovetail tenon halves were also found (ranging between 13 cm × 5 cm × 3.2 cm and 12.5 cm × 3.3 cm × 2.3 cm).

Three wood fragments feature what might be the remains of rectangular mortises and gribble, and thus can be identified as pieces of dismantled ship timbers.

Two wood elements are almost triangular in section and are heavily reworked; they can be interpreted as possible wedges or types of repair elements (15.5 cm × 10.5 cm × 4.7 cm).

Two wood elements ca. 40 cm long are rounded in section with what appears to be an internal concavity. They are both heavily damaged along their entire length; estimated diameter is 4.5 cm. They might have originally been poles, possibly used as part of the ship equipment.

Ship timbers, preliminary catalog

<u>T57</u>: WG 55, C1, SU10 bottom, Cave 7 entrance

Max L = est. ca. 65 cm, W = ca. 30 cm, Th = ca. 14 cm

Wood type: not recorded.

<u>General description</u>: Wood plank entirely encrusted in thick, rock-hard salt concretion, which prevents further identifying any diagnostic features. Found at a depth of 150 cm below the cave entrance. Part of the timber was broken during excavation and was stored in Cave 3. It was not possible to precisely record the full length of this timber.

<u>Fastenings</u>: not recorded.

<u>Tool marks</u>: not recorded.

<u>Storage</u>: Cave 3.

<u>T72</u>: WG 32, B4, SU33, Cave 6 entrance

Max est. L = 210-220 cm, Max exposed W = 23 cm, Max exposed Th = 18 cm

Wood type: *Faidherbia albida.*

<u>General description</u>: steering oar blade, covered by a thick layer of salt encrustation. Only one face (upper face as found) and a portion of

the upper part were recorded. The timber's fragile condition precluded its full excavation until further assessment can be completed.

Fastenings: Mortise 1, eroded, Max L = 8.5, Max W = 1.5. Hole diameter 7 cm.

One edge of the blade appears concave in section in order to receive the central pole [what does this mean? The loom?] to which it would have been originally attached. The estimated diameter of the concavity is ca. 18 cm.

<u>Toolmarks</u>: saw marks (or smoothing tool marks) choose one are visible on the upper part of the rounded end.

<u>Storage</u>: *in situ*.

<u>T73</u>: WG 33, C1, SU3

Max L = 69.2 cm, Max W = 23.4 cm, Max Th = 4.8 cm, Min Th = 2.4 cm

Wood type: not coniferous.

<u>General description</u>: deck plank, with the lower face almost completely covered by thick salt encrustation; two large cuts are visible at the interface between this face and one side. The upper face is flat and shows some cracks, one large knot, and two small knots.

The wood condition is quite good, but some small cracks are visible on the surface.

Fastenings: two grooves, or possibly lashing channels, are carved at the interface between the upper face and one end; they measure ca. 1.5 cm × 1 cm.

<u>Toolmarks</u>: one adze mark (7.5 cm × 4 cm) on the lower face. Two possible chisel marks on the upper face. Saw marks are visible at both ends.

<u>Storage</u>: Cave 3.

<u>T74</u>: WG 55, C1, SU11, Cave 7 entrance

Max L = 77 cm, W = (maximum recorded) 17 cm, Th = 4.5 cm

Wood Type: not recorded.

<u>General description</u>: rectangular plank, not completely recorded and left *in situ* lying across the entrance to Cave 7. A small notch (1.2 cm deep) was recorded on the exposed face.

<u>Fastenings</u>: not recorded.

<u>Toolmarks</u>: not recorded.

<u>Storage</u>: *in situ.*

T75: WG 55, C1-C2, SU2-SU11
Max L = 94.2 cm, Max W = 21.2 cm, Max Th = 4 cm
Wood type: cedar type.

General description: reworked hull plank (Type 2 converted to Type 4[2]). One large knot (ca. 5 cm wide) is visible on both faces. Wood condition is quite good, aside from a long crack and some salt encrustations on the inner face (Face B: lower face as found).

Fastenings: Mortise 1, a through mortise located toward one end of the plank, measures 5.5 cm × 0.9 cm and 3.9 cm deep. No tenon remains are inside the mortise, but traces of white plaster can be discerned. Mortise 1 was probably cut by mistake: the area originally intended to be cut (8.3 cm in length) can still be identified on Face B. Mortise 2, cut within the thickness of the plank, measures 6 cm × 1 cm; the tenon, 0.4 cm thick, had been broken and moved from its original position. Mortise 3, a through mortise near the center of the plank, was likely carved for the plank's first phase of use; it is associated with a wooden stopper and a channel for copper ligatures carved on Face B. Mortise 3 measures 11.5-9 cm × 1.6 cm, while the wooden stopper measures 8.1 cm × 1.5 cm. White plaster was used on the inner face (Face A: upper face as found) to fill the gaps between the mortise and the wooden stopper. Green traces of five copper strips, 1.5 cm wide, are still visible within the ligature channel. Two lashing channels with holes (1 cm in diameter), spaced 6.7 cm from each other, were carved in order to connect one side with an adjacent plank. The related grooves for the lashing passage are visible on Face A. Remains of a black substance are associated with this fastening. A peg is located between the two lashing channels and measures 1.1 cm in diameter.

Toolmarks: three large shallow cuts, including two smaller adze marks (3 cm and 4 cm wide), characterize the lower part of the outer face (Face A). Chisel marks are visible all around the peg and in the grooves carved for the lashing channels on Face A. On Face B some tool marks are visible close to one end (End 1).

Storage: Cave 3.

[2] For typologies, see Bard and Fattovich 2007: 135-146.

Wood functional elements, summary

W379 to W406: 27 pieces in total.

W403, W389: 2 elements, triangular in section: possible wedges.

W390, W393: 2 elements, circular in section, est. diameter 5 cm.

Tenons: 16 (+ 1 possible).

Dovetail tenon halves: 3.

Fragmentary timbers

W382, W383, W384: fragmentary timbers, two (W382 and W383) with possible mortise cavity and gribble; unknown provenance, possibly from WG 55.

5.1.c Ship timbers and maritime artifacts, 2009-2010

Cheryl Ward and Chiara Zazzaro with the collaboration of Mohamed Abd El-Maguid Mustafa

During the 2009-2010 field 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

Excavations in WG 64 within Cave 2 (see 3.2.d Excavations, western terrace slope, Cave 2), revealed evidence of intensive woodworking activities. Indeed, 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 (Figure 113). 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).

A tool handle for an adze (W962, Figures 70 and 114) 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.

In the southwestern corner, W963 and W965, probable blade fragments (Figure 115 A), and W961, a probable oar loom segment 53 cm long and 6 cm in diameter were found in the center of the trench (Figure 115 B). 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 (Fig. 115 C).

Discussion, WG 64

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 was 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.

WG 32: the ship timber deposit

In WG 32, a timber deposit was brough to light (see 3.2.d Excavations, western terrace slope, Cave 2). 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 116). 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. Ship components were recorded and consolidated, and most were left *in situ* for further conservation.

Discussion, WG 32: the ship timber deposit

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 ca. 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, 2009-2010[3]

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, 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 117). 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.

[3] Much of this section was first published as C. Ward, C. Zazzaro and M. Abd El-Maguid 2010.

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, T64

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 (type 3, recut from type 2) from WG 65, B2, SU2: 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

<u>T61</u> (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
Wood type: *Cedrus libani*

<u>Description</u>: 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 (shipworm) 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*.

<u>Fastenings</u>: 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
Wood type: *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.

<u>Fastenings</u>: 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.

<u>Toolmarks</u>: 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.

<u>T66</u>
WG 39, A10, SU20
Type 1 beam, reworked
Exposed L 120 cm
W rem 20.5 cm
Th rem XX cm
Wood type: *Cedrus libani*

<u>Description</u>: 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 × 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 × 4 cm) and passes entirely through the beam in the adjacent hole (5 × 5 cm). On Edge 1, a mortise 3 × 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*.

<u>T72</u>
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
Wood type: *Faidherbia albida*

<u>Description</u>: 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.

<u>Fastening</u>: 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]
Wood type: *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
Wood type: 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
Wood type: *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

Wood type: *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
Wood type: *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 × 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

Wood type: *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
Wood type: *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
Wood type: *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 × 2.4 cm; M2: 9.6 cm × 1.6 cm; M3: 9.5 cm × 2 cm; M4: 10.5 cm (fragmentary).

T90
WG 32, SU33, beneath T72
Obscured features
Wood type: *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
Wood type: *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 × 3.5 cm; M2: 10 cm × 2 cm; M3: 9 cm × 2.5 cm; M4: 6.5 cm × 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
Wood type: *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.

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 × 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 completely eroded and eaten by termites. 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.

<u>T98</u>
WG 60, D5
Tool handle, Type 5
L 42 cm
W 3.2 cm
Th 3 cm
Wood type: *Avicenna* sp.

<u>Description</u>: 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.

<u>T99</u>
WG 60, D5
Tool handle, Type 5
L 45 cm
W 3.4 cm
Th 3.2 cm
Wood type: *Avicenna* sp.

<u>Description</u>: The handle is in good condition, tapering at one end to 3.0 × 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.

<u>T100</u>
WG 60, D5
Tool handle, Type 5
L 50 cm
W 3.5 cm
Th 3 cm
Wood type: *Avicenna* sp.

<u>Description</u>: 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 T99.

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

Description: This 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 is 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 114).

See also: 6.2.d Identification of wood and charcoal, 2009-2010.

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 115 C).

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 115 B).

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 115 A).

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

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.

5.1.d Maritime archaeology, 2010-2011

CHERYL WARD AND CHIARA ZAZZARO

The 2010-2011 excavation season at Mersa/Wadi Gawasis included continued exploration, excavation, documentation and conservation of maritime-oriented archaeological remains. Major funding through the Antiquities Endowment Fund of the American Research Center in Egypt, funded by USAID, permitted us to bring a conservation team to the site to assess, clean, stabilize, and safely store ship timbers and other finds from previous field seasons and to consider the problem posed by the dry and brittle coils of rope in Cave 5. In addition, conservator Howard Wellman was able to successfully stabilize and lift part of a disaggregating rope coil from Cave 5 (see 11.4 Conservation, 2010-2011).

Documentation

Since January 2005, approximately 100 identifiable ship and boat components have been excavated and studied on site. Several (steering oar blades T1 and T2, hull plank T34) are now curated by the Supreme Council of Antiquities in a display at the Museum of the Sea in Suez.

The others were stored in the inner portions of Caves 2 and 3, on the gallery floors.

The AEF grant allowed us to focus much of our attention on preparing more efficient and secure storage shelves in the gallery for these components and to document them by digital images, video, and with drawings prior to storage in a more controlled environment individually tailored to each piece. Photographer Easton Selby also made publication-quality still images of each ship component to complement scale and full-sized drawings and descriptions of individual features and objects.

Many of the timbers were too long and delicate to remove from the gallery, so they had to be photographed in sections and the resulting images digitally composited together. In addition to documenting the timbers, Selby documented the rope cave/gallery, the pottery assemblage for project ceramicist Sally Wallace-Jones, the timber archiving process used by conservator Howard Wellman, and made site record photographs of trenches under excavation, panoramic photographs of the entire site, and general photographs of the excavation and study process.

The documentation process was extremely important because during our review of all stored timbers, new information was retrieved from several that had received little attention when excavated. One of these, cedar ship's hull plank T19 was excavated in 2006-2007 from the entry to Cave 2. It has the most damage from marine mollusks yet recorded (8 cm into the plank thickness) and attests to the condition of lower hull planks at the end of some voyages.

Another, made of Nile acacia according to Rainer Gerisch, is likely the frame of a Type 4 small craft. T117 has a curved outer surface that ends in a flat. Type 4 refers to the unique and relatively thin planks, of native woods or reworked cedar hull planks, joined to one another with small mortise-and-tenon fastenings and lashings. This discovery expands the range of Type 4 timbers to include hull planks, sheer planks, and a frame.

WG 32 ship timber stabilization

As noted in the 2009-2010 report, considerable attention was given to the ship timbers outside the entrance to Cave 6. These seem to have been used as a ramp by ancient Egyptians, and consist of a pair of steering oar blades about 4 m long, along with a range of auxiliary timbers. Stabilization efforts in 2010-2011 focused on providing a plaster casing for these fragile timbers. The wood is both cedar and the white acacia recognized in the pair of blades (T1 and T2) in the entrance of Cave 2, and it is in extremely poor condition. The blades were heavily infested with shipworm in the submerged portion, and there is a very thin layer of wood fragments amongst the mollusk shells and remains of copper ligatures (see 5.1.c Ship timbers and maritime artifacts, 2009-2010).

New finds

In WG 70/72/73/76, a number of thin boards and stakes in poor condition were found in the areas immediately adjacent to the north side of the mud-brick building and to the east (T121, T122, T123 and T101). Two factors are primarily responsible for their fragmentary condition: these are thin and narrow sycomore or acacia boards discovered only in a few centimeters of sand below the surface, thus subject to moisture and temperature cycling in addition to insect activity. There is no identifiable maritime purpose for these fragile boards, but they were surrounded by the remains of a windblown mass of cedar wood chips and debitage, as well as the very decayed remains of larger cedar shavings and debitage, suggesting that this area was downwind of a major woodworking activity area.

Excavation in WG 71, in Room 2 of Cave 2, produced wood debitage, including dovetail and trapezoidal tenon fragments, oar loom fragments ca. 6 cm in diameter and often about 45 cm long, and a section of the first piece to be identified with confidence as a spar fragment.

Twenty-four fragments of rope of different types, ranging from 5 to 24 cm in length, were also collected in this excavation unit. The cordage varies in dimension and composition, the two-strand line type is composed of Z-spun yarns and S-twisted strands; the three-strand line is composed of S-spun yarns and Z-twisted strands. According to Ksenija Borojevic and Rebecca Mountain, the material used for making the ropes is papyrus.

Summary

The AEF grant from the American Research Center in Egypt permitted us to establish a long-term solution to the storage of ship components in the innermost part of Cave 3 after intensive photo documentation and cataloging. Additional details retrieved from previously excavated timbers add significantly to our data about the small watercraft represented by Type 4 planks. In addition, the maritime team recorded about 20 new planks or timbers and, once again, thousands of fragments of wood debitage from WG 31, WG 64, WG 71 and WG 70/72/73/76.

5.2 Anchors

5.2.a Anchors, 2006-2007

CHIARA ZAZZARO AND MOHAMED ABD EL-MAGUID MUSTAFA

During the 2006-2007 field season five stone anchors, two complete and three fragmentary, were discovered. Some fragments of limestone slabs, possibly pieces of anchors, showing chisel marks on the surface, were also recorded. The stone anchors were studied and numbered from A21 to A25, continuing the inventory numbers of the Mersa/Wadi Gawasis general catalog of anchors (Bard and Fattovich 2007: 161-162).

Geologist Mohamed Badr selected 14 stone samples for petrographic analyses from anchors at the site. The goals were to better understand the production process of the Mersa/Wadi Gawasis anchors and, consequently, to investigate an important part of the organization and provisioning of seafaring expeditions. All identified stone anchors were described, photographed, and drawn to scale, recording dimensions and, if possible, also the weight.

Anchors recorded during this field season have the typical rounded top, with a hole and groove for rope. Two complete anchors, A23 and A24, represent a new typology (Figure 118) because they are rectangular in shape and smaller, 21-24 cm in length, than anchors previously recorded at Mersa/Wadi Gawasis. A24, found in the lagoon bottom as was the larger one A11 (2005-2006 field season, see Bard and Fattovich 2007: 158; Fattovich and Bard 2006: 13), demonstrates that ships approached the lagoon with anchors of different dimensions. Possibly small boats that could easily enter the lagoon used such small anchors, or small anchors were used together in a chain (Wachsmann 1997: 286-287).

A23 was found reused for construction in the northwest wall of Cave 2 and placed at the entrance between the cave's ceiling and ship timber T20. This is the seventh anchor recognized in the walls of Cave 2, after the six larger ones (A3-A8) discovered during the 2004-2005 field season (Bard and Fattovich 2007: 157-158).

The fragmentary anchors A21, A22 and A25 were found in WG 33, SU2, near the Cave 4 entrance. They were possibly also reused in the cave's structure.

Comparing these partially preserved anchors with the dimensions of the complete anchors already discovered at the site, it is possible to estimate their original dimensions and type.

The fragmentary small anchor A25 is comparable, in the estimated dimensions, possibly 40 cm × 22-24 cm, to the small anchor found by Abdel Monem Sayed during his excavations at Wadi Gawasis, on the eastern terrace (Sayed 1980: XXII: 3).[4]

The shape of the top of anchor A21 is comparable to the complete limestone anchors found in the walls of Cave 2 during the 2004-2005 field season. In particular, the type and dimensions of the groove are similar in anchor A4 (see Bard and Fattovich 2007: 157-158). The estimated length of A21 is ca. 98-100 cm.

5.2.b Anchors, 2009

CHIARA ZAZZARO

In the 2009 field season three new fragmentary anchors (A26, A27, A28) were recorded in the same context of a circular structure named Feature 9 (see 3.2.a Excavations, eastern terrace), but in different Stratigraphic Units.

A26 is a fragment of the rounded top of an anchor. It features the typical groove for the rope and part of the hole (Figure 119). The fragment is 12.5 cm thick. The groove for the rope is 16 cm × 3 cm in size, and the upper hole is 9 cm in diameter. Thus, A26 is comparable to the middle-size anchors at Mersa/Wadi Gawasis (Bard and Fattovich 2007: 161-162).

A27 is a large fragment of the body and the base of an anchor, 46 cm × 24.5cm × 12 cm in size, preserved (Figure 120). An unfinished squared hole, 7 cm × 5.5 cm × 5 cm in size, was carved at the base of the anchor.

[4] Looking at the photograph published by Sayed, this anchor seems to measure ca. 40-45 x 20-25 cm. The thickness is difficult to establish, but must be no more than 15-20 cm.

Another shallow unfinished hole, 6 cm × 5.5 cm × 2.8 cm in size, was carved close to the base on the opposite side of the anchor. The possible original size of this anchor is comparable to those of other of middle- to large-size anchors at Mersa/Wadi Gawasis (Bard and Fattovich 2007: 161-162).

A 28 is a fragment of a limestone anchor with the preserved circular hole (Figure 40), it measures 28 cm in length, 44 cm in width and 8 cm in thickness. The circular apical hole measures 13 cm in diameter and 11 cm in thickness. This anchor was found in the mound of the circular structure named Feature 9.

A concentration of several limestone fragments, most likely from an intentionally crushed anchor, was also found in WG 58, associated with Feature 10. The limestone fragments were arranged in a circle beneath the gravel mound and might represent a foundation ritual for the structure (Figure 121, see also Figure 36).

Finally, a limestone anchor, A2, from Feature 6 (WG 23), already recorded in 2003-2004 (Bard and Fattovich 2007: 42-43 and 157), was also re-examined. This anchor was still *in situ*, at the base of the structure. During the 2009 field season the occurrence of part of a hole for a rope at the base of the anchor was observed. The evidence of diagonal chisel marks confirmed that the hole was intentionally carved. The unusual location of the hole in anchor A2 may suggest a re-shaping from another anchor, which might have been damaged during fabrication. A similar hypothesis can be also suggested for the two unfinished squared holes of anchor A27. The unfinished upper holes in A2, A27 and A9 (Bard and Fattovich 2007: 155, 158) clearly indicate that extensive activity of manufacture and modification of the ship equipment was practiced at the site.

Catalogue, 2009 anchors

A26 – WG 58, SU2 (Figure 119)
Max L = 24 cm
Max W = 20 cm
Max Th. = 12.5 cm
Material: Limestone.
Archaeological context: This anchor was found within the gravel mound around the main circular structure [Feature 9].

Description: It is only partially preserved the rounded top of an anchor. It features the typical groove for the rope and part of the hole. This anchor is comparable to the middle-size anchors at Mersa/Wadi Gawasis.

Condition: Surfaces slightly eroded.

Features: The partially preserved hole, ca. 9 cm in diameter, is pierced using a chisel. A groove for the rope, 16 cm × ? cm and 0.6 cm depth; it is visible only on one face.

Tool marks: chisel marks are visible on one side and in the hole.

Storage: Cave 3.

A27 – WG 58, SU5, E3 (Figure 120)
Max L = 46 cm
Max W = 24.5 cm
Max Th. = 12 cm
Material: Limestone.

Archaeological context: This anchor was found in the foundation deposit of a circular structure [Feature 9], and was associated with an oyster shell and fragments of construction materials.

Description: Only part of the body and and the base of an anchor, is preserved; it measures 46 cm × 24.5cm × 12 cm in size. The possible original size of this anchor is comparable to those of other of middle- to large-size anchors at Mersa/Wadi Gawasis.

Condition: Surfaces slightly eroded.

Features: An unfinished squared hole, measuring 7 × 5.5 × 5 cm in depth, is featured on one face. A concave recess, measuring 6 × 5.5 × 2.8 in depth, was recorded on the opposite face.

Tool marks: Two faces still have the original surface with chisel marks; the opposite face is broken or eroded.

Storage: Cave 3.

A28 – WG 58, SU19 (Figure 40)
Max L = 28 cm
Max W = 44 cm
Max Th. = 8 cm
Material: Limestone

Archaeological context: This anchor was found in the mound of a circular structure [Feature 9].

Description: Only part of the rounded top and the apical hole is preserved.
Condition: Surfaces slightly eroded.
Features: A circular apical hole, measuring 13 cm in diameter and 11 cm in thickness.

5.3 Cave 5 ropes

5.3.a Cave 5 ropes, 2006-2007

André J. Veldmeijer

The Cave 5 ropes are coiled longitudinally and wound in the middle as to allow easy storage for future use. This technique of storing long ropes is still used today to prevent rope from getting tangled. The back of the cave contains the majority of the rope coils; toward the front the number decreases rapidly. Remarkable is the fact that there are two smaller coils situated on top of the windblown sand that now obscures the original entrance to the cave. Farther back in the cave, the visible layer of coils is the top layer; at the back of the cave there is, at least partially, a second layer.

The preservation is remarkable but the ropes are very brittle. Many coils have fallen apart and only a few are more or less complete. The small holes in the ropes are remnants of insects, but it has yet to be determined by what kind.

All ropes are made of the same material, macroscopically identified as halfa grass.[5] The composition is sZ_3, which is an often-used composition. The ancient Egyptians used a third yarn and increasing diameter rather than cabling to create stronger ropes.

The diameters of the various coils vary from about 24 mm to as much as almost 40 mm for the ply. The estimated length of the most complete coil seems to be 30 m. A detailed analysis of these diameters and the Cord Index of Ply is in progress.

In the top layer, 16 more or less complete coils have been identified, and two big piles of rope, possibly consisting of three or more coils. These have been drawn on a map. It is clear that not all rope was de-

[5] To more thoroughly analysis this resulted to be *Cyperus papyrus* (papyrus), see 5.3.c Cave 5 plant fiber material analysis, 2010-2011.

posited as coils or, more likely, not as comparable coils. The second layer, probably extending in half a circular from the collapsed wall, which now serves as the cave entrance, might contain an additional 10 coils, bringing the estimate of the total number to about 30.

5.3.b Cave 5 ropes, 2007-2008

André J. Veldmeijer

In 2007-2008, the study of the contents of Cave 5 was completed. This work was to focus on a description of the finds, acquiring additional measurements in order to estimate quantity, and investigation through excavation. The latter work, however, was abandoned after consultation with the expedition's conservator (Pasquale Musella) and discussions with other members of the team, as the cordage proved to be too fragile. Attention was also given to the condition of the cordage, viz. possible insect activity.

Conservators specializing in the conservation and preservation of organic materials from archaeological sites, as well specialists in insects, will be consulted. Installation in 2008 of devices to check the cave's environment will give insight into its condition and the conservation of its contents.

Alternatives for getting an estimate of the weight of a coil of rope, such as reproduction in the ancient technique with the same, if not comparable material, are currently being explored. The cordage has been photographed in detail by the expedition's photographer, and the final analysis is expected to be finished later this year (see Veldmeijer and Zazzaro 2008).

5.3.c Cave 5 plant fiber material analysis, 2010-2011

Rebecca Mountain and Ksenija Borojevic

During the 2010-2011 field season, plant fiber artifacts such as rope, matting, and raw plant leaves and stems were analyzed. Four samples came from the large rope coils in Cave 5; each sample came from a different coil.

The species of fibrous plant was determined by first creating longitudinal thin sections of each sample using a razor blade and then mounting the section on a glass slide and examining it with a compound microscope (100x to 400x). The species were identified by the unique epidermal cell patterns visible in the thin sections.

Samples from four distinct rope coils from separate locations within the cave were taken in Cave 5 in order to determine if all of the coils were constructed from the same plant species. All four samples were identified as *Cyperus papyrus* (papyrus), suggesting that all of the coils were constructed from the same material, and confirming the previous identification of the authors that the large ropes were made of papyrus.

Cyperus papyrus is native to the Nile Valley and did not grow along the Red Sea or anywhere near the site of Mersa/Wadi Gawasis in antiquity. It is more likely that the expedition members brought the large papyrus ropes found in Cave 5 with them from the Nile Valley rather than bringing raw papyrus stalks to construct the ropes at the site. Rope making on this scale requires some specialized processing and equipment, of which no evidence has been found so far at Mersa/Wadi Gawasis (see Borojevic and Mountain 2011).

Figure 109. *T55 in situ in WG 39, Cave 3.*

Figure 110. *T64 from WG 39.*

Figure 111. *T75 from WG 55.*

Figure 112. *T72 in situ in WG 32, at the entrance of Cave 6.*

Figure 113. *Excavation in progress in WG 64, Cave 2 and remains from the concentration of wood debitage in that area.*

Figure 114. *Tool handle for an adze from WG 64.*

Figure 115. *Finds from WG 64, W963 (A), a possible blade fragment, W961 (B), a probable oar loom segment, and W960 (C), a probable oar loom segment.*

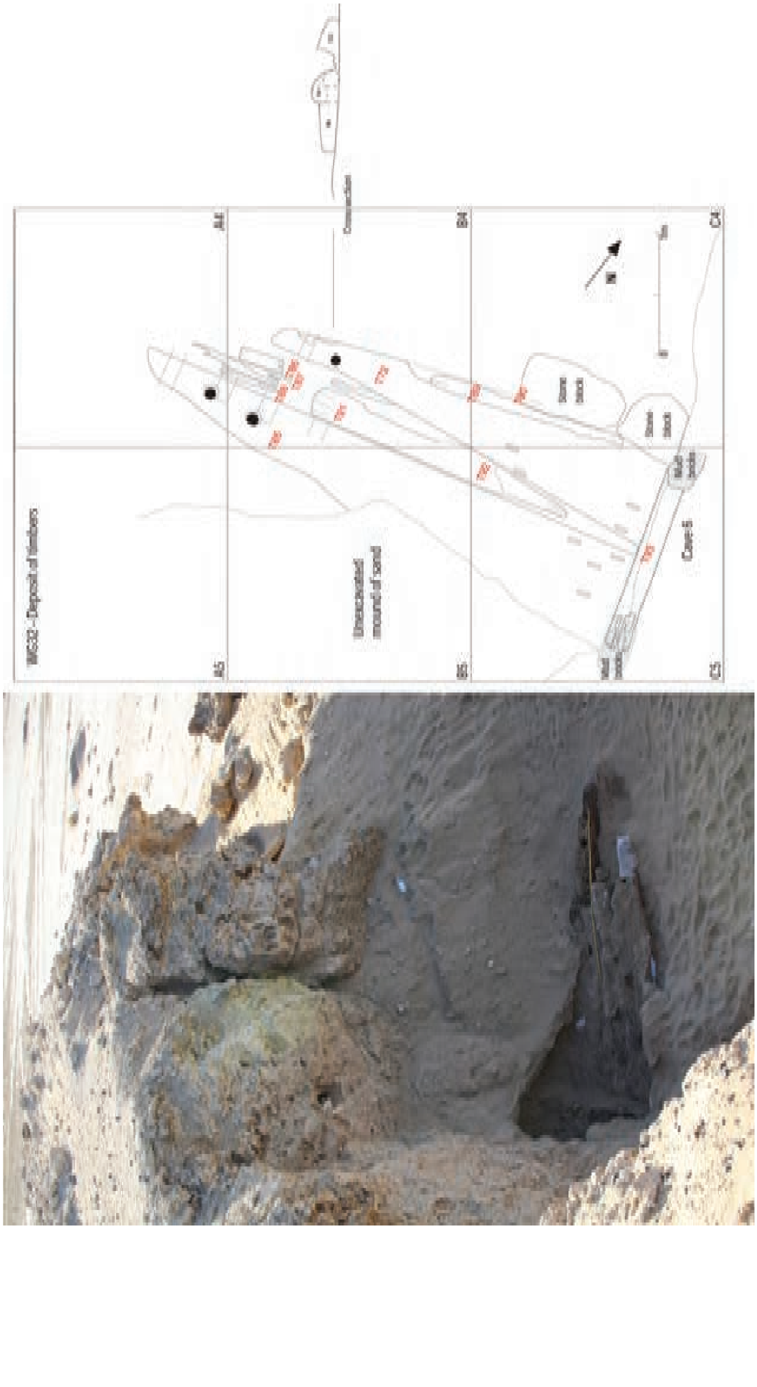


Figure 116. *Deposit of timbers in WG 32, with steering oar blades T72 and T85.*

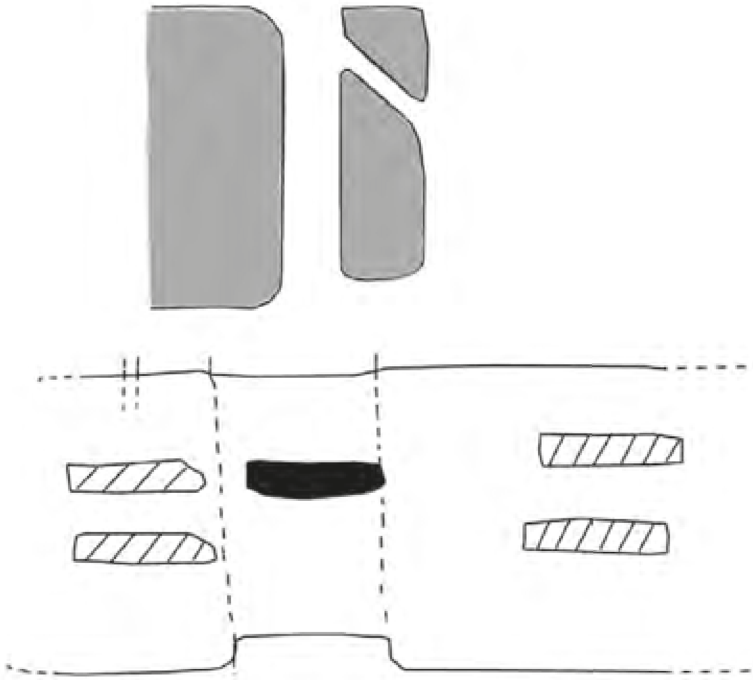


Figure 117. *Fastenings on T64 from WG 32.*

Figure 118. *Anchors A23 (A) and A24 (B).*

Figure 119. *Anchor A26 from WG 60.*

Figure 120. *Anchor A27 from WG 60.*

Figure 121. *Fragments of limestone, possibly from an intentionally crushed anchor in situ in WG 58.*

Chapter 6
Finds at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011:
Other Wood and Wood Identification

6.1 Wooden artifacts

6.1.a Wooden boxes, 2006-2007

ANDREA MANZO

Twenty-two complete or fragmentary wooden boxes were excavated in WG 32 in 2006-2007 (see 3.2.b Excavations, western terrace slope), in the same Middle Kingdom assemblage where other 21 similar boxes were found in 2005-2006 (Bard and Fattovich 2007: 60). The boxes were piled altogether and were from the same shipment. The boxes were covered and filled by a deposit of sand and sea grass (Figure 122). Some of them had been damaged by insect activity. An inscription on a box discovered in 2005-2006 suggested that they were used to transport products from Punt (Bard and Fattovich 2007: 238).

Nine boxes were 50-52 cm × 32-34 cm in size, like those discovered in 2005-2006, and in some cases 24-27 cm high. Four boxes were ca. 45-48 cm × 30-34 cm × 20 cm in size. Four were ca. 51-55 cm × 37-39 cm × >21 cm in size. The planks forming the boxes were always ca. 2 cm thick. Five boxes were very fragmentary and only the thickness of the planks was recorded.

The sides, bases and lids of the boxes were formed by two or more planks, matched and connected by dowels. The external and internal surfaces of the boxes were usually covered with plaster. A light red color is often visible beneath the plaster coating. Frequently, a thick layer of white plaster, different from the plaster of the coating, was found on plank joints and, in the case of Box 41, formed a stratum in the box fill. This plaster was probably intended to better seal or to preserve the content of the boxes.

All boxes are similar in typology and construction technique. The joints between the planks were fixed with dowels with a round cross-section, 2.5 cm to 10 cm long 0.5 cm to 2.5 cm in diameter. The base, when preserved, was always characterized by rectangular furring strips.

All the components of the boxes were analyzed to identify the wood used in their production (6.2.b Identification of wood and charcoal, 2006-2007).

On a lid and on a short side of box 42 conical pegs were preserved (Figure 123). They were intended to close the boxes with ropes. Their occurrence confirms that most of the clay sealings excavated here with impressions of a peg, ropes and wood grain may have been originally used to seal the boxes.

In particular, Box 21 had a hieroglyphic inscription painted in black on the external surface of one of the short sides, confirming that these boxes were used to transport products from Punt (see 9.4 Cargo box inscriptions). Shorter inscriptions consisting of few signs were remarked on Boxes 36 (possibly a fabrication mark), 40, 41 and 42 (see again 9.4 Cargo box inscriptions).

Boxes similar to those from Mersa/Wadi Gawasis were also found at Kahun in an assemblage dating to the 12th Dynasty (David 1986: Pl. 4).[1]

6.1.b Wood artifacts, 2007-2008

CHIARA ZAZZARO

During the 2007-2008 field season, four complete or fragmentary conical wood artifacts were found in different contexts in WG 55. They were ca. 3.5 cm in length and 2.2-3.2 cm in diameter and were interpreted as pegs, perhaps for closing boxes. One of them is complete, (3.5 cm long, 3.2 cm in diameter), with a dowelled end for insertion (Figure 124). It is similar to an artifact found at Kahun, now in the Petrie Museum of Egyptian Archaeology, London (UC7371), probably dating to the 12th Dynasty. Similar artifacts were also interpreted as pegs or pins (*e.g.*, UC7448 and UC7095 in the Petrie Museum), and were also found at Kahun and dating to the same period.

Wood debris found in the sand deposit on the slope, in WG 32, WG 55 and WG 56, also included some fragments covered with white plaster; they were interpreted as possible box fragments (see 6.1.a Wooden boxes, 2006-2007). Among them was a complete side of a box (SF21, ca. 26 cm × 9.5 cm) with holes for pegs, found in WG 32. Two fragmentary ends of boxes were also found: one, 16 cm × 2.5 cm × 2 cm, from WG 56, A2, SU8 with a peg still in place, and the other was 34.5 cm × 3.7 cm × 2.5 cm, from WG 55, C1, SU11.

[1] See also the box in the Petrie Museum of Egyptian Archaeology, London: UC7513.

A wooden angle of a joint was found in WG 55, C3, SU11. It is 11.5 cm × 16.5 cm and has three pegs and one hole for a peg for insertions. It is similar to two artifacts found a Kahun which date to the 12th Dynasty (Petrie Museum UC7113 and UC7114). A cylindrical wooden artifact, 3.5 long and 1.7 in diameter, was also found in WG 55, D1/2, SU3.

6.2 Identification of wood and charcoal[2]

RAINER GERISCH

6.2.a Identification of wood and charcoal, 2005-2006

In the first stay with the excavation project at Mersa/Wadi Gawasis, the main focus was the recording of the taxa represented in the wood charcoal and desiccated wood to get an impression of the assemblages.[3] Charcoal samples recovered in this field season (excavation units WG 16, WG 19 and other) revealed 14 woody taxa among which *Acacia nilotica*, *Cedrus libani*, and *Avicennia marina* provided the largest proportions. They come from the eastern Mediterranean region, the Nile valley, the coastal region of the Red Sea, and East Africa. From the seagoing ships, construction parts, among them a deck beam, hull planks, two steering oar blades, and wooden cargo boxes were studied. Wood of *Cedrus libani*, *Acacia nilotica*, *Faidherbia albida*, and *Ficus sycomorus* was used. The activities of dismantling, cleaning, repair, and modification of timbers at the harbor have led to discarded parts, wood debitage (wood chips) and other wood debris which served as an important source of fuel in a sparsely vegetated environment.

The main objective of the anthracological studies was the recording of the native and non-native taxa of trees and shrubs, providing information on the ancient plant cover, the range of woody plants utilized for

[2] For further details on the excavation units of studied material see Appendix 4.

[3] In the present and following annual reports, descriptions of the examined wood charcoal are given before those of the desiccated wood due to the greater amount of information obtained from the identified taxa and the quantitative data. Each report includes a summary with remarks on the conducted activities and main findings. Plants are first mentioned by their scientific (Latin) names, and in other places also by their English common names.

fuel, and the used sources for the gathering of firewood, and giving indications of trade connections through the occurrence of remains of valuable imported wood. Of most interest in the study of the desiccated wood was the microscopic analysis of finds belonging to structural elements of the oldest seagoing ships excavated in abundance under supervision of maritime archaeologist C. Ward. They include deck and hull components and maritime equipment among which are a deck beam, numerous planks and tenons, blades from two steering oars, a crutch and a knob, which may be an oarlock, and construction elements of plastered wooden cargo boxes which were used to transport commodities from the land of Punt. Additionally, shrubs growing near the excavation were identified.

Charcoal is generated by a distillation process where wood is charred in an oxygen-reduced atmosphere, in the course of which moisture and organic compounds are driven off as pyrolysis gases. These volatile substances can comprise more than 80% of dry wood; the residue of solid material is charcoal. In antiquity, charcoal was produced in kilns and pits to make use of the high temperatures which can be obtained by charcoal fires. To a certain extent, distillation occurs as a transitional stage also in the combustion process of the usual wood fires. Residues of charcoal can therefore be found in fire-pits of wood fires as well as in those of charcoal fires, provided the fire has been extinguished before the fuel was completely converted into ashes. In wood fires, moisture is driven off at temperatures of about 100°C (drying), between 100 and 150°C the thermal decay begins and above 150°C the generation of pyrolysis gases increases (degasification). The actual combustion starts at about 225°C by inflammation of these gases and the generation of heat at temperatures near 300°C, provided that a sufficient quantity of oxygen is available. After the volatile substances are burnt, the glowing charcoal is left over, burning slowly and nearly without flame at a temperature of more than 700°C (burning out).

Under the weathered surface of charcoal fragments, wood anatomical features are remarkably well preserved even after thousands of years of deposition in the ground, since charcoal is chemically quite inert and resistant to microbial decomposition. To examine charcoal, the pieces are fractured by hand, cut/fractured with a sharp blade or already existing breaks are used, and the wood structure is observed in the planes transversal, tangential longitudinal, and radial longitudinal using an incident light microscope. Anatomical characters used to identify the different types of hard and soft-wood on the genus or species level are the presence or absence of growth ring boundaries, porosity, form and size of vessels and pattern of vessel arrangement, wall thickness and arrangement of fibres, distribution and arrangement of axial parenchyma, ray size and composition, the type of vessel perforation, in coniferous wood the presence or absence of resin ducts or traumatic resin ducts, ray size and composition, tracheid to ray pitting, etc. For documentation, the pieces of each taxon represented in a sample were counted and their volume and weight measured.

The studied charcoal comprises 1,310 pieces combined in 56 samples with a volume of about 1,570 ml. From these, 1,287 are identifiable pieces of wood charcoal, the remaining portion comprises unidentified pieces. The material was recovered by hand selection and through dry sieving. The largest amount of charcoal fragments came from fire-pits in the industrial area (WG 19) at the base of the western slope of the fossil coral terrace where a variety of activities including bread production had taken place. Deposits containing the largest amounts of charcoal were found in WG 19, SU50 (541 pieces, 450.4 ml), SU58 (108 pieces, 50.1 ml), both circular fire-pits, deep concentration of ash, ca. 30-40 cm, 70-80 cm in diameter, chunks of charcoal, and a huge amount of pottery and bread mold sherds, most of which was burnt, SU44/SU45 (102 pieces, 98.6 ml), two possible post-holes, circular, with ca. 15 cm diameter, and WG 16, SU19 (180 pieces, 133.7 ml), soft sand mixed with wood and rope fragments, potsherds, and dung.

The obtained spectrum proved to be strongly influenced by the repair work at the harbor site with man-made caves cut into the coral terrace, some of which were used as workshops and storage rooms. From the long voyages, planks of the seagoing ships had weathered and were destructed by shipworms and other marine wood-borers (*Teredo* sp., family: Teredinidae (mollusks); *Limnoria* sp., family of Limnoriidae (crustaceans). Shipwrights marked such pieces, which later were removed by sawing or chiseling through the tenons. From the activities of dismantling, cleaning, repair, and modification of ship timbers, waste wood was produced and parts lost their planned use. Inside the Caves 2 and 3, activity areas of woodworking were found which were charcterized by concentrations of wood fragments; some of them could be identified as fragments of mortise-and-tenon joints and dovetail joints. To a greater extent such remnants served as fuel. In general, fuel material is collected from the nearest resources, while in woodworking material from greater distances also was used.

Charcoal analysis on finds of the examined excavation units has yielded 14 taxa among which *Acacia nilotica* (Nile acacia), *Cedrus libani* (cedar of Lebanon), and *Avicennia marina* (grey mangrove) provided the largest proportions. The identified woods, presented in Table 9, came from three different geographical directions and the local environment: the mountain forests of the eastern Mediterranean region: *Cedrus libani*, *Pinus* sp. (pine), *Quercus* sp. (deciduous and evergreen oak); the floodplain of the Nile valley: *Acacia nilotica*, *Faidherbia albida* (white acacia), *Ficus sycomorus* (sycamore fig), *Salix* sp. (willow); from the dry savanna woodlands of the South: *Diospyros* sp. (ebony); and the coastal region of the Red Sea: *Avicennia marina*, *Leptadenia pyrotechnica* (broom bush), *Suaeda* sp. (seablite). *Tamarix* sp. (tamarisk) is found as well in the Nile valley as on the Red Sea. The majority of the charcoal remnants was obtained from excavation units WG 19 and WG 16 (Figure 125) in which also most of the wood taxa occurred, 11 in each unit, whereas in the other excavation units, 1-6 were present corresponding to the lower number of charcoal finds.

In the identified material, *Acacia nilotica* dominates with 39.6%, occurring with 510 pieces (779.7 ml) in 45 samples, the percentage of pres-

MERSA/WADI GAWASIS **Charcoal** 2005-06 / Wood taxa	**Presence [spls]**	**Count [pcs]**	**Volume [ml]**	**Weight [g]***
Cedrus libani	28	486	450.4	173.5
Pinus sp., pinoid pits	2	2	12.2	5.8
Acacia nilotica	45	5107	779.7	586.3
Acacia sp.	4	9	7.2	4.1
Avicennia marina	29	130	136.3	72
Diospyros sp.	2	9	9.1	4.1
Faidherbia albida	4	28	52	16.4
Ficus sycomorus	2	5	2.5	0.7
Leptadenia pyrotechnica	9	11	7.5	2.7
Quercus sp., deciduous	3	19	24.8	10.9
Quercus sp., evergreen	2	2	0.8	0.4
Salix sp.	2	3	1.9	0.5
Suaeda sp.	9	58	48.5	31.8
Tamarix sp.	13	17	14.7	5.3
**sometimes affected by salt adherences*	56	1,287	1,547.6	914.5

Table 9. *Anthracological spectrum of field season 2005-2006.*

ence amounts to 80.4%. *Cedrus libani* follows with 486 pieces (450.4 ml) and 37.8%, identified in 28 samples, its percentage of presence is 50%. *Avicennia marina* shows with 130 pieces (136.3 ml) a less amount (10.1%) but is present in 29 samples (51.8%). The other taxa make up less then 10% concerning the number of identified pieces. *Suaeda* sp. is represented with 58 charcoal pieces (4.5%), 48.5 ml, in 9 samples (16.1%). *Tamarix* sp. occurs with a percentage of pieces of only 1.3% but percentage of presence of 23.2%. *Leptadenia pyrotechnica* is found mostly in single pieces but in 9 samples (16.1%) (Table 9, Figures 126, 127).

The obtained results in relation to excavation units and their Stratigraphic Units are given in Tables 10 and 11.

The precious timber from the cedar of Lebanon was the most frequent among the imported coniferous woods, brought from the harbors of the Levant. The ancient Egyptians used the reddish brown, straight-grained, and aromatic wood extensively, which is easy to work and durable. Byblos had developed into the most important timber shipping center of the eastern Mediterranean from where cedar, pine and other coniferous woods were transported to Egypt.

MERSA/WADI / **Excav.** **GAWASIS** units (10) Wood taxa (14) /	**WG 16**	**WG 19**	**WG 24**	**WG 26**	**WG 27**	**WG 30**	**WG 31**	**WG 32**	**WG 35**	**GTT**
Analyzed spls / material pcs /	19 296	7 860	7 21	4 15	1 10	12 64	1 9	2 26	1 1	1 7
Cedrus libani	•	•	•		•	•	•	•		
Pinus sp., pinoid pits	•									
Acacia nilotica	•	•	•	•	•	•	•	•	•	•
Acacia sp.	•	•	•							
Avicennia marina	•	•	•	•		•	•			
Diospyros sp.	•							•		
Faidherbia albida		•				•				
Ficus sycomorus	•	•								
Leptadenia pyrotechnica	•	•		•						
Quercus sp., deciduous		•								
Quercus sp., evergreen		•				•				
Salix sp.	•									
Suaeda sp.	•	•	•							
Tamarix sp.	•	•				•				

Table 10. *Wood taxa identified in the charcoal material from the different excavation units.*

Excavation Unit	SU number / No. of samples	Wood taxa	Count [pcs]	Volume [ml]	Weight [g]*
WG 16	SU1 / 1 sample	*Acacia nilotica* *Avicennia marina* *Cedrus libani*	3 2 1 (1)	4 1.2 0.3 (1.5)	2.2 0.6 0.1 (0.9)
	SU19 / 8 samples	*Acacia nilotica* *Acacia* sp. *Avicennia marina* *Cedrus libani* *Diospyros* sp. *Ficus sycomorus* *Leptadenia pyrotechnica* *Salix* sp. *Suaeda* sp. *Tamarix* sp.	108 3 30 16 1 3 6 3 2 6	80 3.2 19.2 14.2 0.1 1 2.3 1.9 3.7 7	43.8 2 8.7 3.2 0.1 0.4 0.7 0.5 2.2 2.4
	SU45 / 1 sample	*Acacia nilotica* *Cedrus libani*	1 1	1.6 0.6	1.1 0.2
	SU48 / 1 sample	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Suaeda* sp.	2 1 1 1	1.4 0.4 0.7 0.7	0.7 0.2 0.2 0.4
	SU49 / 1 sample	*Acacia nilotica*	6	2.6	1
	SU66 / 1 sample	*Acacia nilotica* *Pinus* sp., pinoid pits	2 1	24 9.5	19 3.8
	SU74 / 1 sample	*Acacia nilotica*	4	20	15.9
	SU77/SU75 / 1 sample	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Suaeda* sp. *Tamarix* sp.	(5) 4 (1) (2) 49 (19) 1	(3.5) 4 (1) (2) 29 (16) 0.1	(0.7) 2.8 (0.4) (0.7) 20 (7.9) 0.1
	Sand surface / 4 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Leptadenia pyrotechnica* *Pinus* sp., pinoid pits *Tamarix* sp.	19 8 3 1 1 4	16.2 3.7 1.3 1.2 2.7 3.3	8.4 1.8 0.3 0.5 2 1.2
WG 19	SU11 / 1 sample	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Quercus* sp., deciduous	16 6 2 2	20.5 9.5 3 1.2	7 5.2 0.8 0.7
	SU42 / 1 sample	*Acacia nilotica* *Avicennia marina* *Quercus sp., deciduous*	42 8 16	62 14.5 23	21.7 6.9 9.8

WG 19	SU44/SU45 / 1 sample	*Acacia nilotica*	36	26	12.4
		Avicennia marina	5	1.3	0.5
		Cedrus libani	36	23	7.4
		Faidherbia albida	20	45	14
		Leptadenia pyrotechnica	1	0.2	0.1
		Suaeda sp.	1	1.7	0.9
		Tamarix sp.	1	0.2	0.1
	SU50 / 1 sample	*Acacia nilotica*	188	165	97.2
		Acacia sp.	3	2.6	1.4
		Avicennia marina	27	20	11.9
		Cedrus libani	301	246.5	67.5
		Faidherbia albida	4	4.3	1.5
		Ficus sycomorus	2	1.5	0.3
		Leptadenia pyrotechnica	1	0.1	0.1
		Quercus sp., deciduous	1	0.6	0.4
		Quercus sp., evergreen	1	0.3	0.2
		Suaeda sp.	1	0.4	0.2
		Tamarix sp.	1	0.4	0.1
	SU58 / 1 sample	*Acacia nilotica*	22	10	5.4
		Avicennia marina	2	1.2	0.6
		Cedrus libani	82	38	10.2
		Suaeda sp.	1	0.2	0.1
	SU60 / 1 sample	*Suaeda* sp.	2	12.4	7.8
	SU66 / 1 sample	*Acacia nilotica*	3	41	45.4
		Avicennia marina	6	9.5	5.9
		Cedrus libani	1	0.7	0.3
		Faidherbia albida	3	2.2	0.7
		Leptadenia pyrotechnica	1	0.2	0.1
WG 24	SU34 / 1 sample	*Acacia nilotica*	5	72	50.5
		Avicennia marina	1	18.2	10.2
	SU37 / 1 sample	*Acacia nilotica*	3	4.2	3.4
		Acacia sp.	1	1.4	0.7
		Cedrus libani	1	0.3	0.1
		Suaeda sp.	1	0.4	0.2
	SU43 / 2 samples	*Acacia nilotica*	1	20	16.1
		Avicennia marina	2	12	6.4
	SU53 / 2 samples	*Acacia nilotica*	2	5.5	4.2
		Avicennia marina	2	2.4	0.9
WG 26	SU30 / 1 sample	*Acacia nilotica*	1	45	97.7
	SU72 / 1 sample	*Acacia nilotica*	1	66	69.2
		Leptadenia pyrotechnica	1	3.5	1.2
	SU75 / 1 sample	*Acacia nilotica*	1	6.5	5.9

	SU81 / 1 sample	*Acacia nilotica* *Avicennia marina*	2 5	4.2 2.4	3.8 1.3
WG 27	SU62 / 1 sample	*Acacia nilotica* *Cedrus libani*	3 7 (1)	10.5 43 (50)	8.4 50.7 (41.2)
WG 30	SU50 / 6 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Quercus* sp., evergreen *Tamarix* sp.	9 14 (1) 6 1 3	9 7.3 (9) 21.4 0.5 3.2	3.9 3.3 (5.5) 7.2 0.2 1.2
	SU62 / 3 samples	*Cedrus libani*	9 (1)	22.4 (5)	15 (4.6)
	SU65 / 1 sample	*Cedrus libani*	6	8	2.3
	SU68 / 2 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Faidherbia albida* *Tamarix* sp.	1 4 8 1 1	1.2 2.5 4.1 0.5 0.5	0.8 1.3 1.2 0.2 0.2
WG 32	SU1 / 1 sample	*Acacia nilotica* *Cedrus libani*	1 1	6.2 0.9	3.1 0.3
	SU16 / 1 sample	*Acacia nilotica* *Cedrus libani* *Diospyros* sp.	16 (9) 8	20.5 (36) 9	11.4 (15.4) 4

Unidentified charcoal pieces are not included. The values in brackets concern finds of uncharred or slightly charred wood.
**sometimes affected by salt adherences*

Table 11. *Results of charcoal analysis in relation to Stratigraphic Units.*

Cedrus libani is a majestic tree, between 20 and 30 m high with large widespreading, horizontal branches. It can reach an age of more than 1,000 years. Extensive forests were found in Asia Minor and Western Asia, in the Taurus mountains, in Syria and Lebanon. The trees grow primarily in rocky soils at about 1,800 m. Nowadays, only relicts of the original forests are still preserved. The wooded areas in Lebanon are covering approximately 6% of the country (Masri 1995). The cedar forests have been reduced to less than 3% of their former extension. They are limited to 12 separate stands in the Mount Lebanon range. The

Bcharre cedars are the most famous; the grove with about 400 trees contains the oldest and largest specimens. Further protected areas are Jabal el-Barouk, located on the slopes of the central section of the Mount Lebanon chain, and the Horsh Ehden forest in northern Lebanon. The largest amounts of cedar charcoal are present in the fire-pits of WG 19, SU50 (301 pieces, 246.5 ml) and SU58 (82 pieces, 38 ml), as well as in SU44/SU45 (36 pieces, 23 ml).

Contact with the Syro-Palestinean area is also demonstrated by the presence of charcoal from pine and oak. Among the coastal pines are *Pinus halepensis*, the Aleppo pine, and *Pinus pinea*, the stone pine, which form a characteristic part of the Lebanese mountain landscape. Oak wood is not supposed to have been frequently imported into ancient Egypt. *Quercus coccifera* (kermes oak) and *Q. infectoria* (Cyprus oak) belong to the main widespread forest tree types in Lebanon. To deciduous or summergreen oaks belong *Q. cerris* (Turkey oak), *Q. infectoria*, *Q. ithaburensis* (Tabor oak), and *Q. libani* (Lebanon oak); an evergreen oak is *Q. coccifera*. The yellowish brown heartwood is very durable and foul-resistant and provides an excellent timber. Oak charcoal was found in three contexts with the largest amount in the fire-pit of WG 19, SU42 (16 pieces, 23 ml), further in SU11 (2 pieces, 1.2 ml), both with deciduous oak, and in the fire-pit of SU50 with a single piece of deciduous and evergreen oak each (1 piece, 0.6 ml; 1 piece, 0.3 ml).

The trees of *Acacia nilotica* have been exploited since Predynastic times. The reddish to light brown, hard, dense, and termite resistant wood was taken as high-quality firewood and for charcoal making because of its excellent calorific properties. It was also used to a great extent for construction works, furniture, coffins, statues, boxes, tools, dowels, and for boat and ship building. The Nile acacia prefers alluvial soils and a continuous water supply and grows in the floodplain of the Nile valley and in the oases. It is a 3-15 m high tree branching from the base and forming a rounded crown, with a dark stem, bipinnate leaves, and stipular spines; bright yellow, fragrant flowers are clustered in small round heads (Boulos 1999: 368). The tree is important in arid regions where wood is scarce.

Faidherbia albida grows on the Nile and channel banks in Egypt and the Sudan; in Egypt, it is nowadays only found between Aswan and

Qena and at one documented and one reported stand in the Eastern Desert (Boulos and Hobbs 1986). The up to 18 m high tree has its main distribution in tropical Africa. Other identified trees from the Nile valley are *Ficus sycomorus* and *Salix* sp. The sycamore fig is one of the most important fruit trees; the figs are very sugary and can be dried and stored. The wood was frequently used, especially for purposes with no high demands on hardness and strength, for coffins, furniture, statues, and in boat and ship building. It is too coarse for the making of fine furniture. *S. subserrata* (Egyptian willow) is a small dioecious tree or shrub on the banks and islands of the Nile and is also cultivated in the countryside. The soft, light-weighting, non-splintering wood was used for bowls and other domestic items, the withies for basketry; the fuel is of poor quality.

Wood charcoal of *Diospyros* sp. was found in two samples, in WG 16, SU19 (1 piece, 0.1 ml), soft sand mixed with wood and rope fragments, potsherds, dung, and in WG 32, SU16 (8 pieces, 9 ml), sand layer under a seagrass layer (SU15), including a fire-pit with a potsherd and some pieces of wood. The identified charcoal provides good evidence for trade from Punt. The genus *Diospyros* belongs to the Ebenaceae family; the tropical hardwood trees favored for their beautiful and highly valued wood are mainly growing in Africa, India, and Ceylon. *D. mespiliformis*, the jackalberry, more widespread and abundant than other ebonies, is the most likely species distributed over the whole of tropical Africa, especially East and South Africa, from the southern Sahel, Senegal eastward up to Ethiopia and southward up to Namibia and Transvaal. It is most commonly found in savannas and savanna woodlands. The up to 20-25 m high tree with a trunk that can reach 1.4 m in diameter, has a dense, dark green, and spreading crown. Its wood is very hard, heavy, and dense. The more brown than black, fine grained heartwood, clearly defined from the pale sapwood, is exceptionally decorative and used mainly for high-quality furniture and for inlays and veneering to contrast with other woods or ivory (Gerisch 2017: 210).

One of the few sources of timber and firewood from the local region is the grey mangrove. The tree can be found from the Red Sea coast of Egypt southward to South Africa and eastward to the West Pacific. Mangrove stands are relatively small in Egypt. The usual habitat of the mangroves is the shallow water along the Egyptian Red Sea coast, especially in protected areas like lagoons, bays, coral reefs parallel to the shore, and where wadis enter the sea from the mountains (Zahran and Willis 2009: 109). In a few locations, *Avicennia marina* occurs on the terrestrial side of the shoreline. The northernmost locality of the western Red Sea coast (Egypt, Sudan) is Abu Sha'ar, about 22 km north of Hurghada, where small stands of mangrove are growing in the bay; further stands can be found on the western shoreline of Safaga Island with trees up to 4.8 m high, in South Safaga and on the bay of Quseir (PERSGA/GEF 2004: 11-15, Zahran and Willis 2009: 322-324). The tree is most common along the Egyptian coast of the Gulf of Aqaba. The other mangrove species occurring on the Red Sea coast, *Rhizophora mucronata*, is only recorded from areas near the Egyptian-Sudanese border coexisting along with *Avicennia marina*. *A. marina* is a small evergreen tree or shrub with a light grey bark and thick leathery leaves; numerous vertical pneumatophores arise from horizontal roots. The grey mangrove is perfectly adapted to the environment. It has a distinct salt tolerance and the ability to grow in anaerobic and often unstable sediments. The tree receives oxygen through the aerial roots. The yellowish grey to reddish brown wood is medium heavy, hard and strong, often spiral-grained, and difficult to work. It has been exploited for timber and fuel over millennia as the results of wood and charcoal analyses testify. Mangroves have been more widespread in the past. Woodcutting has led to a reduction of the original richer growth along the coastal region of the Red Sea. In most localities, they represent remnants of formerly larger stands.

A common plant on the Red Sea coast representing the similar use of local resources is *Suaeda* sp., a halophytic shrub or rarely small tree, which can be found in salt marshes and on fringes of the coastal plain. *Leptadenia pyrotechnica*, a much branched, spinescent, leafless shrub, is distributed in the Red Sea coastal land, the Sinai, as well as in the Nile region, in sandy plains and wadis. *Tamarix* spp. are widespread in Egypt and found in a variety of habitats. The shrub or small tree grows on saline soils, in salt marshes and wadis, and is found in the floodplain of the Nile. Tamarisk wood was used for furniture, coffins, statues, dowels, and as fuel.

About 50 objects, samples taken from those, and fragments of timber and wood from the seagoing ships have been studied, which comprise 7 woody taxa (Table 12). The most abundant are *Cedrus libani* and *Acacia nilotica*; occasionally present is *Ficus sycomorus*, and in single cases *Avicennia marina*, *Faidherbia albida*, and *Tamarix* sp.

Catalog number	**Object**	**Wood taxon**	**Field season**	**Excavation unit**	**Stratigraphic unit**
T1	Rudder blade 2(upper portion)	*Faidherbia albida*	2004-05	WG 24	SU26
T1b	Rudder blade 2 (lower portion)	*Acacia nilotica*	2004-05	WG 24	SU26
T2	Rudder blade 1	*Acacia nilotica*	2004-05	WG 24	SU26
T5	Plank, Type 2	*Cedrus libani*	2004-05	WG 24	SU35
T8	Plank, Type 3	*Ficus sycomorus*	2004-05	WG 24	SU34
T9	Plank, Type 3	*Cedrus libani*	2004-05	WG 24	SU34
T13	Plank, Type 4	*Acacia nilotica*	2005-06	WG 30	SU62
T14	Plank, Type 4	*Acacia nilotica*	2005-06	WG 30	SU62
T15	Plank, Type 3	*Ficus sycomorus*	2005-06	WG 16	SU19
T16	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	SU56
T17	Plank, Type 3?	*Cedrus libani*	2005-06	WG 24	SU56
T19	Plank, Type 2	*Cedrus libani*	2004-06	WG 24	SU32
T20	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	Entrance corr.
T21	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	Entrance corr.
T22	Plank, Type 3?	*Cedrus libani*	2005-06	WG 24	Entrance corr.
T23	Plank, Type 2	*Cedrus libani*	2004-05	WG 24	SU32
T25	Plank, Type 3	*Cedrus libani*	2005-06	WG 30	SU62
T26	Plank, Type 3	*Cedrus libani*	2005-06	WG 30	SU62
T27	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	SU57
T28	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	SU57
T29	Plank, Other	*Avicennia marina*	2005-06	WG 24	SU57
T31	Plank, Type 4	*Acacia nilotica*	2005-06	WG 30	SU69
T32	Deck beam	*Cedrus libani*	2005-06	WG 30/16	SU71
T33	Plank, Type 2	*Cedrus libani*	2005-06	WG 30	SU71
T34	Plank, Type 2	*Cedrus libani*	2005-06	WG 32	SU9
T39	Plank, Type 2	*Cedrus libani*	2005-06	WG 24	SU57
T41	Plank, Type 4	*Acacia nilotica*	2005-06	WG 30	SU62

T42	Plank, Other	*Cedrus libani*	2005-06	WG 24	SU64
T44	Crutch	*Acacia nilotica*	2005-06	WG Cave 4	SU1
T45	Knob, possib. oarlock	*Ficus sycomorus*	2005-06	WG 24	SU56
T46	Plank	*Cedrus libani*	2005-06	WG 30	SU50
T48	Plank, Other	*Cedrus libani*	2005-06	WG 24	SU57
T50	Plank, Other	*Acacia nilotica*	2005-06	WG 24	SU57
	with dowel	*Acacia nilotica*			
T60	Plank, Other	*Cedrus libani*	2005-06	WG 16	SU75
W8	Plank, Other	*Ficus sycomorus*	2005-06	WG 24	SU34
	Dovetail	*Acacia nilotica*			
	Stick	*Tamarix* sp.			
W9	Tenon, Size III	*Acacia nilotica*	2005-06	WG 24	SU34
W23	Tenon, Size I	*Acacia nilotica*	2005-06	WG 24	SU53
W33	Tenon, Size II	*Acacia nilotica*	2005-06	WG 30	SU50
W51	Tenon, Size I	*Acacia nilotica*	2005-06	WG 30	SU62
W53	Tenon, Size II	*Acacia nilotica*	2005-06	WG 24	SU57
W61	Plank, Other	*Acacia nilotica*	2005-06	WG 24	SU53
	Plank, Other	*Cedrus libani*			
W135	Tenon, Size I	*Acacia nilotica*	2005-06	WG 30	SU50
W143	Plank, Other	*Cedrus libani*	2005-06	WG 24	SU34
	Tenon, Size I	*Acacia nilotica*			
	Half-round piece	*Ficus sycomorus*			
W145	Tenon, Size I	*Acacia nilotica*	2005-06	WG 24	SU34
W147	Wedge-shaped piece	*Ficus sycomorus*	2005-06	WG 24	SU43
W167	Tenon	*Acacia nilotica*	2005-06	WG 24	Entrance corr.
Cargo box 1	Planks	*Ziziphus spina-christi*	2005-06	WG 32	SU1
	Furring strips	*Acacia nilotica*			
	Dowels	*Acacia nilotica*			
Cargo box 3	Planks	*Ficus sycomorus*	2005-06	WG 32	SU1
	Furring strips	*Tamarix* sp.			
	Dowels	*Tamarix* sp.			

Cargo box 8	Planks	*Faidherbia albida*	2005-06	WG 32	SU1
		Ficus sycomorus			
Cargo box 11	Planks	*Ficus sycomorus*	2005-06	WG 32	SU1
	Furring strips	*Ficus sycomorus*			
	Dowels	*Tamarix* sp.			
Cargo box 13	Planks	*Ficus sycomorus*	2005-06	WG 32	SU1
	Furring strips	*Ficus sycomorus*			
Cargo box 18	Planks	*Ficus sycomorus*	2005-06	WG 32	SU1

Table 12. *Examined finds of desiccated wood.*

The deck beam was identified as cedar wood. Also for planks mainly cedar wood was used, less often that of *Acacia nilotica* and *Ficus sycomorus*, and in one case of *Avicennia marina*. The tenons and one dovetail were all made from wood of the Nile acacia. The timber of quarter rudder blade 1 was identified in the upper part as *Faidherbia albida*, in the lower part as *Acacia nilotica*, and that of rudder blade 2 as *Acacia nilotica*. One can assume that the vessels were predominantly built from *Cedrus libani*, the wood of which is light in weight and dense, and through the naturally occurring resins relatively resistant to termite attack; the hard and strong wood of the Nile acacia served for fastenings and other parts. The shipwrights already knew the importance of using tenons that were harder than the wood surrounding them. The examined plank fragments of Type 4 (terminology: C. Ward), thinner than hull planks and joined with both mortise-and-tenon fastenings and ligatures, are all of *Acacia nilotica*, the examined deck planks, Type 3, are of *Cedrus libani*, some of *Ficus sycomorus*. From the fragmentary and complete wooden cargo boxes (6 of 21) excavated in WG 32, in front of the entrance to Cave 6, the different construction elements were analyzed by taking off splinters and thin slices. Microscopic analysis revealed that the planks of these boxes are predominantly of *Ficus sycomorus*, some of *Faidherbia albida* and *Ziziphus spina-christi* (Christ's thorn), furring strips are of *Ficus sycomorus*, some of *Acacia nilotica* and *Tamarix* sp., dowels of *Tamarix* sp. and *Acacia nilotica*. In the eastern sector on the top of the fossil coral terrace, a stone platform near the seashore was excavated which probably was part of an open-air altar constructed with conglomerate stone slabs covered with rocks of coral and limestone and covering a center framework of wood, which was identified as that of *Avicennia marina*.

6.2.b Identification of wood and charcoal, 2006-2007

In 2006-2007, samples and objects of excavation materials were examined again to gather further information on the taxonomic assemblages of the four main categories of wood related finds: wood charcoal, wooden construction parts of the seagoing ships (timbers, fastenings), nautical equipment, and wood debitage and other wood debris from the ships and cargo boxes, and through which sources and activities the taxa found entrance into the fuel material (collecting of firewood, ship repair work, modification of ship timbers). Samples of wood charcoal incoming from the fieldwork on a daily basis were studied and documented (WG 32, WG 39, WG 55 and other units). Noteworthy are the remains of *Quercus* sp. from the excavations in trench WG 39, Cave 3. Parts of additional cargo boxes from WG 32 were examined by their construction elements, and also a large amount of wood debitage from WG 39.

As usual, the charcoal was fractured by hand in the three main anatomical planes: transverse, tangential longitudinal, and radial longitudinal, desiccated wood cut by means of sharp blades, and the wood structures were studied under an incident light microscope. The identifications were carried out with help of wood anatomical atlases, online databases, a modern reference collection, and taxonomic and phytogeographical literature. The number of pieces and the amounts of volume and weight were determined for each taxon of a sample and the presence of salt adherences was recorded, which sometimes affected the weight measurements. The preservation of the charcoal material was observed and photographs were taken of larger pieces and rare finds of taxa. Remains of ship parts and cargo boxes were identified by their type of wood and documented in descriptions of their preservation and a larger number of photographs. Wood debitage (wood chips) and other wood debris were identified, counted per taxon, measured in length and width, weighed, and the presence or absence of damage caused by the infestation of marine boring animals (shipworm, gribble), remains of red paint, and of salt adherences were recorded. The preservation was again described and photographs were taken.

The charcoal fragments are very well to well preserved, dry, hard and strong, often with small to more rarely larger salt adherences; in some cases they are badly preserved, heavily salt encrusted and fragile. The size of the fragments ranges from small to very large; in Cave 3 fairly large charcoal pieces were found.

During the anthracological work, 1,490 pieces of charcoal have been examined combined in 71 samples, which represent almost the complete amount of excavated material. Wood charcoal was collected from excavation units WG 26, WG 32, WG 33, WG 38, WG 40, WG 42, and WG 44, recovered by hand selection and dry sieving from the soil material of deposits (aeolian, colluvial) and fills (fire-pits). Most of the remains were found in WG 32 (22 samples, 944 pieces, 650.7 ml), SU10: a sand stratum covering the boxes, SU25: sand fill at the entrance to Cave 6, and SU25/SU31: SU31: a sand stratum covered by SU25 in front of the entrance of Cave 6**;** WG 39 (19 samples, 152 pieces, 1,587.2 ml), SU12: windblown sand with evidence of very shallow hearths; and WG 44 (3 samples, 156 pieces, 279.6 ml), SU1: very loose fine aeolian sand with lots of salt encrustations including a medium to high quantity of artifacts and organic materials (charcoal, small branches), SU2: amorphous brown sand with gypsum nodules and some charcoal flecks, some fire-pits in different squares. In other excavation units, between 2 and 10 samples, each including between 9 and 109 pieces were collected. The pattern of composition in the examined samples was repeating and did not change the general picture obtained from the material of the first field season.

The wood-based fuel used at Mersa/Wadi Gawasis consisted of material brought to the site, of discarded ship timbers, wood debitage and other wood debris from the repair work and modification of timbers, and of wood collected from the local mangrove and salt marsh vegetation.

Anatomical analysis has allowed the identification of 12 woody taxa coming from the eastern Mediterranean region: *Cedrus libani*, *Pinus* sp., *Quercus* sp., the Nile valley: *Acacia nilotica*, *Faidherbia albida*, *Ficus sycomorus*, *Salix* sp., *Tamarix* sp., and the coastal region of the Red Sea:

Avicennia marina, *Leptadenia pyrotechnica*, *Suaeda* sp., *Tamarix* sp. The three major proportions of the fuel material are formed by *Acacia nilotica*, *Avicennia marina*, and *Cedrus libani*. The total values for the identified taxa are: *Acacia nilotica* (53 samples, 379 pieces, 1,688.3 ml), *Avicennia marina* (42 samples, 492 pieces, 394.8 ml), *Cedrus libani* (38 samples, 380 pieces, 500.2 ml), *Faidherbia albida* (5 samples, 7 pieces, 11.3 ml), *Ficus sycomorus* (11 samples, 18 pieces, 57.8 ml), *Leptadenia pyrotechnica* (10 samples, 12 pieces, 4.8 ml), *Pinus* sp. (2 samples, 5 pieces, 10 ml), *Quercus* sp., deciduous (3 samples, 10 pieces, 139 ml), *Quercus* sp., evergreen (1 sample, 1 piece, 0.2 ml), *Salix* sp. (1 sample, 1 piece, 1.5 ml), *Suaeda* sp. (7 samples, 19 pieces, 44.9 ml), and *Tamarix* sp. (15 samples, 46 pieces, 34.4 ml).

Wood taxa additional to those identified in field season 2005-2006 were not found (Table 13).

MERSA/WADI GAWASIS Charcoal 2006-07 / Wood taxa	**Presence [spls]**	**Count[pcs]**	**Volume[ml]**	**Weight[g]***
Cedrus libani	38	380	500.2	173.3
Pinus sp., pinoid pits	2	5	10	4.5
Acacia nilotica	53	379	1,688.3	1,191.3
Avicennia marina	42	492	394.8	226.3
Faidherbia albida	5	7	11.3	5.8
Ficus sycomorus	11	18	57.8	17.1
Leptadenia pyrotechnica	10	12	4.8	2.2
Quercus sp., deciduous	3	10	139	89.4
Quercus sp., evergreen	1	1	0.2	0.1
Salix sp.	1	1	1.5	0.2
Suaeda sp.	7	19	44.9	22.1
Tamarix sp.	15	46	34.4	18.3
*sometimes affected by salt adherences	71	1,370	2,887.2	1,750.6

Table 13. *Anthracological spectrum.*

The number of wood taxa for the excavation units ranges from 1 to 10: WG 26 (5 taxa, 57 pieces), WG 32 (10 taxa, 944 pieces), WG 33 (1 taxon, 9 pieces), WG 38 (7 taxa, 54 pieces), WG 39 (6 taxa, 152 pieces), WG 40 (2 taxa, 109 pieces), WG 42 (4 taxa, 9 pieces), and WG 44 (8 taxa, 156 pieces). In trench WG 32, *Avicennia marina* (362 pieces, 200.7 ml) and *Cedrus libani* (311 pieces, 258 ml) dominate the sample composition; also *Acacia nilotica* (113 pieces, 100.4 ml) is well represented. In WG 39, *Acacia nilotica* (89 pieces, 1,189.1 ml) provided the main proportion of the charcoal assemblages among which many pieces are large. Also the finds of oak are important. Oak wood is not known to have been brought to pharaonic Egypt in large quantities since finds are rare. Pine is represented in WG 44 by 5 pieces; in the previous field season, two pieces were recorded in WG 16. The charcoal pieces showed several resin ducts and pinoid tracheid-to-ray pits (Tables 14, 15).

MERSA/WADI / GAWASIS 06-07 Wood taxa (12) / **Excav.** units (8)	**WG 26**	**WG 32**	**WG33**	**WG38**	**WG 39**	**WG40**	**WG42**	**WG44**
Analyzed spls / material pcs /	10 57	22 944	2 9	10 54	19 152	2 109	3 9	3 156
Cedrus libani	•	•	•	•	•		•	•
Pinus sp., pinoid pits								•
Acacia nilotica	•	•		•	•	•	•	•
Avicennia marina	•	•		•	•	•	•	•
Faidherbia albida		•		•				•
Ficus sycomorus		•			•			
Leptadenia pyrotechnica	•	•		•				•
Quercus sp., deciduous					•			
Quercus sp., evergreen		•						
Salix sp.		•						
Suaeda sp.	•	•		•	•			•
Tamarix sp.		•		•			•	•
Suaeda sp.	•	•	•					
Tamarix sp.	•	•				•		

The values for the analyzed pieces comprise identified and unidentified wood charcoal as well as few pieces of bark.

Table 14. *Wood taxa identified in the charcoal material from the different excavation units.*

Excavation unit	SU number /No. of samples	Wood taxaand bark	Count [pcs]	Volume [ml]	Weight [g]*
WG 26	SU1 /2 samples	*Avicennia marina* *Suaeda* sp.	4 1	24 15	13.1 6.7
	SU30 /2 samples	*Acacia nilotica* *Avicennia marina* *Leptadenia pyrotechnica*	2 1 1	1.711	0.9 0.9 0.4
	SU76 /1 sample	*Avicennia marina*	2	2	1.5
	SU77 /2 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani*	13 5 13	10 22.1 91.1	9 13.8 29.4
	SU96 /1 sample	*Suaeda* sp.	4	15	7.6
	SU99 /1 sample	*Avicennia marina*	1	5	3.8
WG 32	SU1 /4 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Ficus sycomorus* *Leptadenia pyrotechnica* *Tamarix* sp. bark	8 40 37 1 2 3 1	5.4 13.8 12.9 0.5 0.3 0.9 0.2	4.5 7 4.5 0.1 0.1 0.4 0.1
	SU10 /6 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Faidherbia albida* *Ficus sycomorus* *Leptadenia pyrotechnica* *Tamarix* sp. bark	27 67 71 2 6 3 1 1	18.4 29.4 56.8 0.7 5.5 1 0.5 3	9.9 13.3 17.6 0.2 1.4 0.4 0.2 2.6
	SU25 /4 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Ficus sycomorus* *Quercus* sp., evergreen *Salix* sp. *Suaeda* sp. *Tamarix* sp. bark	34 74 (1) 90 3 (1) 1 1 1 10 1	28.1 50.5 (0.7) 98 2.2 (1) 0.2 1.5 0.2 9.5 1	16 28.6 (0.2) 37.3 0.5 (0.3) 0.1 0.2 0.1 5.5 0.8

	SU25/SU31 /1 sample	*Acacia nilotica*	17	11	6.2
		Avicennia marina	102	52	29.5
		Cedrus libani	44	16.2	4.5
		Ficus sycomorus	1	0.3	0.1
		Leptadenia pyrotechnica	2	0.8	0.6
		Tamarix sp.	1	0.6	0.2
	SU26 /1 sample	*Acacia nilotica*	12	22.5	11.3
		Avicennia marina	33	17	7.6
		Cedrus libani	45	55	17
		Faidherbia albida	2	1.6	0.5
		Ficus sycomorus	1	1.7	0.4
		Tamarix sp.	9	9.5	4
	SU27 /1 sample	*Acacia nilotica*	5	3	1.9
		Avicennia marina	14	14	7
		Cedrus libani	8	2.9	0.9
		Tamarix sp.	8	2.5	1.1
	SU31 /4 samples	*Acacia nilotica*	9	8.8	4.2
		Avicennia marina	26	21.3	10,1
		Cedrus libani	11	7.2	1.7
		Tamarix sp.	3	2.8	1.5
	Surface /1 sample	*Acacia nilotica*	1	3.2	1.9
		Avicennia marina	6	2.7	1.2
		Cedrus libani	5	9	3
		Tamarix sp.	3	1	0.4
WG 33	SU2 /2 samples	*Cedrus libani*	9	19.5	5.8
WG 38	SU1 /4 samples	*Acacia nilotica*	20	14.9	7.7
		Avicennia marina	9	7.2	4
		Cedrus libani	2	0.3	0.2
		Faidherbia albida	2	7	4
		Leptadenia pyrotechnica	1	0.3	0.1
		Tamarix sp.	1	0.6	0.3
WG 38	SU2 /3 samples	*Acacia nilotica*	10	12.1	8.5
		Avicennia marina	1	1.5	0.7
		Cedrus libani	1	0.5	0.1
		Leptadenia pyrotechnica	1	0.2	0.1
	SU3 /1 sample	*Avicennia marina*	1	1.5	0.9
	SU4 /1 sample	*Acacia nilotica*	1	0.8	0.4
		Suaeda sp.	1	1.2	0.7
	SU6 /1 sample	*Avicennia marina*	1	0.5	0.2
WG 39	SU1 /2 samples	*Acacia nilotica*	3	3.6	1.9

	SU11 /5 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani*	9 1 1 (4)	40.5 0.5 0.3 (5.5)	30 0.2 0.1 (1.6)
	SU12 /5 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Ficus sycomorus* *Quercus* sp., deciduous	67 1 4 4 9	986 13 12.2 19 132	736.8 12.2 4.8 4.6 86.4
	SU14 /1 sample	*Acacia nilotica*	1	45	34.5
	Surface /5 samples	*Acacia nilotica* *Cedrus libani* *Ficus sycomorus* *Suaeda* sp.	9 21 (2) 1 1	114 64 (8.7) 28 0.5	79.8 28 (4) 9.8 0.2
WG 40	SU2 /2 samples	*Acacia nilotica* *Avicennia marina*	35 60 (2)	104.2 52 (16)	66.7 27.8 (9.9)
WG 42	SU1 /1 sample	*Avicennia marina* *Cedrus libani* *Tamarix* sp.	1 2 1	0.4 0.3 0.6	0.3 0.1 0.2
	SU2 /1 sample	*Acacia nilotica*	4	0.1	0.1
WG 44	SU1 /2 samples	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Leptadenia pyrotechnica* *Pinus* sp., pinoid pits *Suaeda* sp. *Tamarix* sp.	48 37 10 2 4 11 5	92 48 25.5 1.2 9 13 5.2	49.9 29.6 10.1 0.5 3.5 6.8 4.1
	SU2 /1 sample	*Acacia nilotica* *Avicennia marina* *Cedrus libani* *Faidherbia aldbia* *Pinus* sp., pinoid pits *Tamarix* sp.	28 5 3 1 1 1	50 16 16 2 1 0.7	30.8 13 4.2 1.1 1 0.4

Unidentified charcoal pieces are not included. The values in brackets concern finds of uncharred or slightly charred wood.
**sometimes affected by salt adherences*

Table 15. *Results of charcoal analysis in relation to Stratigraphic Units.*

Large pieces of charred wood from deciduous oak were identified from WG 39, not found before in this size by the author from other archaeological sites in Egypt: in A9, SU12, 8 charcoal pieces (72 ml), two of them larger, 5 and 6.6 cm in length, thickness 1.4-1.6 cm; in one sample without lable: one medium-sized oak piece (7 ml) with a thickness of 1.4 cm; in A10, SU12 a chunk (60 ml), larger dimensions between 5.1 and 5.5 cm, with one side where material had been removed (Figures 128, 129).

The desiccated wood is very well to well preserved; in other cases, mostly from outside the caves, it is badly preserved: soft, fraying, crumbling, powdery disintegrating, with salt adherences, in one case with mold (WG 39), and occasionally damaged by termite infestation (cargo boxes). Ancient damage is visible from infestation by marine wood-borers.

Finds of ship timbers, fastenings, and cargo boxes unearthed from units WG 32, WG 39, and Cave 2 have been examined anatomically (Table 16).

Catalog number	**Object**	**Wood taxon**	**Field season**	**Excavation unit**	**Stratigraphic unit**
T52	Plank	*Cedrus libani*	2006-07	WG 39	SU9
T53	Plank	*Cedrus libani*	2006-07	WG 32	SU25
T55	Large timber	*Acacia nilotica*	2006-07	WG 39	SU11
T55	Peg	*Acacia nilotica*	2006-07	WG 39	SU11
W168	Tenon	*Acacia nilotica*	2006-07	WG Cave 2	Disturbed context
W174	2 Tenons	*Acacia nilotica*	2006-07	WG 39	SU1
W175	Dovetail	*Acacia nilotica*	2006-07	WG 39	SU1
W177	Dovetail	*Acacia nilotica*	2006-07	WG 39	Surface
W178	Dovetail	*Acacia nilotica*	2006-07	WG 39	Surface
W179	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface
W180	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface
W181	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface
W182	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface
W183	Dovetail	*Acacia nilotica*	2006-07	WG 39	Surface
W184	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface
W185	Dovetail	*Acacia nilotica*	2006-07	WG 39	Surface
W186	Dovetail	*Acacia nilotica*	2006-07	WG 39	Surface

W187	Dovetail	*Acacia nilotica*	2006-07	WG Cave 2	Disturbed context
W188	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface.
W195	Tenon	*Acacia nilotica*	2006-07	WG 39	Surface.
W197	Tenon	*Acacia nilotica*	2006-07	WG Cave 2	Disturbed context
W198	Tenon	*Acacia nilotica*	2006-07	WG Cave 2	Disturbed context
W203	Tenon	*Acacia nilotica*	2006-07	WG 32	SU25
W208	Tenon	*Acacia nilotica*	2006-07	WG 32	SU25
W211	Possible mortise from a ship timber	*Ficus sycomorus*	2006-07	WG 32	SU25
W216	Tenon	*Acacia nilotica*	2006-07	WG 39	Disturbed context
W377	Dovetail	*Acacia nilotica*	2006-07	WG 39	SU12
Cargo box 21	Planks	*Ficus sycomorus*	2006-07	WG 32	SU10
	Dowels	*Tamarix* sp.			
Cargo box 32	Planks	*Ficus sycomorus*	2006-07	WG 32	SU10
	Furring strips	*Ficus sycomorus*			
Cargo box 36	Planks	*Ficus sycomorus*	2006-07	WG 32	SU10
Cargo box 37	Planks	*Ficus sycomorus*	2006-07	WG 32	SU10
	Furring strips	*Ficus sycomorus*			
Cargo box 41	Planks	*Ficus sycomorus*	2006-07	WG 32	SU10
Cargo box 42	Planks	*Tamarix* sp.	2006-07	WG 32	SU10
	Furring strips	*Ficus sycomorus*			
	Dowels	*Tamarix* sp.			
Cargo box 43	Planks	*Tamarix* sp.	2006-07	WG 32	SU10
	Furring strips	*Tamarix* sp.			
W173	Wood debitage	*Acacia nilotica* 71 pcs, *Cedrus libani* 249 pcs	2006-07	WG 39	SU1

W176	Wood debitage and other wood debris	*Acacia nilotica* 182 pcs, *Cedrus libani* 653 pcs, *Ficus sycomorus* 14 pcs	2006-07	WG 39	Surface

+ *A few very small pieces taken from each type of construction element where possible.*

Table 16. *Examined finds of desiccated wood.*

The wood of planks T52 (Figure 130) and T53 was identified as *Cedrus libani*, and of the large timber T55 and Peg 1 in this timber as *Acacia nilotica*. Tenons W168, 174 (2x), 179-182, 184, 188, 195, 197, 198, 203, 208, 216 were made of Nile acacia wood, and also dovetails W175, 177, 178, 183, 185-187, and 377 (Figure 131). From the cargo boxes excavated this field season in excavation unit WG 32, the following types of wood were obtained: Box 21/ planks: *Ficus sycomorus*, dowels: *Tamarix* sp.; Box 32/ planks: *F. sycomorus*, furring strips: *F. sycomorus*; Box 36/ planks: *F. sycomorus*; Box 37/ planks: *F. sycomorus*, furring strips: *F. sycomorus*; Box 41/ planks: *F. sycomorus*; Box 42/ planks: *Tamarix* sp., furring strips: *F. sycomorus*, dowels: *Tamarix* sp.; Box 43/ planks: *Tamarix* sp., furring strips: *Tamarix* sp.

In addition, four bags with wood debitage (woody waste assemblages produced during the reworking of construction parts) and in part other wood debris collected from the surface (W176) and SU1 (W173) of WG 39 were analyzed giving further insights into the repair work on the ships' hull and material forming an important source of fuel in the desert environment. Some of the pieces showed the white calcareous linings of burrows, indicating that they were caused by mollusks. Apart from these remains of infestation, the great majority of the examined wood is very well preserved, dry, hard and strong and has no salt adherences, only some pieces are more soft. From a total of 1,169 pieces, 902 are of *Cedrus libani*, 253 of *Acacia nilotica*, and 14 of *Ficus sycomorus*. No remains of red paint were observed. Damage by the shipworm was present in the case of *Cedrus libani* on 307 pieces and *Acacia nilotica* on 47 (Figures 132, 133). Sometimes rows of traumatic resin ducts were seen in the transverse section of the cedar wood; ray heights of up to 40 cells, transverse tracheids, and scalloped tori in bordered pits were found in the two longitudinal planes. A comparison of the frequency and weight distributions for the taxa identified in the samples of wood charcoal and wood debitage, respectively, is given in Figures 134 and 135.

6.2.c Identification of wood and charcoal, 2007-2008

During this field season accompanied by wood anatomical studies, an additional mangrove taxon from the shore regions of the Red Sea and further southward was found in the remains of wood charcoal (*Rhizophora*/*Bruguiera* sp.). Also, charcoal of *Diospyros* sp. could be identified from a few pieces. Trees of this taxon provided a highly valued dark, hard, and dense wood, which belonged to the trade goods from East Africa. The identification and documentation work on the wood related finds excavated at the harbor site continued, to create a comprehensive data catalog for the project and to provide information for spatial analysis and evaluation to the excavators and maritime archaeologists. The excavated wood charcoal came from WG 54, WG 55 and other excavation units. Samples of wood debitage and in part other wood debris were studied like in the previous field season (from WG 32, WG 54 and other units).

Microscopic examination of charred and desiccated wood from the harbor site of Mersa/Wadi Gawasis was continued to obtain valuable information on the ancient environment, the use of wood in ship building, and the reuse of discarded timbers, wood debitage and other wood debris from the ship repair work and the modification of timbers as fuel.

In the course of the 2006-2007 post-excavation work, studies on the remaining material of wood charcoal revealed the occurrence of a second mangrove species besides the commonly found grey mangrove, *Avicennia marina*, which provided an important fuel along the Egyptian Red Sea shore. It belongs to the Rhizophoraceae family and can be ascribed to either *Rhizophora* or the *Bruguiera* genus.

The red mangrove, *Rhizophora mucronata,* is distributed over the whole of tropical Asia, Australia, East Africa, and Madagascar. In Egypt, the tree is nowadays found near the Sudanese border where it occurs in monospecific stands or together with *Avicennia marina* (Zahran and Willis 2009: 109). The distribution extends southward to cover the whole Red

Sea coast of Sudan. In comparison with *A. marina*, the red mangrove is less tolerant to high soil salinity and requires more humid conditions. It is an evergreen tree growing in the tropics up to 25 m high, in Egypt 3-6 m. The wood structure, which is different to that of *A. marina* (Avicenniaceae), does not contain included phloem with lignified conjunctive parenchyma bands. It is characterized by small vessels, solitary and in radial rows and clusters of 2-4, opposite and scalariform intervessel pits, scalariform perforation plates, very thick-walled fibers, paratracheal scanty axial parenchyma, and heterocellular rays, mainly 3-5-seriate.

Another mangrove species along the eastern coast of Africa is the large-leafed or oriental mangrove, *Bruguiera gymnorrhiza*. The tree reaches 30-36 m in height but is commonly 7-20 m. Due to wood anatomical similarities of both genera, the term *Rhizophora/Bruguiera* sp. is used (Tengberg 2002: 152). The yellow mangrove, *Ceriops tagal* (Rhizophoraceae), is also distributed along the coast of Eritrea southward to the Kosi Bay in South Africa, but the wood differs anatomically by the presence of confluent axial parenchyma (Van Vliet 1976: 36).

Wood charcoal from *Rhizophora/Bruguiera* sp. was mainly identified from WG 47 (in 2007-2008) and WG 32 (in 2006-2007); a few fragments came from other excavation units such as WG 53 and WG 55. These finds represent the earliest substantial evidence for ancient Egypt. It can be assumed that the wood was cut and brought from mangrove woodlands in the South on the return of seafaring expeditions.

In the first five days, one box with a large amount of charcoal which remained unidentified from the last field season was studied and documented. This material comprises 24 samples with 659 pieces. Wood anatomical analysis has yielded the identification of 10 taxa: *Acacia nilotica*: 391 pieces (4.597.2 ml), *Avicennia marina*: 60 pieces (62.9 ml), *Cedrus libani*: 101 pieces (540.5 ml), *Diospyros* sp.: 1 piece (1 ml), *Faidherbia albida*: 1 piece (0.6 ml), *Ficus sycomorus*: 16 pieces (77.8 ml), *Leptadenia pyrotechnica*: 3 pieces (1.1 ml), *Quercus* sp., deciduous: 48 pieces (356.2 ml), *Rhizophora/Bruguiera* sp.: 17 pieces (9.7 ml), and *Tamarix* sp.: 5 pieces (2.1 ml). Most of the remaining material which was excavated after the author's departure in 2007 comes from WG 39. Among the charcoal from this trench, many more pieces of deciduous oak appeared in the sample bags. They were found in squares A7, SU16; A8, SU11, SU14-17, surface; and A9, SU17. In each of the 9 samples between 1-20 pieces

(5.5-176.9 ml), mostly 1-4 pieces, occurred. The largest sample was collected from A8, SU14 and contained: *Acacia nilotica*: 8 pieces (99.2 ml), *Cedrus libani*: 3 pieces (5 ml), *Ficus sycomorous*: 2 pieces (7 ml), and *Quercus* sp., deciduous: 20 pieces (176.9 ml) (Figure 136). It can be assumed that these finds are associated with the ship remains.

In the following two weeks, remains of charcoal excavated during the 2007-2008 field season were analyzed comprising 33 samples with 1,760 pieces. The major proportions of the fuel material are formed again by *Acacia nilotica*, *Cedrus libani*, and *Avicennia marina*. The assemblages are characterized by the presence of 16 taxa: *Acacia nilotica*: 847 pieces (1,132.7 ml), *Acacia* sp.: 1 pc (1.2 ml), *Avicennia marina*: 372 pieces (241.5 ml), *Calotropis procera*: 1 piece (2.5 ml), *Cedrus libani*: 250 pieces (331.2 ml), *Diospyros* sp.: 8 pieces (5 ml), *Faidherbia albida*: 40 pieces (68.3 ml), *Ficus sycomorus*: 14 pieces (9.7 ml), *Leptadenia pyrotechnica*: 16 pieces (9.1 ml), *Pinus* sp., pinoid pits: 5 pieces (9.7 ml), *Quercus* sp., evergreen: 3 pieces (3.8 ml), *Rhizophora/Bruguiera* sp.: 62 pieces (44 ml), *Salix* sp.: 22 pieces (21.2 ml), *Suaeda* sp.: 87 pieces (111 ml), *Tamarix* sp.: 28 pieces (33.4 ml), and *Vitis vinifera*: 1 piece (5 ml). Newly found taxa were *Calotropis procera* and *Vitis vinifera* (the latter, however, is represented by a surface find). Most of the species occur in excavation units WG 54 and WG 55. The largest number was found in sample WG 54, A2-3, B2-3, SU1, with 283 pieces (448.3 ml) yielding 12 taxa (Figure 137). In WG 47, a hearth was uncovered which contained charcoal of both mangrove taxa: concerning the charcoal volume, about two-thirds was of *Avicennia marina* and one-third of *Rhizophora/Bruguiera* sp. Again, some fragments of *Diospyros* sp. were identified in the charcoal remains. The contexts in which ebony was found in the 2007-2008 field season are WG 32, SU25 and WG 55, SU2, SU3; those from 2006-2007 are WG 16, SU19 and WG 32, SU16, showing that the majority of the ebony charcoal recovered so far was along the slope of the fossil coral terrace with the man-made caves. A sample composition with ebony obtained from this season is: WG 55, C-D-E 1-2-3, SU2 / *Acacia nilotica*: 206 pieces, 230 ml, *Avicennia marina*: 20 pieces, 14 ml, *Cedrus libani*: 13 pieces, 13.5 ml, *Diospyros* sp.: 6 pieces, 4 ml, *Faidherbia albida*: 1 piece, 1.2 ml, *Ficus sycomorus*: 6 pieces, 4.5 ml, *Leptadenia pyrotechnica*: 3 pieces, 1.7 ml, *Pinus* sp., pinoid pits: 1 piece, 0.4 ml, *Salix* sp.: 16 pieces, 13.5 ml, *Suaeda* sp.: 32 pieces, 29 ml, *Tamarix* sp.: 7 pieces, 5.5 ml.

Further samples from remains of timbers were taken by C. Calcagno and C. Zazzaro: in Cave 2 (T51); the exterior of Cave 2 (T58); in Cave 3 (T56, T57, T61, T64-T70, a block-like wooden object); WG 32, SU33 (T22); and WG 33, SU2 (T71); and the types of wood were determined. The planks and beams are made of cedar wood; only plank T56 is of *Ficus sycomorus*. Two finds of poles, T68 and T70, are of *Acacia nilotica*. Also examined were small wood pieces of a newly discovered deck beam (T73), collected in the trench, and of a badly preserved steering oar blade (T72) which remained in the ground. The latter sample, taken by C. Zazzaro, was identified as *Faidherbia albida*. The find shows similarities to steering oar blade T2 discovered in 2004-2005, where the upper portion was made of the same type of wood. A few tenons (W378, W379, W380, and one from T72) were made of Nile acacia wood, as is the case with all previously excavated tenons and dovetails.

From the large quantities of wood debitage and in part other wood debris which were excavated again this field season, a reasonable amount was investigated (30 samples, 741 pieces). Most of the debris pieces are the by-product of ship repair work; some are parts from boxes. The material was documented as mentioned in the report for 2006-2007. While the wood debitage excavated in Cave 3 in 2006-2007 is well preserved, hard and strong, the debitage and other wood debris excavated outside the caves in 2007-2008 was in poorer condition, more soft and fraying, and some pieces showed adherences of salt. From contexts WG 32: A4, SU1, SU10, SU25 (Figure 138); A5, SU10, SU25, SU39; B4, SU33; C4, SU25; C9, SU39; and WG 32, A4 / WG 53, L4, SU10, 358 pieces of *Cedrus libani*, 19 of *Acacia nilotica*, and 14 of *Ficus sycomorus* were identified. In WG 52, SU1 and surface, 60 pieces of *Cedrus libani*, 4 of *Acacia nilotica*, and 1 of *Ficus sycomorus* were identified. In WG 52, additionally a few branches from *Avicennia marina* were found: length 60 cm, width 1.9-3.0 cm; length 14.6 cm, width 3.5-4.0 cm; length 10 cm, width 2.6 cm; and length 10 cm, width 1.2-1.5 cm. Samples from WG 53, SU10, SU25, and surface contained 135 pieces of *Cedrus libani*, 8 of *Ficus sycomorus*, and 3 of *Acacia nilotica.* A sample from the oven located on the slope towards the entrance of Cave 2 included 2 wood pieces of *Cedrus libani* and 3 pieces of *Acacia nilotica*.

6.2.d Identification of wood and charcoal, 2009-2010

Large amounts of charcoal were examined which were recovered from trenches during fieldwork of the 2007-2008 and 2009-2010 seasons. Among them are WG 61, WG 61/65, WG 65 and WG 54, WG 55, WG 56, respectively. Two additional wood taxa were identified in 2009-2010 leading to a total number of 19 which are known from the site. Charcoal of *Diospyros* sp. was found in 14 samples of WG 55 (field season 2007-2008). The source of the oak charcoal in WG 39 could be localized with the burnt block-like wooden object which received number T78. Samples taken from the large timber, T55, from two steering oar blades (T72, T85), plank fragments of different types, and large tool handles were examined. During a visit to the mortuary temple of Hatshepsut at Deir el-Bahari, the reliefs with palms, trees, and logs of wood in the Punt colonnade were studied which provide the best textual and pictorial documents of a Pharaonic maritime expedition to the southern Red Sea.

In the 2009-2010 field season, wood and charcoal were examined to continue the studies on the use of wood in ship building and as fuel in Middle Kingdom times, the ancient coastal vegetation, and for the documentation of the recovered material. An extraordinary discovery has been made with additional charcoal pieces of *Diospyros* sp. (WG 55), the first substantial finds uncovered in Egypt at a harbor site associated with expeditions to the land of Punt, which may belong to 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 6.2.d Identification of wood and charcoal, 2009-2010 below). The source of the deciduous oak charcoal in Cave 3 has also been identified with the charred block-like object which received number T78 (see 6.2.e Identification of wood and charcoal, 2010-2011). Parallel to the charcoal identification, finds of desiccated wood, those of recovered objects, samples taken from objects that were lying *in situ* in the excavated trenches, wood fragments, and selected wood debitage were analyzed by their anatomical structure.

During a visit to the mortuary temple of Hatshepsut at Deir el-Bahari, the scene with palms and trees at a Puntite village on the seashore, and the scenes with piles of resin, incense trees, and logs of ebony were studied in the Punt colonnade, which documents in detail a trading expedition in the ninth year of her reign.

Results of charcoal identification

The examined charcoal material comprises almost the amount as from the previous three field seasons taken together (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 about 4,060 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 samples, 1,697 pieces, about 1,560 ml), season 2009-2010 (25 samples, 2,895 pieces, about 2,500 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: *Salvadora persica* (toothbrush tree) and a member of the Palmae or Arecaceae family.

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, SU30 / Fire-pit 12 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).

The charcoal assemblages are similar to those identified in previous field seasons. The samples of Mersa/Wadi Gawasis are heterogeneous in character and dominated by wood of the three taxa mentioned before. They consist of a mixture of wood debris from ship timbers, fastenings, and equipment and woods from the Red Sea region and derived from fire-pits for domestic and industrial purposes. Stratigraphic Units with more than a few charcoal pieces contain between 4 and 13, mostly between 5 and 8 wood taxa. Units with the largest charcoal portions have yielded 327 pieces, about 275 ml for 2007-2008 (WG 54, SU1/SU2) and 1,871 pieces, about 1,405 ml for 2009-2010 (WG 61/65, SU19). Charcoal of *Quercus* sp. was found in small numbers in WG 55 (deciduous oak), WG 54, WG 61, and WG 65 (evergreen oak). In previous field seasons, 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 excavated from WG 39. *Ziziphus spina-christi* has only been identified as desiccated wood so far (planks from boxes, wood debris). The results of the identifications are listed below, by field season, excavation unit, and stratigraphic unit.

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 (SU42) was found in SU40.

Field season 2007-2008

<u>WG 33</u>**:**

<u>SU4</u>: (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* sp.: 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

<u>WG 46</u>**:**

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

<u>WG 52</u>**:**

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

<u>WG 54</u>**:**

<u>SU1/SU2</u> (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: *C. libani*: 1 pc, 23 ml, 11.2 g (o), 1 pc, 7.5 ml, 2.3 g (x)

<u>SU2</u> (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* sp.: 1 pc, 0.4 ml, 0.2 g, total: 284 pcs, 258.3 ml, 105 g / uncharred, slightly charred: *C. libani*: 9 pcs, 8.5 ml, 4 g (S) (o)

<u>WG 55</u>:

<u>SU1/SU2</u> (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, *Dios-*

pyros sp.: 1 pc, 0.9 ml, 0.4 g, total: 21 pcs, 12.9 ml, 7.2 g / uncharred, slightly charred: *C. 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* sp.: 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* sp.: 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* sp.: 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: *A. 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* sp.: 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: *C. 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* sp.: 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: *C. 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* sp.: 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: *C. 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* sp.: 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: *C. 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* sp.: 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* sp.: 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: *C. 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* sp.: 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**:**

Surface (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* sp.: 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: *A. 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* sp.: 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* sp.: 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* sp.: 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: *C. libani*: 3 pcs, 4.5 ml, 2.6 g (x), *Rhizophora/Bruguiera* sp.: 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* sp.: 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: *A. marina*: 4 pcs, 2.5 ml, 1.6 g (x) / weed/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* sp.: 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* sp.: 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* sp.: 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* sp.: 1 pc, 1.2 ml, 0.7 g, total: 21 pcs, 12.5 ml, 6.1 g / uncharred, slightly charred: *A. 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

Surface collection (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-partly charred,
xxx-with uncharred traces, (S) adherences of salt 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. 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, in 2006-2007: WG 32; WG 40, SU3; in 2007-2008: WG 33, SU3; WG 53, SU2; WG 54, SU1/SU2; WG 55, SU6; in 2009-2010: WG 61/65, SU19) and red brown deposits with the remains of roots in the "harbor area" of the site (southwestern sector, WG 46, SU4). Geological test trenches indicated that the mouth of the wadi was a wide bay with a lagoon.

In the littoral salt marsh, the area of the periodic inundation by tides, *Tamarix nilotica* (Nile tamarisk) could have grown. Shrubs of the sandy plains and wadis in the Eastern Desert are *Leptadenia pyrotechnica* and *Salvadora persica*. Near the main excavation area, the western slope of the western coral terrace, shrubs of the halophytic succulent *Nitraria retusa* (salt tree) occurred, which were found in green condition and as remains in sand hillocks during the field seasons, and some dried out remains of dwarf shrubs. The plant grows in the salt marsh, at the edges, and towards the desert. Wood samples have been charred and used as modern reference material in addition to wood anatomical atlases, but no charcoal was found in the studied excavation material. The halophytic succulent *Suaeda monoica* (monoecious sea-blite) is comparable in habitat with *N. retusa*. The latter species occurs in the northern 700 km stretch; *S. monoica* gradually replaces *N. retusa* within the 300-700 km stretch (Zahran and Willis 2009: 114).

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 from the Red Sea coast north of Sudan (FAO 2006). One can assume that the wood of these trees was cut in the South and taken with the ships to the harbor.

Ebony at Mersa/Wadi Gawasis

Charcoal from ebony trees (*Diospyros* sp.) has been identified from three 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 T. Spurrier. Among the highly valued commodities obtained from the lands of Nubia and Punt was a dark, dense, and heavy wood which ancient Egyptian texts mention as *hbny* (*hebny*, “ebony”). It is thought to have mainly come from trees of the leguminous species *Dalbergia melanoxylon*, in modern times called African blackwood or grenadill. For a few years it was not known from which object the ebony charcoal might have derived from and for what reason the precious wood was put in a fire-pit. 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 get some slight ideas on the possible 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 might give a few hints to their outer structures. Mingled with charcoal from other taxa, a number of fragments was found that roughly seemed to belong together by size and shape (Figures 139-140). They occurred in 3 sample bags from WG 55, C2, SU2. Further samples from this excavation unit contained 1-6 pieces of ebony charcoal with similar shapes and came from SU1-5, SU11, and SU13. Some of the charcoal pieces might indicate longitudinal structures, but assumptions are often difficult with charred wood due to its fracturing behavior. The identified ebony pieces are charred completely and do not show traces of uncharred wood. Given below is a list of the ebony finds from the excavations.

Ebony wood was brought to ancient Egypt through trading expeditions, tributary deliveries, and common trade and was reserved for the kings and gods. As part of the shiploads that reached the harbor of Mersa/Wadi Gawasis, the items 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 (the "alcove shrine" in WG 56) that was used throughout the 12th Dynasty. It is an interesting area from where two sherds from Minoan pottery vessels, brought from Crete, also were identified. The charcoal pieces represent the first evidence uncovered in Egypt of ebony found at a harbor site associated with the expeditions to Punt. The burnt remnants could have originated from a trade good but could also stem from parts of the ships or of equipment that were later discarded.

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

The values for "total" include the complete charcoal of a sample. Given are the amounts of ebony charcoal and the length (in direction of the wood grain), width, thickness, and weight of fragments.

<u>WG 16</u>, 2005-2006, - , Trench 2, Square 2, SU19 (total: 13 charcoal pieces): 1 pc, 0.1 ml, 0.1 g

<u>WG 32</u>, 2006-2007, - , C5, SU25 (total: 60 charcoal pieces): 1 pc, 1 ml, 0.4 g

<u>WG 32</u>, 2005-2006, - , - , SU16 (total: 24 charcoal pieces): 8 pcs, 9 ml, 4 g

<u>WG 55</u>, 2007-2008, 10.1., C1, SU11 (total: 52 charcoal pieces): 5 pcs, 4 ml, 2.4 g / 1.9 cm × 1.9 cm × 1.3 cm, 1.4 g; 1.5 cm × 1.0 cm × 1.1

cm, 0.6 g; 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., C-D-E 1-2-3, SU2 (total: 311 charcoal pieces): 6 pcs, 4 ml, 2.1 g / 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, - , C-D-E 1-2-3, SU2 (total: 5 charcoal pieces): 1 pc, 0.2 ml, 0.1 g / 0.8 cm × 1.4 cm × 0.5 cm

WG 55, 2007-2008, 12.1., C2, SU2 (total: 49 charcoal pieces): 3 pcs, 8.4 ml, 4.5 g / group of fragments 1: 3.7 cm × 1.9 cm × 1.4 cm, 2.7 g; 2.9 cm × 1.6 cm × 0.9 cm, 1.1 g; 2.0 cm × 1.3 cm × 0.9 cm, 0.8 g

WG 55, 2007-2008, 13.1., C2, SU2 (total: 31 charcoal pieces): 13 pcs, 19.3 ml, 10.3 g / group of fragments 2: 2.3 cm × 1.3 cm × 1.0 cm, 0.6 g; 2.6 cm × 1.9 cm × 1.2 cm, 1.7 g; 1.4 cm × 1.8 cm × 1.2 cm, 1.0 g; 1.4 cm × 1.3 cm × 1.1 cm, 0.5 g; group of fragments 3: 2.0 cm × 1.8 cm × 0.9 cm, 0.7 g; 4.3 cm × 2.5 cm × 1.1 cm, 2.8 g; 2.4 cm × 2.0 cm × 0.8 cm, 0.9 g; 1.8 cm × 1.8 cm × 0.7 cm, 0.5 g; 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) / group of fragments 4: 3.0 cm × 1.7 cm × 1.0 cm, 1.7 g; 1.9 cm × 1.2 cm × 0.8 cm, 0.6 g; 2.4 cm × 1.2 cm × 0.8 cm, 0.7 g

WG 55, 2007-2008, 10.1., C2, SU2 (total: 8 charcoal pieces): 1 pc, 1.2 ml, 0.6 g / 2.4 cm × 1.5 cm × 1.1 cm

WG 55, 2007-2008, - , C2, SU13 (total: 54 charcoal pieces): 2 pcs, 1.2 ml, 0.5 g / 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/SU2 (total: 21 charcoal pieces): 1 pc, 0.9 ml, 0.4 g / 2.5 cm × 1.1 cm × 0.6 cm

WG 55, 2007-2008, - , D1-2, SU2 (total: 98 charcoal pieces): 1 pc, 0.5 ml, 0.2 g

WG 55, 2007-2008, - , D1-2, SU3 (total: 123 charcoal pieces): 1 pc, 0.5 ml, 0.2 g

WG 55, 2007-2008, 7.1., D3, SU2 (total: 55 charcoal pieces): 2 pcs, 1 ml, 0.5 g / 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 / 1.6 cm × 1.5 cm × 0.7 cm

WG 55, 2007-2008, - , E3, SU5, from W459 (total: 45 charcoal pieces): 1 pc, 6 ml, 2.5 g / 2.5 cm × 3.2 cm × 1.7 cm

Wood finds

The source for the charcoal of deciduous oak in samples from WG 39, A7-10, SU11, SU12, SU14-17, and surface, excavated in 2006-2007, could be localized with one of the timbers belonging to the seagoing ships. It is the burnt block-like wooden object which was excavated in the same season in A9, SU13. In the 2009-2010 field season, 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 this find by conservator H. Wellman conducted in the field laboratory, fragments from the charred block were examined 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.

The studied desiccated wood comprises 40 bags with T- and W-numbers including objects, samples of those, wood fragments, and 4 samples of wood debitage with 53 pieces. Samples taken from the large timber T55, located in WG 39 of Cave 3, were identified as *Acacia nilotica*, those from the two large steering oar blades T72 and T85 from trench WG 32 of *Faidherbia albida*. Also samples from several planks were studied which were uncovered in WG 32, WG 39, WG 61, and WG 65: Type 2: T79, T80, T93; Type 3: T82, T94; Type 4: T81, T86; Type 5: T62, T63, T87; unknown: T83. These consisted of wood from *Cedrus libani* except for T80, T87: *Acacia nilotica* and T83: *Ficus sycomorus*. Wood pieces taken from T91 and T93, found in the timber deposit in WG 32 under salt incrustation SU38, were identified as *Acacia nilotica* and *Cedrus libani*. Four large tool handles recovered from WG 32, SU25 and WG 60, SU1 were made of wood from *Avicennia marina*, and a spoon was cut from a piece of cedar wood (WG 61/65, SU32).

6.2.e Identification of wood and charcoal, 2010-2011

In 2010-2011 wood charcoal recovered from the harbor site was analyzed from WG 31, WG 70 and other excavation units. Modern charcoal could be collected on the beach of Wadi Gasus in which tree taxa growing in the Nile valley and remains of pine timber were found providing a brief outlook to the changes in the composition of wood-based fuel used on the Red Sea coast. Additionally, desiccated wood from the sea-going ships (timbers, wood debitage and other wood debris), a post (WG 61), and three stopper/lids (WG 32) were examined. After the rare event of a torrential rainfall that had occurred at the end of the previous field season, one focus laid on the study of the salt marsh and desert vegetation at different stands in the near-shore areas of Wadi Gasus and Wadi Gawasis. The occurring plant growth gave insight into the current potential vegetation of the landscape at the site and in the closer vicinity.

Microscopic work was continued on wood and charcoal remains recovered from Middle Kingdom contexts. It was aimed to gather information for the newly opened trenches and to work on samples that remained unexamined from previous field seasons. Regarding the number of pieces, about two-thirds of the examined charcoal material were recovered in the 2010-2011 field season, about one-third from the excavations in 2007-2008 and 2009-2010, by volume, three-quarters and one-quarter, respectively. Finds of timber and wood were studied assisting the work of C. Ward and C. Zazzaro.

Also, a year after one of the rarely occurring torrential rainfall had affected the area south of Safaga (16 years after the last one had taken place), the favorable situation was used to carry out further botanical investigations in the near-shore areas of Wadi Gasus and Wadi Gawasis. 9 plant taxa of shrubs, dwarf shrubs, and herbs were identified, adapted to the salinity and dryness of the coastal environment. In the disturbed salt marsh and in the neighboring ground of the main wadi channels, *Tamarix nilotica*, *Zygophyllum album* (white bean-caper), *Nitraria retusa*, *Zygophyllum cocccineum* (scarlet-flowered bean-caper), and *Zilla spinosa* (spiny Zilla) occurred. The plant growth is dependent on salt water, ground water, and water from flash floods.

Results of charcoal identification

The material comprises 58 samples containing 2,857 pieces with a volume of about 4,400 ml, thereof the wood charcoal recovered in 2010-2011 was examined almost completely until the date of departure.

The majority of the charcoal remnants came from excavation units WG 31, WG 61, and WG 70. WG 31 was opened along the western slope of the coral terrace. In SU1, a deposit of windblown sand, many small pieces of wood, burnt mudbrick, and much charcoal were revealed. WG 61 (SU46, SU54) are soil and sand strata going back to the earliest occupation phase brought to light in that excavation unit, earlier than the excavation of Cave 8 (see 3.2.b Excavations, western terrace slope). WG 70 was a test pit in the NE of WG 69 where a number of hearths was recorded.

Anatomical analysis resulted in the identification of 18 woody taxa among which the species *Acacia nilotica*, *Avicennia marina*, and *Cedrus libani* dominate again in the sample compositions by number of pieces and volume and also show the highest ubiquity values. Together, they occur with the lesser abundant taxa in similar assemblages. In the mentioned trenches with the largest amounts of wood charcoal, also most of the taxa occurred, 11, 12, and 13 respectively. The results of the identifications are listed below, by field season, excavation unit, and stratigraphic unit. The distribution of the number of taxa over the increasing number of charcoal pieces was obtained by simulation. From the 58 samples, a second taxon was identified on average with the 4th charcoal piece, a third with the 8th, the further taxa with piece numbers 15, 16, 34, 65, 75, 165, 206, 421, 493. The last two values were obtained from a single sample each. This relationship possesses approximately a logarithmic character and forms the basis for the statistical determination of the diversity of woody taxa in the material of the site.

Additionally, modern charcoal has been collected on the beach of Wadi Gasus, presumably remnants of prefabricated charcoal delivered from the Nile Valley and those of construction wood (pine), to study the taxonomic composition of wood-based fuel used in present times on the Red Sea coast. Beside charcoal pieces of *Acacia nilotica*, which represented together with other *Acacia* species the main fuel plant along the floodplain of the river Nile in pharaonic times, identifications revealed a number of non-native tree taxa: members of the genera *Casuarina* native to Australia, Southeast Asia, and islands of the western Pacific Ocean, *Eucalyptus* to Australia, *Citrus* native to East and South Asia, *Ficus* to tropical and subtropical regions, *Morus* (mulberry) to East and West Asia, *Prunus* to Middle and Southwest Asia and China, and *Mangifera indica* (mango) from India to Burma, which have become common fruit and street trees in Egypt.

Field season 2007-2008

WG 54:

SU1 (2 spls) / *Acacia nilotica*: 14 pcs, 13 ml, 8.8 (S), *Avicennia marina*: 1 pc, 0.8 ml, 0.4 g (S), *Cedrus libani*: 29 pcs, 75.3 ml, 21.5 g (S), *Faidherbia albida*: 3 pcs, 2.4 ml, 0.8 g (S), *Tamarix* sp.: 1 pc, 0.3 ml, 0.1 g, total: 48 pcs, 91.8 ml, 31.6 g / uncharred, slightly charred: *C. libani*: 22 pcs, 94 ml, 30.1 g (o)

Field season 2009-2010

WG 61:

SU46: (1 spl) / *Acacia nilotica*: 275 pcs, 235 ml, 106.8 g (S), *Acacia* sp.: 55 pcs, 42 ml, 23.7 g (S), *Avicennia marina*: 112 pcs, 111.9 ml, 58.9 g (S), *Cedrus libani*: 3 pcs, 2.9 ml, 0.8 g (1-xxx), *Ficus sycomorus*: 1 pc, 0.3 ml, 0.1 g, *Leptadenia pyrotechnica*: 1 pc, 0.3 ml, 0.1 g (S), *Quercus* sp., deciduous: 1 pc, 2 ml, 0.7 g (S), *Quercus* sp., evergreen: 1 pc, 0.3 ml, 0.2 g, *Rhizophora/Bruguiera* sp.: 6 pcs, 4.6 ml, 2.3 g (S), *Salix* sp.: 2 pcs, 1.2 ml, 0.1 g, *Suaeda* sp.: 106 pcs, 70.6 ml, 32.1 g (S) (1-xx, 1-xxx), *Tamarix* sp.: 5 pcs, 4.2 ml, 1.6 g, indet.: 11 pcs, 5.5 ml, 3.8 g (S), bark: 1 pc, 0.2 ml, 0.4 g (S), total: 580 pcs, 481 ml, 231.6 g / uncharred, slightly charred: *Suaeda* sp.: 1 pc, 0.8 ml, 0.3 g (x) / *A. nilotica-lomentum* (one segment without seed, charred): 1 pc, 0.1 ml, 0.1 g

SU54: (1 spl) / *Acacia nilotica*: 31 pcs, 16 ml, 10 g (S), *Avicennia marina*: 4 pcs, 5 ml, 2.5 g (S), *Cedrus libani*: 4 pcs, 2.1 ml, 0.7 g, *Ficus sycomorus*: 1 pc, 0.5 ml, 0.1 g (S), *Quercus* sp., evergreen: 1 pc, 0.6 ml, 0.4 g, *Tamarix* sp.: 1 pc, 0.5 ml, 0.2 g, total: 42 pcs, 24.7 ml, 13.9 g / uncharred, slightly charred: *Leptadenia pyrotechnica*: 1 pc, 1.2 ml, 0.4 g (x)

WG 65:

SU36 in SU2: (1 spl) / *Acacia nilotica*: 62 pcs, 229.1 ml, 120.6 g (S), *Avicennia marina*: 1 pc, 2 ml, 0.7 g (S), *Cedrus libani*: 2 pcs, 1.9 ml, 0.6 g (S), indet.: 2 pcs, 3.5 ml, 1.9 g, total: 67 pcs, 236.5 ml, 123.8 g

SU46: (1 spl) / *Acacia nilotica*: 156 pcs, 106.8 ml, 56.2 g (S), *Avicennia marina*: 102 pcs, 136.8 ml, 62.2 g (S), *Cedrus libani*: 3 pcs, 0.9 ml, 0.3 g (S), *Ficus sycomorus*: 3 pcs, 7.6 ml, 1.9 g (S), *Quercus* sp., evergreen: 1 pc, 2.5 ml, 1.5 g (S), *Rhizophora/Bruguiera* sp.: 17 pcs, 13.6 ml, 6.6 g (S), *Suaeda* sp.: 39 pcs, 47.5 ml, 22.6 g (S), *Tamarix* sp.: 20 pcs, 14.8 ml, 5.9 g (S), total: 341 pcs, 330.5 ml, 157.2 g

Field season 2010-2011

WG 31:

SU1: (6 spls) / *Acacia nilotica*: 383 pcs, 416.4 ml, 224.9 (S), *Avicennia marina*: 41 pcs, 55.6 ml, 29.1 g (S), *Calotropis procera*: 2 pcs, 0.5 ml, 0.2 g (S), *Cedrus libani*: 11 pcs, 10.7 ml, 3 g (S), *Faidherbia albida*: 1 pc, 3.5 ml, 2.1 g (S), *Ficus sycomorus*: 71 pcs, 71.8 ml, 20.3 g (S), *Leptadenia pyrotechnica*: 12 pcs, 10 ml, 3.4 g, *Rhizophora*/*Bruguiera* sp.: 10 pcs, 6.2 ml, 3.4 g, *Salvadora persica*: 1 pc, 1.6 ml, 0.8 g, *Suaeda* sp.: 11 pcs, 13.4 ml, 7 g (S), *Tamarix* sp.: 49 pcs, 51.2 ml, 18.7 g (S), indet.: 6 pcs, 3.6 ml, 2.3 g, total: 598 pcs, 644.5 ml, 315.2 g / uncharred, slightly charred: *A. nilotica*: 1 pc, 0.6 ml, 0.7 g (S) (x), *L. pyrotechnica*: 1 pc, 0.4 ml, 0.2 g (x), *Tamarix* sp.: 2 pcs, 0.5 ml, 0.2 g (x) – 4 pcs, 1.5 ml, 1.1 g / animal bone (fragment, burnt): 1 pc, 1.2 ml, 1.3 g

WG 40:

SU1: (6 spls) / *Acacia nilotica*: 32 pcs, 32 ml, 19 g (S) (1-xxx), *Avicennia marina*: 35 pcs, 69.6 ml, 35.3 g (S) (1-xx), *Cedrus libani*: 14 pcs, 52.1 ml, 17.7 g (S), *Ficus sycomorus*: 5 pcs, 28 ml, 7 g (S), *Leptadenia pyrotechnica*: 13 pcs, 38.2 ml, 12.9 g (S) (1-xx), *Rhizophora*/*Bruguiera* sp.: 28 pcs, 55.4 ml, 31 g (S), *Salvadora persica*: 9 pcs, 16.6 ml, 7.4 g (S), *Suaeda* sp.: 16 pcs, 31.2 ml, 19.5 g (S), *Tamarix* sp.: 5 pcs, 15.1 ml, 5.2 g (S), indet.: 1 pc, 1.3 ml, 0.5 g, total: 158 pcs, 339.5 ml, 155.5 g / cord (uncharred): 1 pc, 8.5 cm long, 0.4 cm in diameter, 0.4 g

SU3: (1 spl) / *Acacia nilotica*: 2 pcs, 8.5 ml, 5.1 g (S), *Avicennia marina*: 6 pcs, 6.5 ml, 3.8 g (S), *Cedrus libani*: 15 pcs, 21 ml, 6 g (S), *Salix* sp.: 1 pc, 1.5 ml, 0.3 g (S), *Suaeda* sp.: 2 pcs, 1.8 ml, 0.8 g, total: 26 pcs, 39.3 ml, 16 g

SU5: (1 spl) / *Avicennia marina*: 3 pcs, 13 ml, 12.3 g (S) (2-xx), *Suaeda* sp.: 5 pcs, 13 ml, 8.6 g (S), *Rhizophora/Bruguiera* sp.: 11 pcs, 23 ml, 13.3 g (S), total: 19 pcs, 49 ml, 34.2 g

WG 64:

SU4: (1 spl) / *Acacia nilotica*: 4 pcs, 4.6 ml, 2.7 g / copper fragments: 2 pcs, 0.4 g (0.6 cm × 0.8 cm × 0.2 cm, 0.2 g; 0.5 cm × 0.8 cm × 0.1 cm, 0.2 g)

WG 69:

SU1: (1 spl) / *Acacia nilotica*: 9 pcs, 6.8 ml, 3.4 g, *Avicennia marina*: 3 pcs, 4.8 ml, 1.6 g (S), *Cedrus libani*: 5 pcs, 5 ml, 1.4 g, total: 17 pcs, 16.6 ml, 6.4 g

WG 70:

SU1: (10 spls) / *Acacia nilotica*: 21 pcs, 43.1 ml, 24.4 g (S), *Avicennia marina*: 19 pcs, 18.7 ml, 10.8 g (S), *Cedrus libani*: 35 pcs, 46.1 ml, 13.5 g (S), *Faidherbia albida*: 1 pc, 0.4 ml, 0.1 g, *Ficus sycomorus*: 2 pcs, 2 ml, 0.3 g, *Leptadenia pyrotechnica*: 2 pcs, 2.8 ml, 0.9 g (S), *Rhizophora*/*Bruguiera* sp.: 1 pc, 0.8 ml, 0.4 g, *Tamarix* sp.: 2 pcs, 2.5 ml, 0.9 g, indet.: 1 pc, 0.3 ml, 0.1 g, total: 84 pcs, 116.7 ml, 51.4 g / uncharred, slightly charred: *C. libani*: 28 pcs, 65 ml, 10.7 g (o)

SU1/SU3: (1 spl) / *Acacia nilotica*: 56 pcs, 108 ml, 52.1 g (S), *Avicennia marina*: 78 pcs, 160 ml, 98.1 g (S), *Cedrus libani*: 17 pcs, 46 ml, 17.2 g (S), *Diospyros* sp.: 1 pc, 0.8 ml, 0.3 g (2.0 cm × 1.0 cm × 0.7 cm), *Rhizophora/Bruguiera* sp.: 34 pcs, 74 ml, 50 g (S), *Suaeda* sp.: 5 pcs, 13 ml, 7.6 g (S), *Tamarix* sp.: 3 pcs, 6 ml, 2.6 g, total: 194 pcs, 407.8 ml, 227.9 g

SU2: (4 spls) / *Acacia nilotica*: 5 pcs, 5.8 ml, 2.4 g, *Avicennia marina*: 17 pcs, 5.1 ml, 3.3 g (S), *Cedrus libani*: 55 pcs, 81.5 ml, 21 g (S), *Rhizophora*/*Bruguiera* sp.: 1 pc, 1.4 ml, 0.7 g, *Salix* sp.: 1 pc, 1.8 ml, 0.5 g (S), *Tamarix* sp.: 1 pc, 0.7 ml, 0.2 g, total: 80 pcs, 96.3 ml, 28.1 g

SU3: (2 spls) / *Acacia nilotica*: 49 pcs, 145 ml, 77 g (S), *Avicennia marina*: 180 pcs, 595 ml, 430.4 g (S), *Cedrus libani*: 31 pcs, 124 ml, 46.5 g (S), *Diospyros* sp.: 1 pc, 2.2 ml, 1 g (1.9 cm × 1.5 cm × 1.1 cm), *Leptadenia pyrotechnica*: 2 pcs, 1.8 ml, 0.7 g, *Quercus* sp., evergreen: 1 pc, 2 ml, 1.2 g (S), *Rhizophora*/*Bruguiera* sp.: 66 pcs, 190 ml, 143.4 g (S), *Tamarix* sp.: 2 pcs, 6.6 ml, 3.2 g (S), *Ziziphus spina-christi*: 1 pc, 0.9 ml, 0.5 g, indet.: 1 pc, 1.8 ml, 0.6 g, bark: 1 pc, 1.5 ml, 2.3 g, total: 335 pcs, 1,070.8 ml, 706.8 g

Feature 1: (2 spls) / *Acacia nilotica*: 1 pc, 0.1 ml, 0.1 g, *Avicennia marina*: 17 pcs, 1.3 ml, 0.4 g, *Cedrus libani*: 9 pcs, 3.3 ml, 0.8 g, total: 27 pcs, 4.7 ml, 1.3 g / uncharred, slightly charred: *C. libani*: 19 pcs, 16 ml, 3.9 g (o)

WG 70/72:

Surface collection: (1 spl) / *Acacia nilotica*: 3 pcs, 3 ml, 1.8 g, *Avicennia marina*: 3 pcs, 3.3 ml, 1.8 g (S), *Cedrus libani*: 2 pcs, 1.5 ml, 0.3 g, *Ficus sycomorus*: 1 pc, 0.4 ml, 0.1 g, *Rhizophora/Bruguiera* sp.: 1 pc, 1.3 ml, 0.6 g, total: 10 pcs, 9.5 ml, 4.6 g

WG 71:
SU1: (1 spl) / *Acacia nilotica*: 1 pc, 1.8 ml, 0.9 g
SU3: (1 spl) / *Acacia nilotica*: 1 pc, 0.9 ml, 0.5 g
WG 72:
SU1: (2 spls) / *Acacia nilotica*: 19 pcs, 27.7 ml, 12.6 g (S), *Avicennia marina*: 8 pcs, 10.2 ml, 5.6 g (S), *Cedrus libani*: 19 pcs, 18.9 ml, 5.7 g, *Pinus* sp.: 1 pc, 1.8 ml, 0.7 g, *Quercus* sp., evergreen, 2 pcs, 2.2 ml, 1.3 g, *Rhizophora*/*Bruguiera* sp.: 5 pcs, 3.6 ml, 2 g, *Suaeda* sp.: 1 pc, 4 ml, 1.7 g, *Tamarix* sp.: 1 pc, 9 ml, 3.7 g, total: 56 pcs, 77.4 ml, 33.3 g
WG 73:
SU1: (2 spls) / *Acacia nilotica*: 6 pcs, 3.2 ml, 1.7 g, *Avicennia marina*: 3 pcs, 2.9 ml, 2 g, *Cedrus libani*: 14 pcs, 12.8 ml, 3.7 g, *Leptadenia pyrotechnica*: 2 pcs, 0.7 ml, 0.3 g, *Rhizophora*/*Bruguiera* sp.: 3 pcs, 1.4 ml, 0.6 g, total: 28 pcs, 21 ml, 8.3 g
SU2: (1 spl) / *Acacia nilotica*: 10 pcs, 39 ml, 25.6 g
SU3: (2 spls) / *Acacia nilotica*: 7 pcs, 6.5 ml, 2.8 g, *Avicennia marina*: 3 pcs, 10 ml, 4.5 g, *Cedrus libani*: 15 pcs, 38 ml, 10.2 g (S), *Ficus sycomorus*: 1 pc, 1.5 ml, 0.6 g (S), *Leptadenia pyrotechnica*: 1 pc, 1.8 ml, 0.5 g, *Rhizophora*/*Bruguiera* sp.: 14 pcs, 17 ml, 7.4 g (S), *Tamarix* sp.: 1 pc, 1.2 ml, 0.4 g, total: 42 pcs, 76 ml, 26.4 g
WG 74:
SU1: (3 spls) / *Acacia nilotica*: 17 pcs, 52 ml, 39 g, *Avicennia marina*: 12 pcs, 22 ml, 15.9 g, *Cedrus libani*: 3 pcs, 12.5 ml, 3.8 g, *Faidherbia albida*: 1 pc, 7.5 ml, 1.7 g, *Quercus* sp., deciduous: 5 pcs, 16 ml, 12 g, *Rhizophora*/*Bruguiera* sp.: 2 pcs, 4 ml, 3.1 g, *Tamarix* sp.: 1 pc, 0.5 ml, 0.2 g, total: 41 pcs, 114.5 ml, 75.7 g (1 sample: W)
WG 75:
SU1: (2 spls) / *Acacia nilotica*: 12 pcs, 23.5 ml, 16.5 g (S), *Avicennia marina*: 10 pcs, 9.5 ml, 6.1 g (S), *Cedrus libani*: 8 pcs, 40 ml, 15.9 g (S), *Leptadenia pyrotechnica*: 5 pcs, 9 ml, 4.4 g, total: 35 pcs, 82 ml, 42.9 g / uncharred, slightly charred: *C. libani*: 1 pc, 0.8 ml, 0.1 g (o)
WG no label:
(2 spls) / *Acacia nilotica*: 3 pcs, 5.2 ml, 3.1 g (S), *Avicennia marina*: 5 pcs, 1.7 ml, 0.7 g, *Cedrus libani*: 5 pcs, 18.5 ml, 4.5 g, total: 13 pcs, 25.4 ml, 8.3 g / uncharred, slightly charred: *C. libani*: 1 pc, 2.2 ml, 0.4 g (o)

Wood finds

The studied desiccated wood again comprises material from different field seasons and included finds of timbers, wood fragments, and wood debitage. Small samples from timbers T99, T100, and T105 taken in the field (WG 70) were identified as *Acacia nilotica* and from T107 (WG 71) as *Cedrus libani*. A fragment of plank T19 (Type 2, WG 24, Cave 2), which revealed the longest shipworm burrows, consisted of wood from *Cedrus libani* (a sample has already been studied in 2006). Samples W960-W967 and W1022 included solitary pieces of *C. libani*, *Acacia nilotica*, *Faidherbia albida*, *Ficus sycomorus*, and *Tamarix* sp., one sample with wood debitage from WG 71 (W1024) 46 pieces of *Cedrus libani*, not showing traces of shipworm infestation. A post uncovered in WG 61 on top of SU55 (2009-2010) was made of wood from *Avicennia marina*. The wood of two complete and one fragmentary lids found in WG 32 (2006-2007) was identified as *Cedrus libani* (SU25, Inv.Nos. 81 and 82) and *Ficus sycomorus* (SU10, Inv.No. 97).

6.3 Vegetation studies, 2010-2011

RAINER GERISCH

The area between north of Hurghada and Quseir has been the subject of several botanical publications, among them Kassas and Zahran (1965, 1967) on the vegetation of the coastal land between El-Galala and Hurghada and on the littoral salt marsh, PERSGA (2004) and Saleh (2006, 2007) on the mosaic-like relict stands on mangrove formations near Hurghada, Safaga and Quseir. Early botanical collections were carried out by G. Schweinfurth in 1865 in the surroundings of Quseir. He visited Wadi Gasus in January 1885 during a journey through the Eastern Desert to record the architectural remains and hieroglyphic inscriptions (Schweinfurth 1885).

The study area can be divided geomorphologically and ecologically into the wadi beds and slopes, runnels, the western and eastern coral terraces, the disturbed littoral salt marshes, and the shoreline, which offer different possibilities for plant growth. After the floods in January, 2010, the situation in both wadis revealed an uneven picture. While in Wadi Gasus the surface water had formed almost a lake, the water in Wadi Gawasis had drained away relatively quickly and had left a muddy soil (Rodolfo Fattovich, *personal communication*).

In 2010-2011 the plant cover was recorded in 76 sample plots, 45 in Wadi Gasus and 31 in Wadi Gawasis, ranging from 8 m × 19 m to 30 m × 30 m, according to the method of Braun-Blanquet. The vegetation in Wadi Gasus was composed of a large number of plants adapted to the dry and salt-rich environment, annual and perennial herbs, low shrubs and shrubs, often well developed and flowering. The plant cover of Wadi Gawasis consisted mainly of shrubs and numerous dried low shrubs and showed no greater differences to that of the years before.

Identified were 9 species of halophytic and xerophytic plants belonging to 7 families: *Astragalus vogelii* (Mimosaceae), *Nitraria retusa* (Nitrariaceae)*, Phragmites australis* (Poaceae), *Reseda pruinosa* (Resedaceae), *Tamarix nilotica* (Tamaricaceae), *Zilla spinosa* (Brassicaceae), *Zygophyl-lum album*, *Z. coccineum* (Zygophyllaceae), and a member of the Asteraceae family.

Zygophyllum coccineum and *Nitraria retusa* were dominating in the mouth of the wadis. A large amount of bright green bushes of *Z. coccineum* was found in Wadi Gasus, while in Wadi Gawasis numerous dried specimens, except of one plant in full foliage, were present. *Z. coccineum* represents the most widespread *Zygophyllum* species in Egypt. The low shrub or perennial herb has 2-foliolate succulent leaves and white flowers and is found within the main channels of wadis. *N. retusa* is a halophytic many-stemmed shrub with fleshy obovate-cuneate leaves and yellowish green flowers. *Zilla spinosa* is a xerophytic woody perennial with densely dichotomously branches, terminating in spines and with white or violet flowers, and occurred as a common associate species. Identified from Wadi Gasus were also *Astragalus vogelii*, *Reseda pruinosa* and a member of the Asteraceae family. One specimen of *Tamarix nilotica* was found in both wadis.

In the disturbed salt marshes and in two runnels on the eastern coral terrace, which slope to the shore, *Tamarix nilotica* and *Zygophyllum album* are the most evident features. *T. nilotica* is a halophytic bush, which can form thickets in the salt marsh or sand hillocks in the deltaic parts of wadis. Associated species in the salt marsh habitat were *Z. album*, *Z. coccineum* and *Nitraria retu-sa*. Near water-filled depresssions in Wadi Gasus, tamarisk bushes occurred together with *Phrag-mites australis*. The common reed is a tall perennial grass which has an extensive rhizome system and spreads rapidly. The runnels showed growth of *Z.*

album, which is a widespread halophytic plant along the whole stretch to the Sudanese border. The many-branched low shrub with mealy-pubescent leaves and white flowers has a high salt tolerance and grows mainly at the shoreline.

Figure 122. *Wooden Box 41 in situ in WG 32.*

Figure 123. *Detail of the wooden peg for sealing Box 42 from WG 32.*

Figure 124. *Wooden peg from WG 55, E3, SU4.*

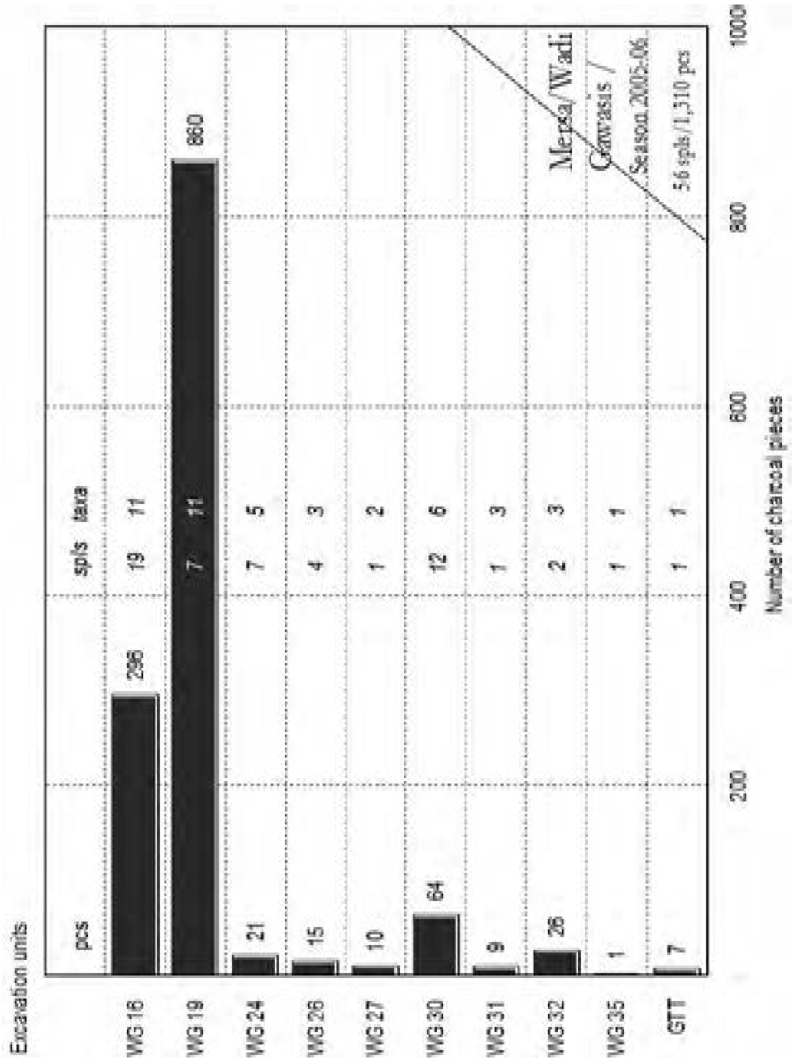


Figure 125. *Number of charcoal pieces from the different excavation units.*

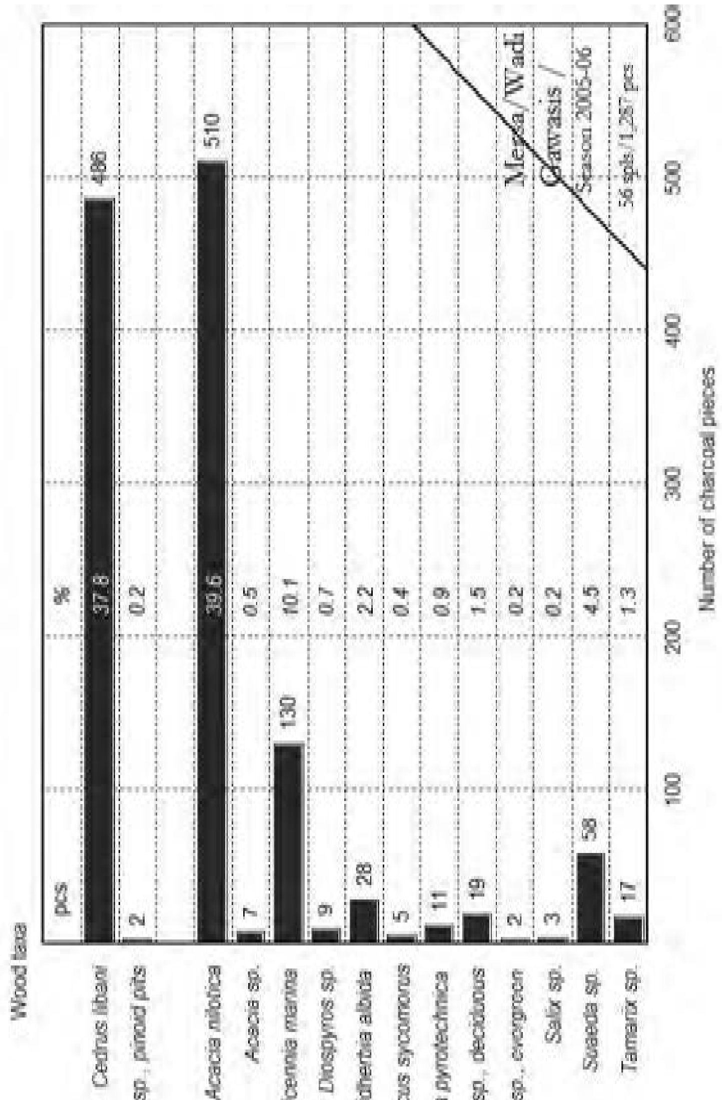


Figure 126. *Number of pieces and percentage for the identified wood taxa.*

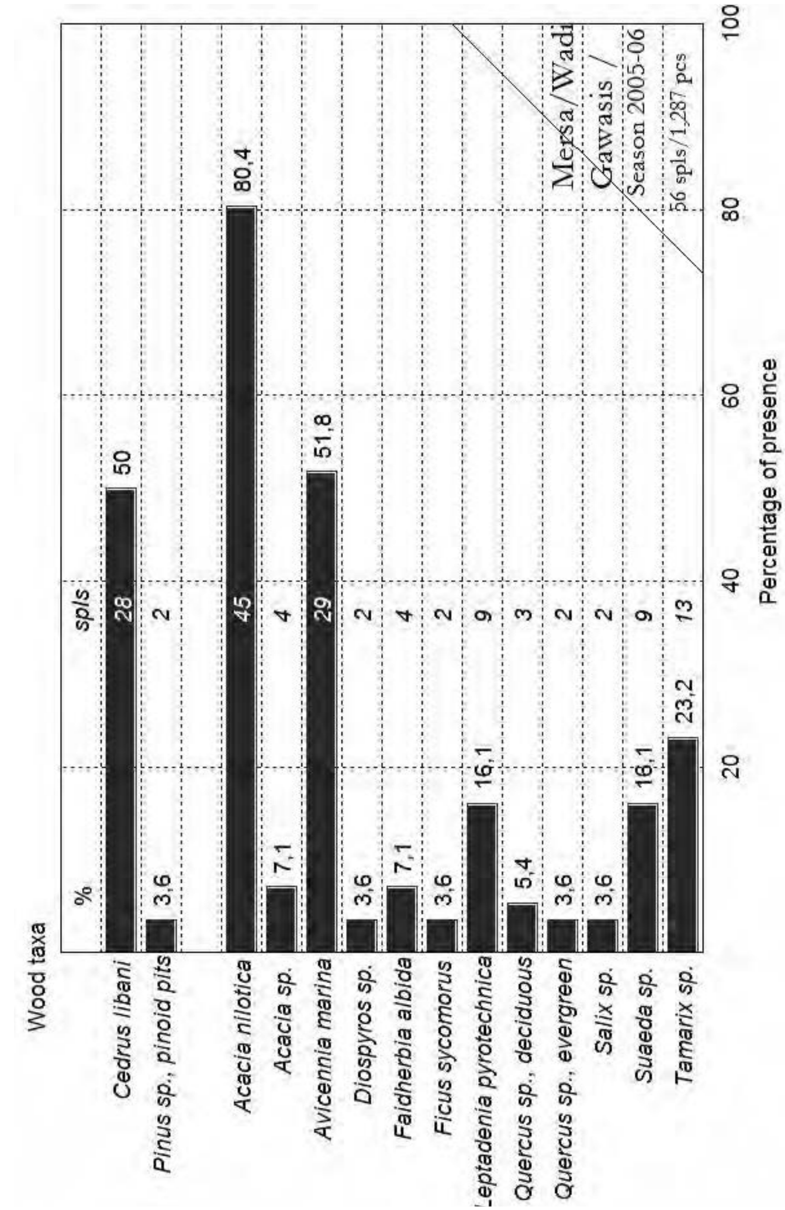


Figure 127. *Number of samples and percentage of presence for the identified wood taxa.*

Figure 128. *Wood charcoal from WG 39, A10, SU12: right: Acacia nilotica, left: Quercus sp., deciduous (above), Cedrus libani (below); scale unit: 1 cm.*

Figure 129. *Large charcoal piece of deciduous oak from WG 39, A10, SU12, faint vertical lines of the wide earlywood vessels visible.*

Figure 130. *Timber T52 from WG 39, B2, SU9 identified as cedar wood.*

Figure 131. *Dovetails and tenons from W174-W198 from WG 39 (with exception of one tenon from Cave 2), identifed as Nile acacia wood; scale unit: 1 cm.*

Figure 132. *Wood debitage, W173 from WG 39, B2, SU1: 1st row: Cedrus libani, 2nd row: Acacia nilotica.*

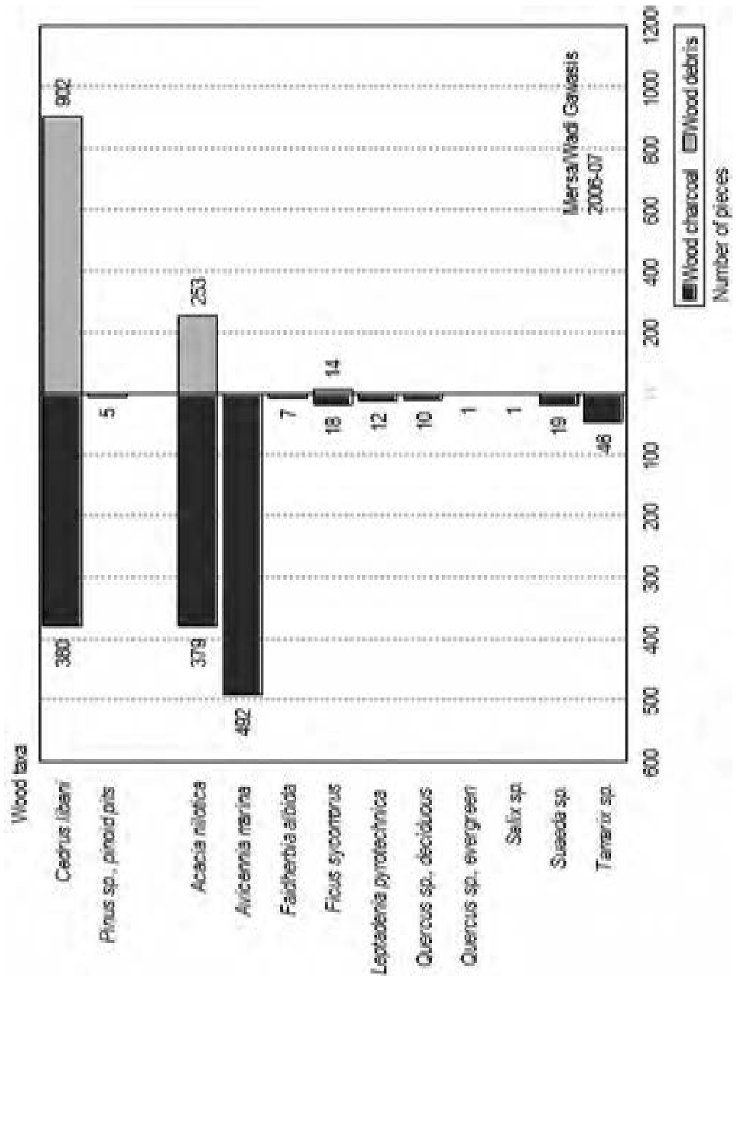


Figure 134. *Comparison of the frequency distributions of taxa identified from wood charcoal and wood debitage / other wood debris, respectively.*

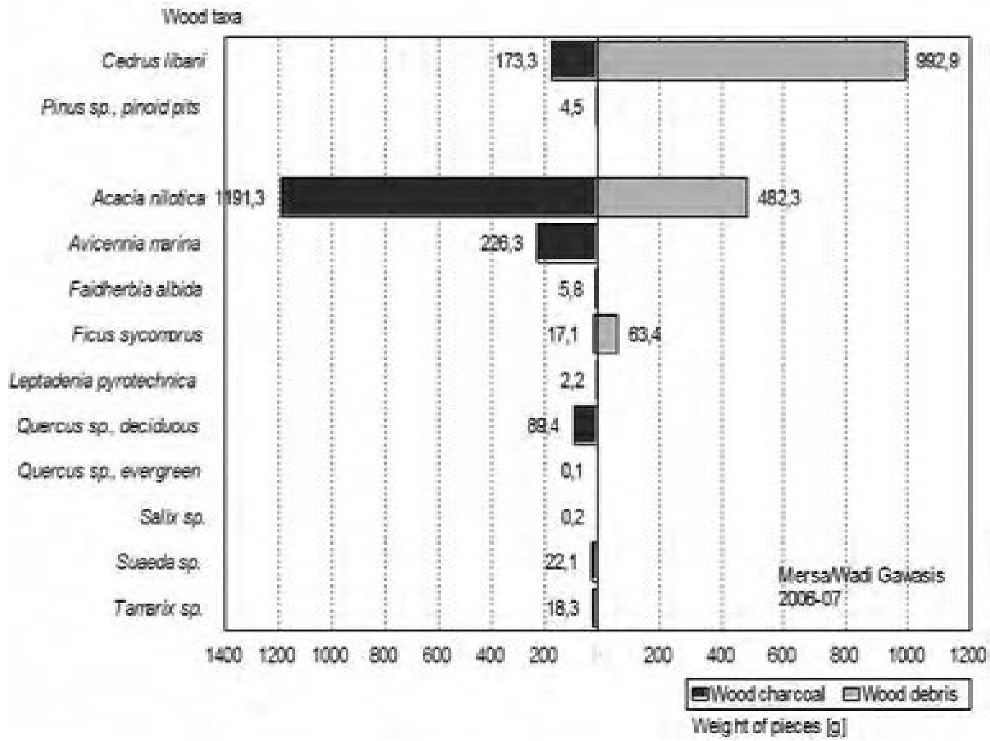


Figure 135. *Comparison of the weight distributions of taxa identified from wood charcoal and wood debitage / other wood debris, respectively.*

Figure 136. *Wood charcoal from WG 39, A8, SU14: above, from left to right: Cedrus libani, Acacia nilotica, Ficus sycomorus, below: Quercus sp., deciduous; scale unit: 1 cm.*

Figure 137. *Wood charcoal from WG 54, A2-3, B2-3, SU1: 1st row, from left to right: Cedrus libani, Pinus sp., pinoid pits, Acacia nilotica, 2nd row: Avicennia marina, Faidherbia albida, Ficus sycomorus, Leptadenia pyrotechnica, Quercus sp., evergreen, 3rd row: Rhizophora/Bruguiera sp., Salix sp., Suaeda sp., Tamarix sp., indet; scale unit: 1 cm.*

Figure 138. *Wood debitage from WG 32, A4, SU25, Cedrus libani; scale unit: 1 cm.*

Figure 139. *Wood charcoal, Diospyros sp. from WG 55, C2, SU2: group of fragments 2 and 3 (see list of samples); scale unit: 1 cm.*

Figure 140. *Wood charcoal, Diospyros sp. from WG 55, C2, SU2: Cross section of a fragment from group 1.*

Chapter 7
Botanical Finds at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011

7.1 Archaeobotanical investigations

7.1.a Archaeobotanical investigations, 2006-2007

KSENIJA BOROJEVIC

Archaeobotanical investigations were conducted at Mersa/Wadi Gawasis during two weeks in December 2006 and January 2007. The objectives were to retrieve plant macro remains during the ongoing excavations, to identify the plant taxa, and to reconstruct possible human activities associated with plant processing. In addition, a bread-baking experiment was conducted using four broken conical molds from the "production area" (WG 19/25/26/27) to test if bread could be baked using the narrow molds.

Methods

Visible plant remains were gathered during the excavation of Cave 3 and the areas outside the caves. In addition, soil samples were taken from various contexts (*e.g.*, hearths and ashes, especially from the Production Area WG 19/25/26/27). Soil samples were dry sieved using four geological sieves (mesh aperture 0.25 mm-2.00 mm). The volume of soil samples ranged in size from 30 ml to 3500 ml (3.5 liters). In total 26 samples, totaling over 15 liters in soil volume, were analyzed. The identification was based on the morphological characteristics of plant remains using a binocular microscope at the site and later from the photographs taken during the analysis. Plant remains were preserved as desiccated, charred (carbonized), or mineralized. Wood and wood charcoal was separately studied by Rainer Gerisch.

Results, Cave 3

Due to the dry conditions, most of the plant material from Cave 3 was desiccated and extraordinarily well preserved. The identified remains included emmer (*Triticum dicoccum*) spikelets without grains, three "brushes" of a monocotyledon plant, an endocarp of dom palm fruit (*Hyphaene thebaica*) gnawed by a rodent(s) (Figure 141), salt tree (*Nitraria retusa*) seeds without endosperm, and a piece of plant rope made from papyrus stalks (*Cyperus papyrus*) with insect holes. All the emmer spikelets were well preserved and do not show signs of pounding. However, all of the spikelets were "hollow." Not a single emmer grain was preserved inside the spikelets. Several spikelets had a visible round whole, indicating that the cereals were infested with pests. Numerous beetle exoskeletons were found with plant remains (Figure 142). Also, a vertebra of reptile, possibly a snake was found in the same area (identification by Justin Lev-Tov, personal communication, 2007). Insect remains from Cave 3, included elytra of the darkling beetle *Trachyderma hispida*; broken corpse of the trogossitid beetle *Tenebroides mauritanicus*, hind body of a tenebrionid beetle, cf. *Mesostena* sp.; fly puparium with anterior segments missing, indicating emergence; and a wasp cocoon (identified by Warren E. Steiner, Smithsonian Institution) [*editor's note*: this information was updated in August, 2017].

A spill of plaster (made of gypsum) from the cave floor (Cave 3, WG 39, B3) was an exceptional find since the bottom side preserved an impression of the floor. The spill was oval in shape, ca. 16 cm wide and 20 cm long (Figure 143 A). The top part was smooth, but the bottom side incorporated three desiccated emmer spikelets, chips of cedar wood, pebbles, a pottery fragment, and an impression of a beetle that matched the thorax and abdomen of the beetles found loose in the area (identified as weevils, Drypothroidae) (Figure 143 B). The find proved that the beetles were contemporaneous with the emmer spikelets and were responsible for eating emmer grains and other plant material, leaving hollow emmer spikelets grains and holes in other plant tissues.

Exterior areas

The majority of plant material from exterior areas, especially from the "production area," was badly burnt (*e.g.*, cereal grains), sometimes mineralized (*e.g.*, cereal chaff), and rarely desiccated (*e.g.*, leaves).

Results, WG 19/25/26/27

The most prolific samples were from the "production area." The majority of plant remains comes from heaths and fires from SU72, SU77, and SU81. Plant remains consist of numerous burnt grains of hulled barely (*Hordeum vulgare*), some emmer grains (*Triticum dicoccum*), and a large quantity of mineralized barley chaff found within ashes. In addition to grains of emmer and barley in SU72 and SU77, we found several small (ca. 1–5 cm) pieces of burnt hulled grains of barley adhered together (Figure 144). Numerous pieces of wood charcoal and a few fragments of charred leaves of a mangrove tree (*Avicennia marina*) were collected from the same units.

Results, WG 32

The majority of plant remains from this area consist of wood charcoal, desiccated fragments of leaves of a mangrove tree (*Avicennia marina*), and a few charred barley and emmer grains.

Results, WG 40

Wood charcoal and compacted leaves of a mangrove tree (*Avicennia marina*) were recovered from this unit. A concentration of pressed, desiccated mangrove leaves, including a whole fruit of *Avicennia marina* (ca. 1 cm large), was found in SU3. An oval ecofact (possibly a whole nut) 5 cm long and 4 cm in diameter, was retrieved from SU4 (Figure 145). A soft brick-like material that contained desiccated plant material, including some chaff and impressions of reeds that were included as temper, was also found in this unit.

Summary and conclusions, 2006-2007

Preliminary analysis of plant macro remains have shown that the principal cereals found at Mersa/Wadi Gawasis were emmer (*Triticum dicoccum*) and hulled barley (*Hordeum vulgare*), the cereals that were staples of ancient Egypt (Murray 2000a: 505). The relative contribution of each cannot be established yet. Cereals were probably brought to the site from the Nile Valley, which is more than 150 km away. Barley, which is a hardy cereal, could have been grown in the wadi after spring floods on a small scale (but not on a large scale); emmer could not be grown around the site due to the insufficient water supply. Cereals were likely transported as spikelets, already coarsely threshed, in some sort of bags. Emmer was stored in spikelets in the caves and was infested by weevils (*Drypothroida*) which ate the grains. Small saddle querns that were found in the caves could have been used for milling grain into flour.

Both emmer and hulled barley do not have naked grains, and unlike free-threshing cereals, *e.g.*, bread wheat, require additional work to break the chaff apart without damaging the grain kernel. The cereals need to be processed further, including pounding and heating to release the chaff. Perhaps the charred grains that were found outside the caves, especially from the production area, represent accidents that happened during the heating of the grains, indicating that those cereals were processed outside. The residue containing badly burnt barley grains adhered together, a sort of barley kasha that got charred, is probably the leftover of some over-burnt porridge or perhaps the cooked residue of beer production.

Cereal chaff was used as tinder for starting fires, as indicated by the presence of a large quantity of mineralized chaff of barley and wood charcoal in the ashes. Cereal chaff was also used as temper for some pottery (*e.g.*, platters) and soft bricks, but not for the conical bread molds or rectangular bricks.

Other plant macro remains include the leaves of a mangrove tree (*Avicennia marina*), which could have been gathered from local mangroves; one still thrives several kilometers north of the site. The desiccated leaves were ubiquitous. Because of the high salt content, neither leaves nor fruits were commonly used for fodder. Dry leaves could have been used for some kind of packing or insulation. Charred fragments of mangrove leaves and mangrove wood charcoal (see 6.2.b Identification of wood and charcoal, 2006-2007) indicate that *Avicennia marina* was used for fuel. Two large nuts (including the ecofact), three "brushes" made of a monocotyledon plant, and few other unknown small seeds must await more precise identification.

Bread-making experiment

A bread-making experiment was also conducted by Ksenija Borojevic and S. Terry Childs to determine how bread was baked in the conical bread molds found at the site. For this experiment, the dough was brought from a local bakery in Safaga where *baladi* (pita-type bread) was made. The ingredients were wheat flour (*Triticum aestivum*), water, salt, and some yeast. Four ancient conical bread molds were used. Bread was baked in the ashes of an open fire at the Coral Garden Resort.

The bread experiment has shown that the conical bread molds needed to be preheated before baking bread and that stiff dough was used if the molds were placed horizontally in the fire. If the bread molds were placed vertically, deep fire-pits or ovens must have been used because the greatest challenge was to start and keep a fire going in strong winds coming from the north. It is possible that the large number of broken cylindrical bread molds is not the result of the molds being broken while trying to get the bread out, but rather a result of mishandling the hot molds.

WG unit	Context	Soil volume (ml)	Content
WG 19/25/26/27, SU72	Hearth in profile	30	A little wood charcoal, 4 charred barley grains and little barley chaff mineral-ized
WG 19/25/26/27, SU72	Hearth	3500	Burnt barley kasha 2.56 g (barley grains), and a few burnt emmer grains separately, cereal internodes, *Avicennia* leaves
WG 19/25/26/27, SU72	Ash and bread mold frag-ments,very dusty	2150	Some mineralized barley chaff, very dusty, half a seed of charred emmer
WG 19/25/26/27, SU77	Fire-pit	2300	Lots of wood charcoal, badly burnt bar-ley grains, mineralized barley chaff, cereal internodes, *Avicennia* leaves, piece of fiber
WG 19/25/26/27 SU81		1600	Much charcoal, desiccated barley chaff, 8 badly burnt barley grains, 1 cf. *Lolium* seed (weed) and small unknown seeds
WG 25, D1, SU89	Small fire- pit on the edge(sand)	400	Mineralized barley chaff
WG 26, C5, SU72	Bottom, large pieces of pottery	800	Much wood charcoal, 60 badly burnt bar-ley grains, small emmer grains, some small unknown seeds - some uncarbonized
WG 26, D5/E5 SU87	Ash and bread mold fragments ~ SU72	250	5 pieces of caramelized organic matter barley kasha, small piece of charcoal, 3 badly burnt barley grains, 1 emmer grain
WG 32, A4, SU10	Sand stratum		Uncarbonized wood, wood charcoal on both sides; no other plant remains
WG 32, A4, SU27	Burnt pottery	2000	Much wood charcoal inside and outside the sherds; small piece of fabric; 3 bar-ley seeds badly burnt, half of an emmer grain; small *Avicennia* leaf fragments
WG 32, B4, SU10		250	Small fragments of *Avicennia* leaves, 3 charred barley grains and one emmer grain, desiccated florets

WG 32, B5, SU10	In front of Cave 2	250	Desiccated-*Avicennia* leaves fragments, 1 fruit of *Zyziphus spina-christi*, 1 cotyledon of a legume seed; 9 barley and 10 emmer charred seeds, 5 cf. cereal internodes, 2 small desiccated seeds
WG 39, Cave 3, A1, SU1	Cave floor		Desiccated-1 large nutshell gnawed by rodent; 2 pieces of rope, twisted (length: 10 cm; 3 cm), burrowed by insects
WG 39, Cave 3, A2, SU1			3 insect exoskeletons, 17 small oval coprolites
WG 39, Cave 3, B2	Surface finds		7 insect exoskeletons, 25 coprolites, 2 fragments of rope, 1 fragment of twig
WG 39, Cave 3, B2 SU8	Cave floor	300	Desiccated-numerous (45) emmer spikelets (grains missing), 3 "brushes" of monocotyledon plant, 2 charred cereal fragments, insect remains, a pottery sherd
WG 39, Cave 3, B3	Plaster floor impression	3 desiccated emmer spikelets without grains, cedar wood fragments, impression of an insect, small pebbles	
WG 39, Cave 3, SU1	Cave floor		Desiccated-8 empty emmer spikelets, 8 identifiable remains of unknown seeds, 1 piece of wood
WG 39, Cave 39, A3			3 insect exoskeletons; 4 small oval coprolites
WG 39, Feature A	Hearth (sand)		Soft light-colored mud-bricks, one with a reed impression, some wood charcoal, 1 barley grain, *Avicennia* leaves fragments
WG 40, Feature A, SU2	Hearth		Small wood charcoal pieces incorporated into ash, several pieces of desiccated straw

WG 40, Feature A, SU3	Sand		Desiccated concentration of *Avicennia* leaves
WG 40, Feature A, SU3	Hearth	v250	Desiccated small concentration of *Avicennia* leaves, 3 charred barley and 3 emmer grains, 1 internode, 1 unknown charred berry, 1 desiccated *Zyziphus spina-christi* fruit, 1 unknown fruit
WG 40, SU2	Salt crystals, sand	800	Wood charcoal, 1 formed spikelet (?), small quantity of burnt charred barley and emmer seeds, one charred unknown berry, several desiccated plant remains
WG 40, SU3		80	More packed *Avicennia* leaves with small *Avicennia* fruit, few fragments of cereal chaff
WG 40, SU4, Feature C	Silt incrusted fire-pit		A whole large nut(?), desiccated/mineralized; packed *Avicennia* leaves

Table 17. *Summary of finds from archaeobotanical samples.*

7.1.b Archaeobotanical investigations, 2007-2008: seeds
Ksenija Borojevic

A lump of charred grains was collected in WG 55, C2, SU2. Even on the basis of the photograph they can be easily identified as *Hordeum vulgare*. It seems as if this lump was from storage, rather than from a cooking context, because the grains are whole and stacked in one layer upon the other.

7.1.c Archaeobotanical investigations, 2009-2010
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 18 and are discussed below by the excavation units from which samples were taken.

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

Table 18. *Summary of finds from archaeobotanical samples.*

Results, 2009-2010

N=number of samples taken and analyzed

vol (volume of soil/sand dry screened) ml

<u>WG 32, A4</u>

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.

<u>WG 33</u>

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.

<u>WG 46, E3, D2, D4</u>

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).

<u>WG 47, A2-3</u>

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.

<u>WG 55, C1-2-3; D1-2, 3; E1-2-3</u>

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*). Sycamore fig fruits (84) were rather small (1-2 cm) and immature (Figure 146). 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 147). 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 rootlets 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, hand-picked

WG 56 is adjacent to WG 55. Two fruits of dom palm (*Hyphaene thebaica*) were collected from this trench (Figure 148). 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 dom 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. Additionally, two garlic rootlets were recovered from WG 61, D2-3, E2-3/WG 65, A2-3, SU19 (Figure 149) 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 (750 ml), 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 150).

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 151). 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 152). Noteworthy, in WG 65, A3, SU27 were fibers from the interior of mats made of *Imperata cylindrica* (Figure 153).

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, 2009-2010

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 7.1.a Archaeobotanical investigations, 2006-2007). 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, indicating 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 sycamore figs and others types of fruits, including two dom 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 sycamore fig and mangrove trees (see 6.2.c Identification of wood and charcoal, 2009-2010). 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 13th Dynasty, according to Murray (2000b: 630). At the Roman site of Berenike, 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 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 Berenike and Mons Porphyrites, but two millennia older. If the Mersa/Wadi Gawasis garlic remains indeed date to the 12th Dynasty, then this garlic is the oldest found in Egypt so far.

7.1.d Archaeobotanical investigations, 2010-2011

Ksenija Borojevic and Rebecca Mountain

More than 40 paleoethnobotanical and micromorphological samples from various features were analyzed in detail at the laboratory facilities available in the field.

The volume of sediment samples collected for macroplant analysis was measured with graduated beakers. In four large samples, subsamples were taken and the rest of the samples were only scanned and could not be further analyzed because of a lack of time. The samples were dry sieved through four geological sieves (apertures 4.00-0.25 mm). Various categories of the recovered material, including small rocks and ceramics were separated from the plant material that was then sorted into the wood charcoal and other macroplant material that was further identified to the most precise taxon. Plant material from sieves larger than 2 mm was analyzed entirely, while material from sieves smaller than 2 mm was either analyzed entirely or, in the case of four larger samples, a subsample from the fraction smaller than 2 mm was analyzed and the counts and volumes were then extrapolated as if the whole fraction of the sample was analyzed and added to the totals for the particular sample. Wood charcoal pieces were not counted, only the volume of total pieces larger than 2 mm was recorded in milliliters. Counting numerous barley grains and fragments represented a challenge, and often the number of grains had to be extrapolated from a volume of grains based on the count of 100 grains from a particular sieve fraction. In many instances, the grains were stuck together in lumps or to pieces of wood charcoal because of salinization processes. In other cases, barley grains and fragments were stuck together because of the carbonization process or perhaps because of cooking, *e.g.*, "kasha lumps." A number of cereal grain fragments seemed to have been charred after being ground (i.e. "bulgur" fragments). In most cases, the fragmentation of grains was due to post-depositional processes. To make the results of the plant analysis among samples and features comparable, the density was computed for each of the fire-pits for plant taxa. The quantity of recovered specimens (count or milliliter for wood charcoal) was divided by the volume (in liters) of sediment from the sample. The identification was based on the morphological characteristics of plant remains identified with a microscope at the site and later from photographs taken during the analysis. The samples were analyzed for each SU unit and feature separately. Botanical material from Fire-pits 14 and 15 was retrieved and analyzed separately and according to the microstratigraphic excavation layers.

Results, 2010-2011, Fire-pits 14 and 15

N=number of samples taken and analyzed

Vol. (volume of sediment/sand dry screened) ml

<u>WG 65 (SU36), Fire-pit 15</u>

N=15

Vol.=5194 ml

A total of 15 samples was analyzed from this feature. The feature in WG 65, Fire-pit 15 (C3 SU36 in SU2) was initially discovered at the end of the excavation season in 2009-2010. The top sand layer was mixed with charred hulled barley seeds, cedar wood charcoal chips, mangrove twigs, small fiber particles, uncharred mangrove leaves, twigs, other blown-in leaf fragments, and desiccated barley chaff.

<u>WG 65 (SU36), Fire-pit 15, Layer 1</u>

N=8

Vol.= 4530ml

Hand-picked=1

Initially four samples from this top layer were collected in 2010 and analyzed together with the remaining four samples in 2011 (a total of 4530 ml of sediment). Larger pieces of wood charcoal (WG 65, Fire-pit 15, C3, SU36 in SU2) consisted of chunks of cedar wood refuse from boat repairs, some of which were clearly infested by pests prior to being used for fuel. Many charcoal pieces were from locally available mangrove twigs (for wood see 6.2.d Identification of wood and charcoal, 2009-2010).

A large sample, #3 (5000 ml of sediment), taken in 2010 from the top layer next to the western brick wall, contained a large quantity of charred barley grains. A subsample of 250 ml (from 5000 ml) was analyzed in which 339 barley grains were recovered in addition to 52 bulgur grain fragments (Figures 154 and 155).

In 2011, four more samples from the same northwest area of Fire-pit 15, where a concentration of charred barley grains was initially noticed in 2010, were collected and analyzed. The highest concentration of charred barley grains was from two samples, ca. 30 cm east of the west wall. Samples were taken from the surface to the depth of 6.5-8 cm (points 1, 2, 10). From Sample #7 (400 ml sediment), ca. 100 ml of wood charcoal was recovered. Most of the wood was cedar. An 8 cm long piece was partially burnt. The majority of the sample consisted of barley grains (140 ml); most of the grains were fragmented. The total of barley grains, including the whole ones and fragmented ones extrapolated to whole grains based on weight, comes to 2735 whole grains (a density of 6837 barely grains per liter of sediment). Among the fragments, an additional 17 were identified as bulgur. From Sample #8 (1600 ml of sediment), 300 ml of wood charcoal consisted mostly of cedar chips larger than 4 mm. Barley grains were also abundant (650 ml) and were extrapolated to 9860 whole barley grains (a density 6162 grain per liter of sediment). In this 25 sample, 22 bulgur fragments and a grain of emmer (*Triticum dicoccum*) grain were found. No barley chaff was recovered. The remainder of the samples consisted of rocks and sand.

<u>WG 65 (SU36), Fire-pit 15, Layer 2</u>

N=1

Vol.=100 ml

Sample #9 (100 ml) was the only sample taken from this 5 cm thick layer in the southern part of the feature. Only 25 ml of wood charcoal was recovered; it contained pieces of cedar and mangrove. Barley grains (44) were poorly preserved. The condition of the grains is much worse than those from Layer 1.

WG 65 (SU36), Fire-pit 15, Layers 3 and 4

N=1 sample

A sample (#11) was taken from the two layers; Layer 3, which consisted of a 1 to 3 cm thick layer of very hard, dark grey cemented ashes that contained few if any seeds, and from Layer 4, which consisted of light grey ashes and slightly cemented and charred material mixed with sand. It was impossible to determine a volume or to analyze the cemented samples.

WG 65 (SU36), Fire-pit 15, Layer 5

N=2

Vol. =31 ml

Two small samples were taken from the south central part of the feature. The layer consisted of few plant remains, mostly unburnt barley chaff and small charred barley fragments, and sand. Sample #12 (30 ml) contained one piece of burnt mangrove and one piece of unburnt mangrove tree. Of 11 recovered barley grains, two were still in chaff and two were badly burnt. Nine chaff fragments were identified, and seven were unburnt. One of grain of uncharred barley spikelets seemed to have a sprouted root, and one charred barley grain had an impression from a growing sprout (coleoptile) (Figure 155 C). Sample #13 was a small burnt cluster of melted barley grains.

WG 65 (SU36), Fire-pit 15, Layers 6 and 7

N=2

Vol=533 ml

The two samples from these layers consisted of burnt and unburnt plant remains, some rocks, and three potsherds. A single small sample was analyzed from Layer 6 (33 ml), toward the eastern edge of the southern part of the feature that contained six remains of unburnt barley chaff and one bud of a mangrove leaf. Sample #15 is from Layers 6 and 7 from the southeast corner of the feature. A subsample of 500 ml (from 1600 ml) was analyzed entirely and was dominated by unburnt barley chaff (an estimated 347 fragments), 45 charred barley grains, and 20 ml of wood.

In sum, Fire-pit 15 is dominated by a large number of hulled barley grains and fragments (*Hordeum vulgare*) in the upper layers. Extrapolated to whole grains, there were 13,600 grains. Although the total number and the density of 2618 barley grains per liter of sieved sediment is impressive, the total volume of barley grains from Fire-pit 14 is ca.

700 ml (from 5000 ml of sediment). The amount of barley chaff remains from Layer 1 that contained the most of charred grains is very small. Chaff was mostly desiccated (unburnt), and the remains were more numerous in the deeper deposits in the area toward the eastern corner in Layers 6 and 7 where fewer charred barley grains were found. No weed seeds or fruit remains were found. More unburnt barley chaff was found in the adjacent unit WG 61 (reported in 2009-2010). The fire-pit was supported by mud-bricks in the southern part, and only sporadic plant remains were found south of the wall. A hand-picked sample was collected from the surface from WG 65, A4-5, SU46 in 2010, and it contained *Acacia nilotica* pod segments (3), a garlic root (1), and a small fig fruit (1).

<u>WG 65 (SU35), Fire-pit 14</u>

N=9

Vol.=2132 ml 26

Fire-pit 14 was excavated after Fire-pit 15 and was also partially excavated. The microstratigraphic removal of sediments was carried out in two areas (blocks) of the feature: 1) the southeast corner (ca. 20 × 20 × 20 cm), and 2) the eastern part of the wall (ca. 20 × 30 × 35 cm). There were three rows of sandy-mud bricks (each brick was ca. 23 × 11 × 8 cm). The bricks were on the top of the sand layer, and below this layer there was a dissected vegetation layer. Most mud-bricks were left in place, but the mud-bricks in the middle of the preserved eastern wall of Fire-pit 14 were removed (Figure 55). The sand layer was reached 35 cm below the datum at the eastern part of the wall, and it was the lowest excavated point in SU35. The thickness and the distribution of layers between the two areas of this feature varied to a degree. Nine samples were taken from Fire-pit 14 (initially Fire-pit 15A), a total of 2132 ml of sediment.

<u>WG 65 (SU35), Fire-pit 14, Layers 1a and 1b</u>

N=4

Vol.= 957 ml

From these two layers four samples were taken and analyzed. Sample #17 (500 ml) from the eastern section consisted of encrusted ashes and wood (Layer 1a). Wood charcoal (32 ml) was recovered together with a lump of charred barley (5-10 mm in diameter, ca. 17 barley grains) (Figure 155 E).

Sample #23 (300 ml volume) in the eastern section was from below the desiccated vegetation (Layer 3) that was above the lower bottom layer of mud-bricks. The sample was brownish in color and perhaps represents dispersal of deposits of Layer 1b in this area. It was the most prolific sample from this feature, yielding 88 plant specimens. Some of the barley grains in this sample were badly burnt, while others were unburnt or partially charred, and two barley grains were still in their husks. The sample contained a small but almost equal number of barley chaff remains and grains.

Samples #18 (200 ml) and #19 (225 ml) from the southeast corner contained a few barley grains and bulgar fragments and several charred pieces of a string. Sample #24 (100 ml) from the southeast corner contained a few barley grains and fragments and two pea (cf. *Pisum sativum*) seeds (3-4 mm in diameter).

<u>WG 65 (SU35), Fire-pit 14, Layer 3</u>

N=2

Vol.=550 ml

This layer of desiccated, blown-in vegetation was composed mainly of grass-type leaves accumulated toward the eastern part of the wall where it was 5 cm thick. Overall, a very small quantity of charred plant material was recovered compared to the amount of dissected plant material recovered. Two samples were collected: Sample #21 (400 ml) and #22 (150 ml). Of the 150 ml sample, ca. 75 ml was desiccated vegetation in addition to a few barley grains and fragments, including a few bulgar fragments. A total of 20 barley grains, an additional 20 grains stuck together in lumps, and 64 fragments were recovered from the total of nine samples. The barley grains were badly burnt. The remains of barley chaff, including two rachises (total of 30 specimens, both unburnt and burnt) were preserved. A total of 21 bulgur grain fragments were identified.

Discussion, Fire-pits 14 and 15

Fire-pits 14 and 15, although adjacent and very similar, seem to have different histories of use. The different preservation of remains of the same plants (barley grains are mostly charred and chaff mostly desiccated) demonstrates different episodes and taphonomic process taking place in the features. It is likely that the desiccated plant remains were blown in after the fire cooled down and before they were covered with another layer of sand or the salt crust.

Fire-pit 14 has fewer layers and significantly less charred material. The botanical material is more mixed, and it contains highly processed (burnt) barley grains, uncharred barely chaff, two charred pea seeds, dissected blown-in vegetation, and insect remains. Fire-pit 15 has a large concentration of the barley grains that are concentrated on the top and seem to be one of the last episodes of the use of the fire-pit. The amount of barley grains in Fire-pit 14 seems to be a spill from Fire-pit 15 mixed with some kind of a burnt refuse. A significant amount of wood charcoal, primarily of cedar and mangrove tree, and other pieces of burnt organic material testify to the use of various fuels.

In Fire-pit 15, a total of 13,600 barley grains have been identified, 98 bulgur fragments, 375 barely chaff remains, and 3 barley rachises. Although the total number and density, 2618 barley of grains per liter of sieved sediment, is impressive, the total volume of barley grains from Fire-pit 15 is ca. 700 ml (from 5000 ml analyzed sediment). This amount of grain is less than 1 kg of barley. There were certainly more grains that were not recovered through sampling, and more that have eroded in the recent and more distant past, but the quantity of barley is still not representative of a type of storage place consumed in a fire, but rather of a smaller quantity of barley, perhaps brought in a bag. Remains of burnt plant fibers were found in the fire-pits. A twined bag (60 × 45 cm large) was found in Cave 2, similar to the ones used for carrying wheat and barley presented in the agricultural scenes in tombs (see Wendrich 2000: 262, Fig. 10.8d) . In such a bag a quantity of barley grains larger than the one estimated of the charred barley grains found in the fire-pits could have been carried. The question remains of why the barley was burnt.

The grains of barley (*Hordeum vulgare*) found in Fire-pits 14 and 15 are of the hulled type and are symmetrical, characteristic of 2-row barley. Not many asymmetrical seeds, which are typically present in 6-row barley varieties, were found. The chaff (lemma and palea) of barley is tightly attached to the surface of barley grains. There was proportionally very little charred chaff found and no weed seeds or straw, indicating that the charred barley must have been sieved and then cleaned of contaminants before it was charred. There was a relatively small amount of barley grains that were processed, i.e., bulgur prior to charring, evidenced by characteristic bulging of the surface in the fracture (see Figure 155 B). Proportionally, the bulgur fragments were not numerous in comparison to the whole seeds or the ones that were fragmented as a consequence of post-depositional processes. The bulgur fragments were not generally small and did not have discernable shiny fracture surfaces, characteristic of bulgur that was well ground and soaked in water prior to charring at low temperatures (Valamoti 2002, Valamoti *et al*. 2008). The barley grains were not sprouted either, except for perhaps two instances from a sample from Fire-pit 15, Layer 5. The whole barley assemblage from Fire-pit 15 indicates activities associated with the processing of barley grains and perhaps of dehusking hulled grains, when the whole quantity of barley was accidentally burnt. It is possible that several scoops of hulled barley grains, after being cleaned of contaminants, were heated to be dehusked or pounded in a mortar with a little water to shear off the thin barley husks without crushing the grains, thus relatively few bulgur fragments were found. Drying or heating of the hulled barley grains close to the fire could have led to accidental burning of barley in the Fire-pit 15, ca. 3875 years ago. It is impossible to deduce the intentions of the ancient Egyptians regarding the barley, but the dehusking of barley would have been necessary before consumption, *e.g.*, for making porridge. But the ancient Egyptians may have been planning to brew beer (using one part of unsprouted grain); the one part of grain that got accidently charred. Dehusked grain would have been later mixed with sprouted grains (that were not exposed to fire and thus not preserved). The whole process of grinding hulled cereals and beer brewing using two batches of grain was experimentally documented based on archaeological evidence from the New Kingdom by Samuel (see publications of Delwen Samuel[1]). Beer jars and storage jars have been recovered at the site of Mersa/Wadi Gawasis.

Archaeobotanical analyses from other excavations units: WG 26, WG 31, WG 40, WG 61, WG 70/72/73, and Cave 3, 2010-2011

<u>WG 26, C5, SU72</u>

N=1

Vol.=500 ml

Sample #26 (500 ml) collected in 2009-2010, contained very little wood charcoal, two barley grain fragments, a fragment of a small bulb,

[1] Delwen Samuel's papers are posted on http://www.ancientgrains.org/html/delwen_s_papers.html.

five unidentified fragments, and two fish vertebra, and possibly a fish tooth.

WG 31, SU1

Hand-picked =1

A sample from 2009-2010 containing a type of unidentified "capsule" without internal divisions, identical to the one found in WG 55, C2, SU2 (reported in 2010), was recorded in addition to two small fig fruits.

WG 40, SU1

Hand-picked=1

Two dom palm endocarps were hand-picked (see Figure 156 A).

WG 61, E4-5, SU46, DE 2-3, SU45, SU46

N=6

Vol.=30

Hand-picked=5

These samples were hand-picked at the end of the 2009-2010 field season. The results of botanical finds from WG 61 have been reported in the 2009-2010 report, when nine samples were analyzed. The entire unit is characterized by the abundance of dissected botanicalv remains, which include fruits, reeds, grass remains, garlic rootlets, acacia pods, barley chaff, and others remains. From the six additional samples analyzed in 2011, no new plant remains were found except for a small fruit, ca. 1 cm, in diameter, possibly a juniper berry. Desiccated remains of a whole garlic head, including cloves and skin, were also found in addition to the rootlets. Another unknown whole seed/fruit, identical to ones from WG 55, D1-2, SU3, was found in this unit.

WG 70, C1, B1/C1, Feature 1

N=3

Vol =1385 ml

From WG 70, C1, B1/C1, and Feature 1, a total of three samples (1385 ml sediment) were analyzed. From WG 70, C1, a dark burnt layer on top of a red concentration, contained visible plant remains. The sample also contained sea shells (some pierced); insect encasings, some of which were burnt; and a small fragment of burnt and of unburned animal bone (Figure 157 C). Sample #25 (525 ml) from the upper part of the layer consisted of a few wood charcoal pieces (21 ml), several whole charred barley grains (21), a few bulgur fragments and kasha lumps, and a large number of barley fragments (330). The barley fragments from WG 70 were more badly burnt than those from Fire-pit 15, indicating that they were exposed to higher temperatures and perhaps represent a refuse of burning during cooking.

WG 73, A4-B4, SU1

Hand-picked=1

One whole, uncharred dom palm fruit was hand-picked (see Figure 156 D).

Cave 3/WG 39 (under T64)

N=1

Vol.=680 ml

A relatively large quantity of uncharred hollow barley (*Hordeum vulgare*) spikelets, many with holes, was found in this sample, a testimony of grain infestation by insects (Figure 158 D).

Plant fiber material analysis, 2010-2011

During the Mersa/Wadi Gawasis 2010-2011 field season, in addition to the macrobotanical remains, plant fiber artifacts such as rope, matting, and raw plant leaves and stems were analyzed. Seventeen samples of botanical fiber artifacts from four separate excavation units were identified. Four samples came from the large rope coils in Cave 5; each sample came from a different coil (see 5.3 Cave 5 ropes). A large reed fragment was collected from WG 65, Fire-pit 14, and 10 samples from a pile of several mats were collected from WG 40 and its extension. Two samples were also collected from WG 64, A1-B1, SU3, which is located inside Cave 2: a fragment of some frayed plant material and a sample from a large assemblage of raw plant stems and leaves.

The species of fibrous plant was determined by first creating longitudinal thin sections of each sample using a razor blade and then mounting the section on a glass slide and examining it with a compound microscope (100× to 400×). The species were identified by the unique epidermal cell patterns visible in the thin sections. The results of the botanical fiber analysis are discussed below by the excavation units from which the samples were taken.

WG 40 and its southern extension: 5 mats

During the 2010-2011 field season, fragments of matting were discovered in the northern wall of WG 40, and the excavation unit was therefore extended, revealing a large pile of approximately five mats.

Samples from different elements of the five mats were analyzed as was a gauze fragment and a small rope fragment recovered within the pile of mats (Figure 159). The gauze was identified as *Linum usitatissimum* (flax/linen) and the rope fragment as *Imperata cylindrica* (halfa grass). For organizational purposes, the mats were labeled A through E, based on their location in the pile in descending order. Most of the mats were constructed with either a weaving or twining method, with the exception of Mat B. Mat A's interior and border fibers were identified as *Desmostachya bipinnata* (halfa grass). Mat B displayed a plaited construction pattern unlike the other woven and twined mats. It was constructed from *Hyphaneae thebeica* (dom palm) leaves. Mat C's interior and border fibers appear to be constructed out of *Desmostachya bipinnata*, although the mat's binding rope was badly degraded, making identification difficult. Mat D was finer than the others and was identified as *Desmostachya bipinnata*; the lowest mat, Mat E, appeared to have been made from *Desmostachya bipinnata*, but the fibers were very degraded.

WG 64, A1-B1, SU3 (Cave 2)

A sample of frayed plant material recovered from this excavation unit was identified as a degraded piece of *Phoenix dactylifera* (date palm) leaf. A few brush-like stems and leaves of raw plant material were recovered in Cave 3 in previous field seasons, and in the 2010-2011 season, a large assemblage of these "brush" stems and sheathes were recovered in WG 64, A1-B1, SU3. They appeared to have been used as some kind of matting or flooring. The plants were identified as *Imperata cylindrica.*

WG 65, Fire-pit 14

A large hollow reed fragment with a prominent node was recovered from this unit. The reed was identified as *Arundo donax* (giant reed).

Conclusion, mats

Both of the most common reed species, *Phragmites australis* and *Arundo donax*, grow near the site of Mersa/Wadi Gawasis and also did so in antiquity. While the intended use of the reed fragment found in WG 65 is unknown, it was likely harvested from nearby.

The majority of the mats and the small rope fragment in WG 40 were made from halfa grasses, *Desmostachya bipinnata* or *Imperata cylin-*

drica, both of which grow in the wadis near the site. It is also possible that *Hyphaneae thebeica* (dom palm) grew around the Red Sea area in antiquity, and therefore all of the mats could have been made from locally available material. A number of dom palm fruits have already been found at the site. The linen gauze fragment item (made of flax fibers) was brought from the Nile Valley because flax does not grow along the Red Sea and needs water for processing (retting). Many of the same type of linen fragments have been found around the site in previous field seasons. The pile of the mats accumulated in WG 40 adjacent to the coral terrace resembles huts made from mats by present-day nomadic tribes in southern Egypt. The plaited technique has only been reported from New Kingdom sites (Cappers 2006: Fig. 3.3).

Both of the samples from WG 64 come from apparently unprocessed plant material. The frayed date palm leaf material probably came from some other artifact, such as a mat. As mentioned previously, *Imperata cylindrica* grows locally in the wadis along the Red Sea, and therefore the leaves and stems used as flooring in WG 64 could have been harvested locally.

Summary and conclusions, 2010-2011

Mersa/Wadi Gawasis provides an exceptional opportunity to study ancient Egyptian botanical remains because of the excellent preservation of the organics at the site. Analysis of the plant remains from the 2010-2011 field season has revealed the usual repertoire of charred and desiccated remains previously identified at the site. The new plant species discovered at the site are two legume seeds, most likely of pea (cf. *Pisum sativum*), and a fruit, possibly a juniper berry (cf. *Juniperus* sp.).The large concentration of charred barley grains (*Hordeum vulgare*) discovered in WG 65, Fire-pits 14 and 15, is a result of the accidental burning of barley, perhaps during dehusking of the spikelets and preparing them for a porridge or beer brewing. It is the last episode of burning in Fire-pit 15. Microstratigraphic excavation and geological analysis have revealed that both fire-pits have different life histories and exhibit multiple episodes of use and abandonment (see also 3.2.b Excavations, western terrace slope). Cereals, probably in spikelets, together with other supplies must have been brought from the Nile Valley and were further processed at the site.

Artifacts, such as the large rope coils in Cave 5, were made of papyrus and were also brought from the Nile Valley. The set of mats found in WG 40, made from the twining of halfa grasses, and a mat of plaited dom palm leaves, could have been made of locally available resources unless they were brought together with other supplies from the Nile Valley. The pile of mats resembles a collapsed tent-like structure made by modern nomads in Egypt and could have been made as an additional shelter adjacent to the caves. The analysis of the plants provides vital information about different activities and ancient plant uses taking place in the ancient harbor of Mersa/Wadi Gawasis ca. 3875-3850 years ago.

Figure 141. *Figure 26. Nutshell with rodent gnaw marks from WG 39, Cave 3, A1, SU1.*

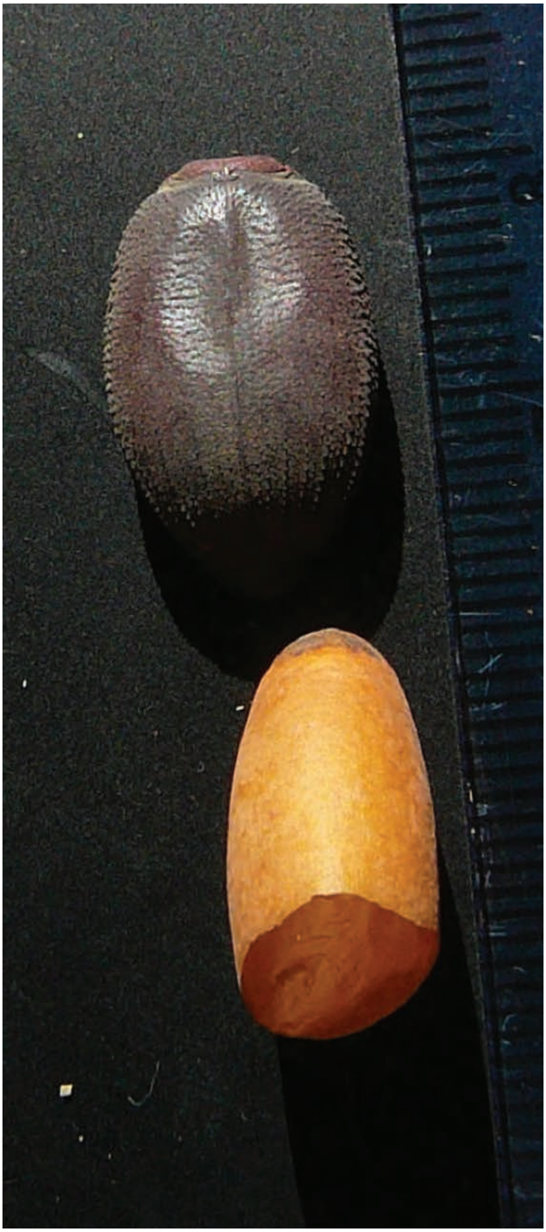


Figure 142. *Abdomen and thorax and inner lining of a weevil (Drypothroidae) from Cave 3.*

Figure 143. *WG 39, Cave 3, A) Plaster spill and B) impression of cave floor on the underside.*

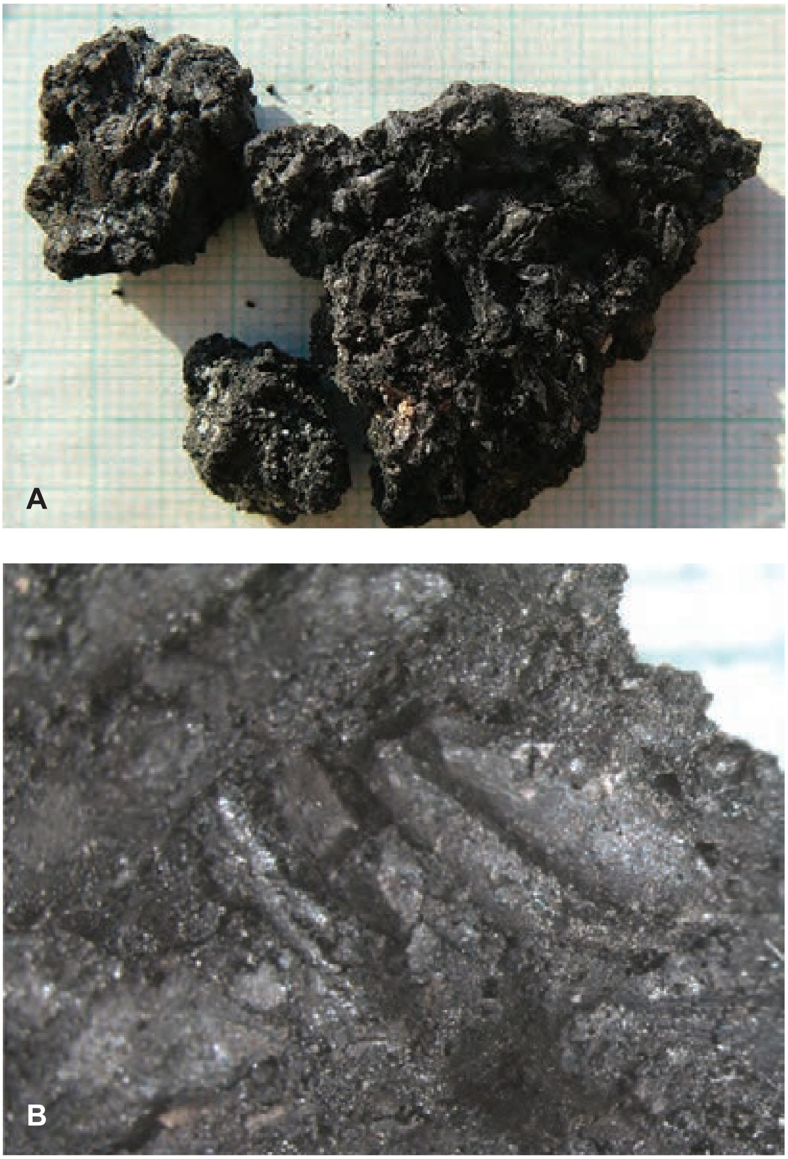


Figure 144. *WG 19/25/26/27, SU72, A) Charred, small pieces of burnt hulled grains of barley glued together: barley kasha; B) detail of barely grains.*

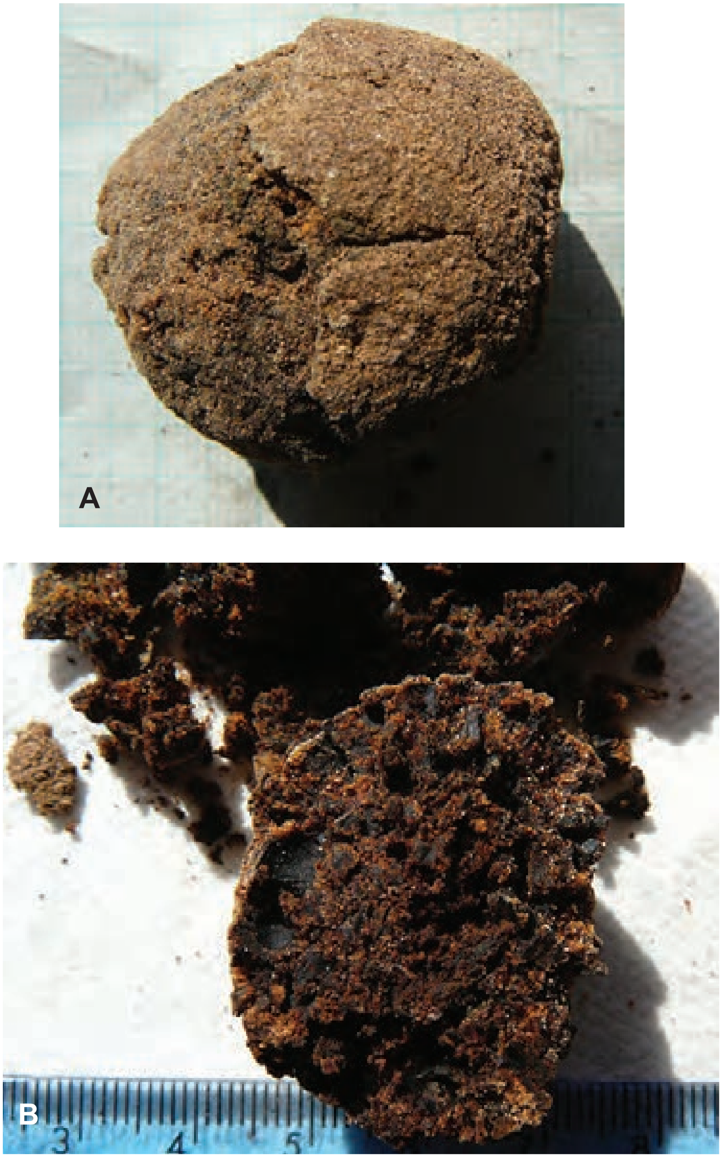


Figure 145. *WG 40, SU4 Feature C, A) An oval ecofact: possible whole nut; B) detail of cross section.*

Figure 146. *Sycomore figs from WG 55, D1-2, SU2, size 1-2 cm.*

Figure 147. Possible capsule of a yet unidentified plant and an unidentified seed from WG 55, C2, SU2, size of the capsule on the left ca. 2 x 3 cm.

Figure 148. *Dom palm fruits from WG 56, A3, SU1.*

Figure 149. *Garlic bulb and a clove on the side from WG 61, D2-3, E2-3/WG 65, A2-3, SU19.*

Figure 150. *"Resin lump" from WG 61, D2-3, E2-3, SU19.*

Figure 151. *Charred barley seeds, from WG 65, C3, SU36, in SU2 Fire-pit 15, SU2.*

Figure 152. *Fibrous material from SU33 "Botanical feature" from WG 65, E4, SU27.*

Figure 153. *Mat-plant detail from WG 65, A3, SU27.*

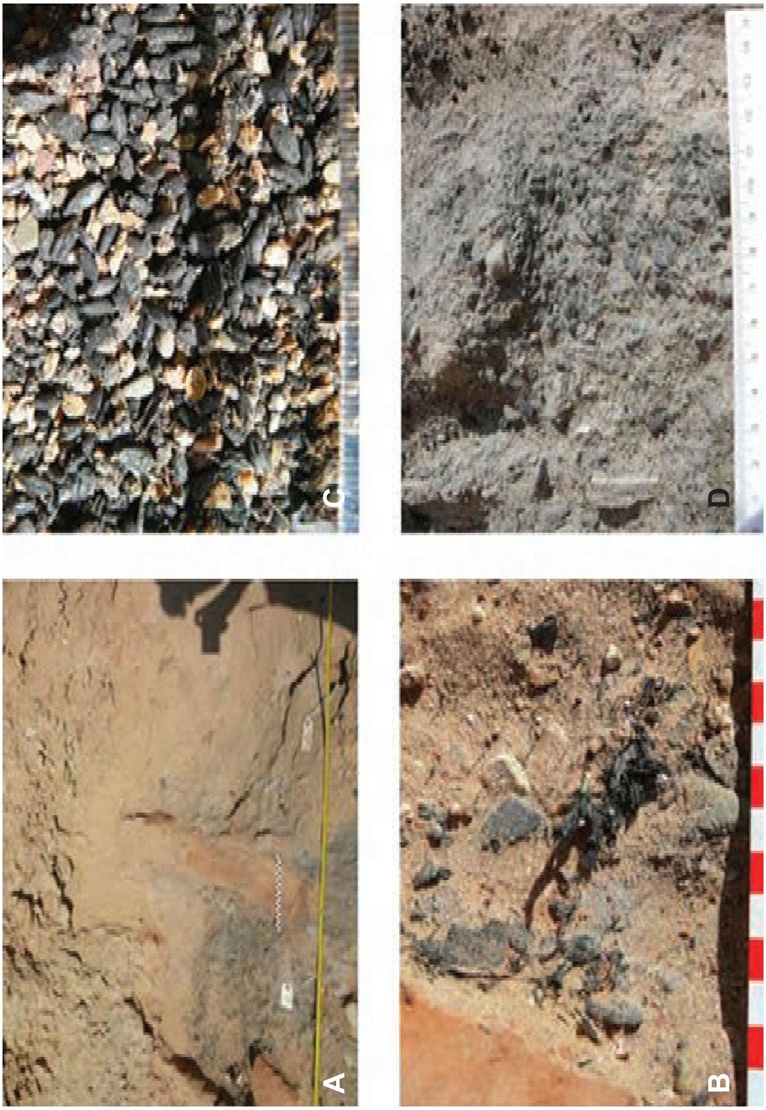


Figure 154. *A) WG 65 View of Fire-pit 15, SU36 left and Fire-pit 14, SU35 right; B) Details of burnt organic material with plant fiber string; C) charred barley in Fire-pit 15, layer 1 mixed with sand; D) charred barley in ashy Layer 2 below.*

Figure 155. *Plants from WG 65, Fire-pit 15, SU36; A) barley lump (Hordeum vulgare); B) a "bulgur" half grain; C) desiccated barley spikelets, and small barley grain with impression of a sprout; Plants from WG 65, Fire-pit 14 (SU35): D) pea seed (Pisum sativum); E) barley lumps charred; F) partially charred barley lump with uncharred insect remains.*

Figure 156: *Various forms and different preservation of dom palm fruits (Hyphaene thebaica): A) WG 40, SU1; B) WG 39, Cave 3, A1 SU1; C) WG 61, D2-3/E2-3, SU45; D) WG 73, A4-B4, SU1; E) and F) WG 56, A3, SU11.*

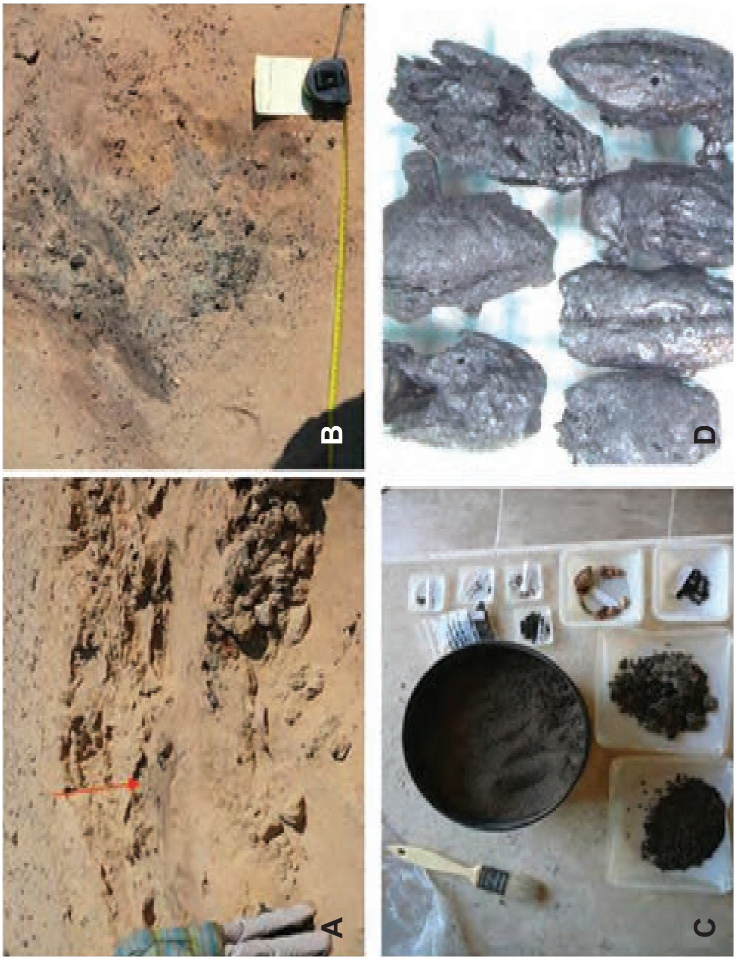


Figure 157: *WG 70: A) Location of the ashy concentration (indicated with an arrow); B) the detail of the surface with ash and charred remains; C) types of the organic material recovered from the sediment sample; D) detail of charred barley grains.*

Figure 158: *WG 39, Cave 3, under WG T64, A) finds of desiccated plant remains in 4 mm sieve; B) hollow barley spikelets (H. vulgare); C) sorted hollow barley spikelets and grass remains; D) detail of barley grains eaten by insects.*

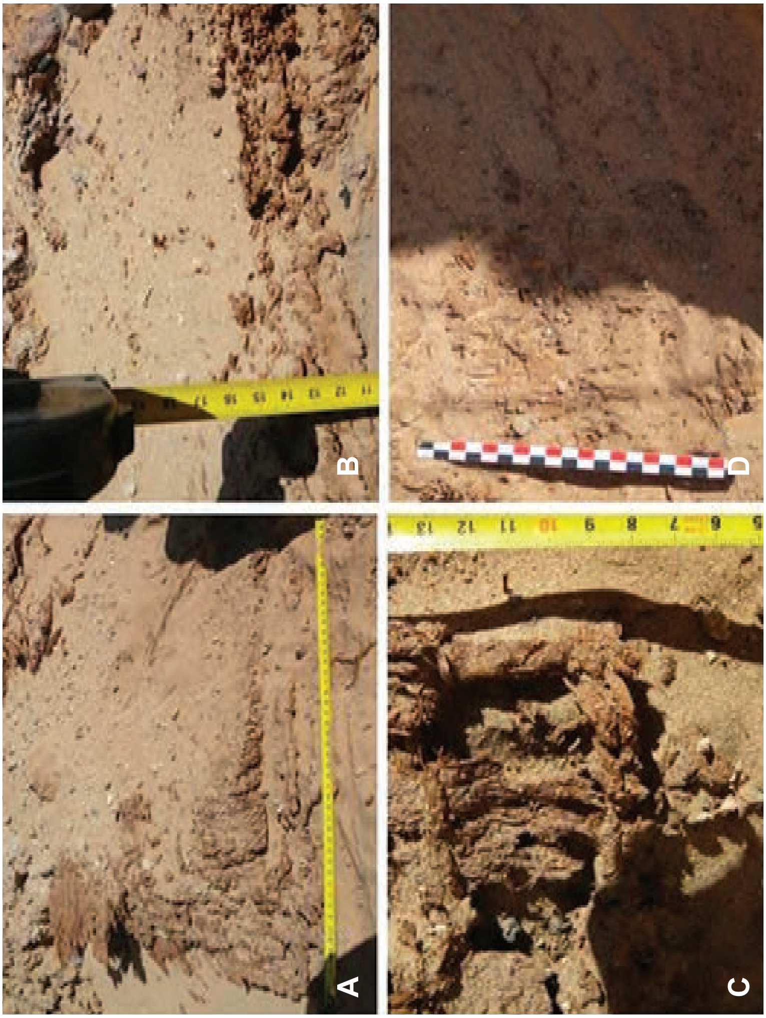


Figure 159. *WG 40 north: A) and B) different views of layers of mats made from plant fibers; C) details of twined mat made from halfa grass; D) plaited mat made of dom palm leaves.*

Chapter 8
Other Finds at Mersa/Wadi Gawasis, 2006-2007 to 2010-2011

8.1 Textiles

CHIARA ZAZZARO

8.1.a Textiles, 2007-2008

Twenty-seven textile fragments were excavated during the 2007-08 field season, mainly in excavation units on top of the slope along the western edge of the fossil coral terrace. 92% of the finds come from units WG 55 and WG 56, mainly from WG 55, SU4. Only two fragments come from WG 32 and WG 52.

A tentative identification of the plant fiber species has been done by observation of the general appearance of the material. All textiles seem to be made of flax/linen. The woven textiles have a loose weave with an equal number of single threads (S-spun) in both warp and weft directions. They were made by passing alternatively one weft over and under alternating warp threads,[1] as is common in pharaonic period textiles and in others textile fragments previously found at the site (Bard and Fattovich 2007: 189-190). Very few textile fragments were made alternating two wefts over and under one warp, or alternating two wefts over and under two warps.

Only one fragment from WG 52 (n. 1) shows a seam along the middle part of the textile, which is possibly a repair (Figure 160).

A strip of painted linen (ca. 20 cm × 4 cm) with a red mark and hieratic script was found in WG 55/WG 56, close to the "alcove shrine." It has been studied by Elsayed Mahfouz (see 9.3 Papyri and inscribed fabric).

No.	Context	Description	Estim. surface
1	WG 52 slope surface	One woven textile fragment (S-spun) equal number of weft and warp threads with seam	200 cm^2
2	Not assigned number	-	

[1] For the terms employed in the description of textile technology, see Jones 2002: 339.

3	WG Cave 7 surface	Three woven textile fragments (S-spun) equal number of weft and warp threads	36 cm^2
4	WG 55 E3 SU4	Twelve woven textile fragments (S-spun) equal number of weft and warp threads	50 cm^2
5	WG 55 E3 SU4	One woven textile fragment (S-spun) number of warp threads greater than the weft ones	90 cm^2
6	WG 55 E2 SU4	Two whole long fragments	20 cm^2
7	WG 56 A3 SU8	One woven textile fragment (S-spun) equal number of weft and warp threads	4 cm^2
8	WG 55 C2 SU2	Two woven textile fragments (S-spun) equal number of weft and warp threads	48 cm^2
9	WG 56 E2 SU5	Two woven textile fragments (S-spun) equal number of weft and warp threads	30 cm^2
10	WG 55 E3 SU5	One woven textile fragment (S-spun) equal number of weft and warp threads	32 cm^2
11	WG 56 D3 infill top sand	One woven textile fragment (S-spun) equal number of weft and warp threads	2.2 cm^2
12	WG 55 C1 SU11	Three woven textile fragments (S-spun) equal number of weft and warp threads	18 cm^2
13	WG 55 CDE1-2-3 SU2	Eight fragments	120 cm^2
14	WG 55 CDE1-2-3 SU2	One fragment	16 cm^2
15	WG 55 D3 SU3	One fragment	14 cm^2
16	WG 55 E2 SU6	Three long fragments	80 cm^2
17	WG 55 C1 SU8	One fragment	4 cm^2
18	WG 56 E3 SU4	One fragment	40 cm^2
20	WG 55 E3 SU4	One fragment	3 cm^2
21	WG 32 B3 disturbed context	One fragment	60 cm^2
22	WG 55 CD1-2-3 SU1	One fragment	6 cm^2

23	WG 55 C1 SU8	Three fragments	48 cm^2
24	WG 55 CDE1-2-3 SU2	Four fragments	80 cm2
25	WG 55 D1-2 SU2	Round assemblage of rope	6 cm in diameter
26	WG 55 D1-2 SU3	One fragment	90 cm^2
27	WG 55 D1-2 SU2	One fragment	40 cm^2
28	WG 55 D1-2 SU2	One fragment	100 cm^2

Table 19. *Catalog of textile finds, 2007-2008.*

8.2 Cordage

CHIARA ZAZZARO

8.2.a Cordage, 2007-2008

Forty-five lots of rope fragments were inventoried in 2007-2008. Cordage was found in the area of the western slope, in trenches WG 33, WG 52, WG 32, WG 54, WG 55 and WG 56. Analyzed fragments were classified and described using the same system already adopted for samples found at Mersa/Wadi Gawasis (see Bard and Fattovich 2007: 192). Most of the rope fragments found during this field season have an average diameter of 3-7 mm with two strands zS plied (see Bard and Fattovich 2007: 190-194). 90.3% was found in WG 55-WG 56 and the rest comes from the other trenches.

Among these were a rope fragment knotted in a reef knot, found in WG 53; 9 simple knots and 2 reef knots found in WG 55; one ending knot found in WG 56; and 2 simple knots and one ending knot found in WG 56.

All ropes found during this field season were from WG 56. The ropes had diameters ranging from 8 mm to 30 mm, with three strands sZ plied (see Bard and Fattovich 2007: 192).

String fragments with diameters of 2-5 mm, composed of two strands sS plied, (see Bard and Fattovich 2007: 192) were also recorded, mainly in WG 55 and WG 56 (90.4%) and in WG 52 (9.5%).

Noteworthy are 2 small coils of string found on the surface at the entrance to Cave 7 and 4 more found in WG 54 and WG 55. These small coils suggest that string still in good condition was stored to be reused.

8.2.b Cordage, 2010-2011: WG 71

The cordage assemblage from WG 71 included 24 fragments of different types ranging from 5 to 24 cm in length. The cordage varied in dimension and composition: the two-strand line type was composed of Z-spun yarns and S-twisted strands; the three-strand line was composed of S-spun yarns and Z-twisted strands. According to Ksenija Borojevic and Rebecca Mountain, the material used for making the rope found at the site is papyrus. The WG 71 cordage assemblage consisted of the following:

1 fragment of a two-strand line, zS2 composition, 2 cm in diameter.
1 fragments of a two-strand line, zS2 composition, 1.3 cm in diameter.
4 fragments of a two-strand line, zS2 composition, 1.1-0.6 cm in diameter.
1 fragment of a two-strand line, zS2 composition, 0.6 cm in diameter.
1 fragment of a two-strand line, zS2 composition, 0.5 cm in diameter with a knot at one end.
1 fragment of a two-strand line, zS2 composition, 0.5 cm in diameter.
2 fragments of a two-strand line, zS2 composition, 0.2 cm in diameter.
4 fragments of a two-strand line, sZ3 composition, 1.5 cm in diameter.
1 fragment of a three-strand line, sZ3 composition, 3.3 cm in diameter, tied at one end.
1 fragment of a three-strand line, sZ3 composition, 3 cm in diameter.
3 fragments of three-strand line, sZ3 composition, 1.1 cm in diameter.

8.3 Copper alloy artifacts

8.3.a Copper-based artifacts, 2006-2007

S. Terry Childs

The majority of the copper-based fragments found during the 2006-2007 field season was small (less than one centimeter in diameter) and heavily corroded. They were unrecognizable as to shape and function. There also were fewer copper-based pieces found this field season than in the previous one. Less than ten were large and intact enough to measure, describe, and speculate about function, given their context.

Similar to the fragments found in 2005-2006, the majority of the sizeable, copper-based pieces were flat straps or bands with standardized widths of either 1.5 or 2.0 cm. Several band fragments from this field season were also 1.0 or 2.5 cm in width, which suggests that there were a number of standardized widths of the bands.

Most typically, the bands were bent and flattened at one end or bent in the middle during use. Several were cut at the ends. Several others were bent, folded over, and twisted in various places as though they were crumpled during removal, possibly from planks as they were repaired after a voyage.

The most interesting artifact this field season was found in the surface level of Cave 3, WG 39. It was an approximately 10 cm. long band, 20 mm. wide, that was folded over on itself three times and flattened so the entire thickness was approximately 6 mm. This carefully folded artifact strongly suggests that it was a portion of an original "reel" of copper banding that was probably brought to Mersa/Wadi Gawasis for purposes of ship building or repair.

The only other copper-based artifacts found that were not bands or flat, nondescript pieces were short rods or pins from WG 32. One was a rod or pin that was pointed at one end and either cut or broken at the other end. Excavated in SU31 of square B5, it was 3 mm. in diameter and approximately 5.5 cm. long. Nearby, but in SU10 of square A5, was a 9 cm. long rod, approximately 3 mm. in diameter, with no visible point at either end.

8.3.b Copper-based artifacts, 2007-2008

CHIARA ZAZZARO

Thirty-one copper pieces were found during the 2007-2008 field season: they were usually flat and fragmentary. Condition of the copper was very corroded and the original dimensions of the pieces had been altered due to the oxidization of the copper.

Twenty-one fragmentary pieces coming from different contexts (WG 32, WG 49, WG 51, WG 53, WG 54, WG 55 and WG 56) were identified as copper strips or bands. The lengths of these strips varied from

1.3 cm to 4.6 cm; they had probably been broken and were too small to be reused. The strips were ca. 1.5-2.0 cm in width and less then 2 mm in thickness, the standardized dimensions for strip fragments already found at the site during previous field seasons, as recorded by S. Terry Childs (Bard and Fattovich 2007: 196). This width is in fact comparable to the remains of copper strips in the fastening of plank T75 that had been dismantled and reworked (see 5.1.b Ship timbers and nautical artifacts, 2007-2008). Ten strips were found bent, possibly from when they were discarded.

The function of the copper strips was probably related to ship fastenings (Bard and Fattovich 2007: 196). They had probably been removed and discarded after expeditions when the ships were disassembled. All recorded strips were found loose in the sand; 35% of the strips were found in WG 55 and were associated with a large concentration of wood debris.

Among copper finds, a knife or saw blade, 8.7 cm × 2.05 cm and 0.25 cm in thickness, with a rounded tip and broken end, was found in WG 32, A5, SU25. It is similar to samples in the Petrie Museum of Egyptian Archaeology, London (UC63104 and UC63497) (Figure 161). A copper rod, 2.2 cm in length and 0.2 cm in diameter was also found in WG 32. A thin pointed rod or pin, ca. 9 cm long and 25 mm in diameter, was found in WG 55, E3, SU4.

Noteworthy was a possible piece of copper slag found in the eastern sector of the wadi area, in excavation unit WG 54. According to S. Terry Childs, who examined photographs of this material, it looks like "highly molten and glassy like slag."

A modern iron strip was found on the surface of unit WG 51; it probably came from the construction of the railway in the 1980s.

8.4 Stone tool assemblages

Giulio Lucarini

The lithic assemblage from Mersa/Wadi Gawasis was techno-typologically classified using a Microsoft Access database, following Close's (1980, 1989) and Lucarini's (2014) descriptive criteria and classification for the Holocene lithic assemblages from the Eastern Sahara, with adaptations as justified by the context under scrutiny.

8.4.a Stone assemblage, 2006-2007

The whole stone assemblage collected at Mersa/Wadi Gawasis, during the 2006-2007 field season, included 1017 knapped lithic artifacts, all manufactured in chert, 16 macro-lithic tools (saddle querns, upper grinders, rubbers and large stones of undetermined function), and 13 quartz fragments.

The 1017 knapped artifacts include cores (25: 2.5%), debitage elements (983: 96.6%) and retouched tools (10: 0.9%).

The artifacts were collected in the excavation units WG 19, WG 24, WG 25, WG 26, WG 38, WG 32, WG 33, WG 39, WG 40, WG 42 and WG 44. Only two pieces were collected on the surface.

The majority of the stone implements were from the activity area in WG 19/25/26/44 at the base of the western terrace slope. Very high concentrations of lithic artifacts, in particular, were recorded in WG 26 (543 lithics and 8 macro-lithic tools) and WG 44 (380 lithics and 2 macro-lithic tools).

The other areas of the site yielded a lower amount of artifacts. Four lithic artifacts and 2 undetermined macro-lithic tools were found in WG 32 and WG 33, in front of the entrances to the caves. An upper grinding stone was found inside the Cave 2 (WG 24).

Finally, 34 lithic artifacts and 1 lower grinding stone were collected in the trenches at the base of southern slope (WG 38/42, WG 39, WG 40).

The lithic assemblages were analyzed according to three main categories: cores, debitage elements, and retouched tools. Considering the very low number of artifacts from these last two areas, the frequency of cores, debitage elements and retouched tools was analyzed only on the artifacts from WG 19/26/44.

The raw material color was classified with *Munsell Soil Color Charts* (1990 Edition Revised).

Main techno-typological traits of the lithic assemblage, 2006-2007

<u>Raw material</u>:

Chert was the only raw material used in manufacturing the lithic artifacts, which were recorded in the 2006-2007 field season. The few quartz fragments did not seem to have been intentionally knapped.

The chert is generally characterized by a fine texture and high homogeneity, even if pieces with several inclusions occur as well.

From the morphology and size of the implements it is likely that medium- and large-size chert pebbles, available along the bed of the wadi, were mainly exploited.

Almost all the artifacts are well preserved, even if some of them are fragmented. A few pieces with a reddish (5YR 5/2) or dark reddish (5YR 4/2) color are burned.

Cores

The 25 cores represent 2.5% of the Mersa/Wadi Gawasis lithic assemblage, ranging from a lowest frequency in WG 44 (1.8%) to higher frequencies in WG 19 (4.3%) and WG 26 (2.6%).

Cores are usually small, sometimes microlithic, and usually show a high or medium degree of exploitation. The multiple platform type is the most frequent (11 cores: 44%), followed by the single platform type (8 items: 32%) (Figure 162 A) and ninety-degree platform cores (5 items: 20%). Finally, an opposed platform core was found in WG 26.

The striking platforms often do not show any trace of preparation. Only a microlithic, single platform core from WG 44, shows tiny edge strengthening removals on its striking platform. The negatives of removals on flaking surfaces provide clear evidence of an almost exclusive production of flakes.

Debitage

Debitage elements (983 artifacts: 96.6%), are the most represented category in all excavation units of the site, ranging from 96.7% in WG 26 to 97.1% in WG 44. In these two trenches, the high frequency of debitage elements may be partially related to the high number of chips (flakes smaller than 15 mm) and chunks (unclassifiable but intentionally knapped elements); respectively 327 and 232 debris (chips and chunks) elements were collected in these two units, respectively (ca. 62% in both trenches).

Flakes are the largest class of debitage elements (296 specimens, with a frequency ranging from 27.1% in WG 44 to 30.9% in WG 26). Flakes are mainly from single platform cores (141 specimens), with a frequency ranging from 40.7% (66 pieces) in WG 26 to 51% (51 pieces) in WG 44. Primary flakes and early stage core working elements are the second well represented class (65 artifacts: 21.9%). Flakes from multiple platform cores are also well represented (57 elements: 19.3%. Flakes from ninety-degree platform cores (20 specimens: 6.8%) and from opposed cores (4: 1.4%) are less frequent. It was not possible to determine the type of the remaining 9 flakes.

The blade index is quite low (22 blades ; 2.2%). The highest number of blades was found in WG 26, where the 10 pieces are 1.9% of the debitage products found in the trench. Nine blades come from WG 44 (2.4%). Almost all specimens are from single platform cores (18 pieces: 81.8%). Two blades from multiple platform cores, one from opposed platform core and one unidentifiable type are present as well.

Core rejuvenation practice is well documented by the presence of 62 core trimming elements (6.3%). They are particularly frequent in WG 26 (26: 4,9%) and WG 44 (28: 7,6%).

<u>Retouched tools</u>

The retouched tool category shows the lowest frequency (10 items: ca. 0.9%) in the whole lithic assemblage. It includes 3 sidescrapers, 3 notches, 2 denticulates, 1 perforator, and 1 piece with a continuous retouch.

Two sidescrapers from WG 26 are manufactured on core-sides, with an inverse, flat retouch (Figure 162 B) and a bifacial, semi-abrupt retouch, respectively, and one from WG 32 on a primary flake with bifacial, flat detachments. All three artifacts show a very smoothed retouched edge, suggesting a long time of use.

The two denticulates from WG 39 and WG 44 were manufactured on a flake and a core-side, respectively. They are characterized by an obverse, slightly invasive, semi-abrupt retouch.

The notch from WG 26 is manufactured on a core-side (Figure 162 C). The other two notches from WG 44 are on flakes. Two notches are of a single-blow type; the third one is retouched.

The piece with a continuous retouch from WG 44 is manufactured on a tertiary flake from a single platform core, and is characterized by a rectilinear, marginal, flat retouch.

A perforator/sidescraper on a secondary flake from a single platform core was also found in the upper deposit of WG 26 (Figure 162 D). This piece shows an inverse, denticulated, slightly invasive, retouch along the whole perimeter. It shows a perforator with bifacial retouch on the distal end. Similar multifunctional retouched tools were already found during the previous field seasons; in particular, several perforator/sidescrapers come from the western slope of the terrace.

Discussion

The large amount of lithic artifacts from the western slope of the coral terrace (WG 19/25/26/44) confirmed what already observed during the previous field seasons about the massive exploitation of the chert in the so-called "production area."

The lithic assemblage showed an almost exclusive presence of debitage elements, in which flakes are the most represented class. Blades, on the contrary, occur in a lower quantity. The fairly high occurrence of core trimming elements, together with the large amount of working debris, provide a clear indication of a prolonged exploitation practice of the cores, pointing to local manufacturing activities. This seems to be also confirmed by the presence of several hammerstones found in the WG 26 unit.

The tool kit does not show a particular standardization of the products and, on the whole, the very scanty retouched elements do not allow a clear definition of typological traits of the assemblage. Pieces to be used for scraping seem to be more frequent, representing the majority of the retouched tools. Among them, the presence of some opportunistic tools (such as different kind of simple scrapers and denticulates), could be connected with wood exploitation.

8.4.b Stone assemblage, 2007-2008

The entire stone assemblage collected at Mersa/Wadi Gawasis during the 2007-2008 field season includes 329 lithic artifacts and 8 macrolithic tools (a term including saddle querns, upper grinders, hammerstones, palettes, anvils and other large stones of undetermined function) coming from excavation units WG 32, WG 33, WG 46, WG 47, WG 49, WG 50, WG 51, WG 52, WG 53, WG 54, WG 55, WG 56, WG 57 and WG Niche 15. Only one piece was collected on the surface area of the terrace's slope.

Considering the very low number of implements brought to light in almost all the trenches (from 1 to 17 items), the statistical analysis carried out on the categories of artifacts and on each class of tools was elaborated only on the data coming from the WG 55 excavation unit. This 6 m × 6 m trench, located at the base of the southwestern slope of the coral terrace, at the entrance to Cave 7, yielded the highest number of artifacts (268).

The lithic assemblage was divided into the three major categories of cores, debitage elements and retouched tools. The 329 lithic artifacts found in the trenches excavated during the 2007-2008 field season include cores (10 items, representing 3.1% of the entire lithic techno-complex), debitage elements (314: 95.4%) and retouched tools (5: 1.5%).

Main techno-typological traits of the lithic assemblage

<u>Raw material</u>

With 319 items representing the 94.4% of the total amount of artifacts recorded during the 2007-2008 field season, chert played the main role in manufacturing the lithic artifacts. Chert occurs in small- and medium-size pebbles and nodules, ca. 10-20 cm in diameter and showing a spherical or oval shape and a thick cortex. These pebbles are available, in great abundance, along the bed of Wadi Gawasis.

The chert shows a fine homogeneous structure, which makes it a particularly good knappable kind of raw material. According to the *Munsell Soil Color Charts* (1990 Edition Revised), the most exploited types of chert go from a brown/dark brown quality to a greyish brown one.

Almost all the artifacts are well preserved. Only a few items show a strong white or very pale brown patina, which was already noticed in almost all the artifacts coming from the excavation units located on the eastern slope of the terrace. Moreover, it has to be stressed that 131 artifacts (38.8% of the total), mainly chips, chunks and cores show traces of burning, and this may indicate intentional heat treatment, in order to facilitate the knapping process.

The other materials used in stone tool manufacturing and detected during this field season are quartz (8 items: 2.4%), quartzitic sandstone (4 items: 1.2%), and obsidian; the latter was used for manufacturing 1 unretouched flake (0.2%).

As reported above, the few quartz fragments found during the 2006-2007 season were probably not intentionally knapped. On the contrary, the quartz core found in WG 55 (SU2) is a clear evidence of an intentional, although very limited, use of this raw material.

Although obsidian elements are scanty, geochemical analysis carried out on the obsidian artefacts found by A. Sayed during the first exploration of the site provided important information about the regions were this material was quarried. These were located along the trade routes of the southern Red Sea and, more specifically, around the Eritrean source of Kusrale and the Yemeni outcrops of Dhamar Reda (Lucarini *et al.* 2020).

Green siltite is present in a great abundance all over the site, and occurs in medium- and large-size pebbles or in flat, tabular form. It was used in order to manufacture macro-lithic tools found at the site, such as palettes or anvils.

Cores

Ten cores were found, all coming from WG 55, representing the 3.7% of the lithic assemblage of this unit. Almost all the items come from SU2 and SU3. The single platform type is the most frequent (4 items) (Figures 158 E), followed by the ninety-degree type (3 cores) (Figure 162 F) and multiple platform cores (2 items). Finally, an initially struck element (rough pre-core) was also found in SU3 of the unit. All the cores are of small size and irregular shape. The platform surfaces do not show clear traces of preparation. The negatives of removals on flaking surfaces indicate that 8 items were mainly exploited for the production of flakes, while the remaining 2 were for blade manufacturing. A high or medium exploitation of cores seems to have been more frequent.

Debitage

As in the units excavated during the 2006-2007 field season, the debitage category (314 total artifacts) shows the highest percentage (95.4%) of the entire lithic assemblage, with an almost equal ratio (95.5%) specific to WG 55, where the debitage elements are 256 of the total 268 artifacts collected.

The debitage category is mainly made up of knapping discard products, named as chips and chunks. The whole site yielded a total of 190 debris products (60.5% of the debitage category). WG 55, with its 160 chips and chunks, shows a similar ratio (62.5%).

Flakes are the second class of debitage represented. A total of 101 items has been recorded, with a general frequency of 32.2%. In WG 55, where 78 flakes have been found, the specific ratio comes down to 30.4%. Flakes are mainly from single platform cores (49 total specimens, with a general frequency of 48.5% of the total flakes detected), and 37 flakes from single platform cores come from WG 55 (47.5%). Primary flakes are the second well represented class (23 in total, 21 of which from WG 55). The general ratio is 22.8% of the total of the flakes detected, and 26.9% in WG 55. Flakes from multiple platform cores are also quite well represented (19 total elements: 18.8%). Flakes from ninety-degree platform cores (4 specimens: 3.9%) and from opposed platform cores (3: 3%) are much less frequent. It was not possible to determine the type of the remaining 3 flakes.

The blade index is quite low, both in the whole site (18 blades representing 5.7% of the debitage category) and in WG 55 (14: 5.5%). Almost all specimens are from single platform cores (10 total pieces: 55.6% of the blades). Five primary blades (27.8%) and 3 blades from opposed platform cores (16.6%) follow. Among the blades, the presence of a very standardized, elongated type, always from single or opposed platform cores, in WG 32 and WG 54 has to be highlighted (Figures 158 G-H). These blades, already found during previous field seasons in excavation units WG 16 and WG 27, seem to have been produced using a pressure technique. Similar blades were also found at Old Kingdom sites on Elephantine Island (Hikade 2002) and Dakhla Oasis (Kobusiewicz 2007). In both contexts these artifacts have been considered as semi-finished or complete products for laminar sickle elements.

Core rejuvenation practice is not well represented. During the field season only 5 core trimming elements have been found (1.6% of the debitage category). They are all core-sides and 4 of them come from WG 55.

<u>Retouched tools</u>

The 5 retouched tools brought to light represent only 1.5% of the total lithic assemblage collected at Mersa/Wadi Gawasis in 2007-2008. They include 2 denticulates, 1 notch, 1 perforator and 1 sidescraper/notch multipurpose tool.

The two denticulates come from WG 55. The first one (Figure 162 I), coming from WG 55, SU3, is manufactured on a large primary flake showing an obverse, right, invasive, semi-abrupt retouch. The second one (Figure 162 J), found in WG 55, SU8, is a bit smaller than the previous one and is manufactured on a naturally fractured pebble. The tool shows four detachments caused by strokes all blown from the same direction, that give the artefact the typical denticulate pattern on one of its ends. The detachments are slightly invasive and semi-abrupt.

The notch and the perforator come from WG 33; the first one is from the general surface of the excavation unit, while the second one is from SU4. The notch is manufactured on a tertiary flake from a ninety-degree platform core, which is fractured on the proximal end. It shows an obverse, left, single-blow, slightly invasive and semi-abrupt notch. The perforator is manufactured on a tertiary blade from an opposed platform core, and it is fractured on the proximal end (Figure 162 K). The distal end of the blade, which is pointed, has two obverse, right, invasive, semi-abrupt, lamellar parallel detachments, which could be interpreted as the result of the first stage of preparation of a perforator.

The last multipurpose, sidescraper/notch, tool (Figure 162 L) comes from the SU1-SU2 interface of WG 57. The tool is manufactured on a tertiary flake from multiple platform core. It shows an obverse, convex, continuous all over distal end, non-invasive, semi-abrupt retouch. On the right side, an obverse, single-blow notch is present as well.

Macro-lithic tools

The 8 macro-lithic tools discovered include: 1 palette coming from WG 46; 1 hammerstone from WG 50; 2 upper grinders and 1 large lower grinding stone/anvil from WG 51; 1 palette, 1 mortar and 1 multipurpose tool whose exact function is not fully clear, coming from WG 52. All these excavation units, where the large stone tools were found, face the southern slope of the fossil coral terrace. The palettes, mortar, grinding stone/anvil and the multipurpose tool are manufactured in green siltite. Green siltite natural pebbles, often characterized by a regular shape, were available in great abundance on the top of the terrace and could be easily exploited for manufacturing large tools.

The multipurpose tool from WG 52 (Figure 163 A) shows a parallelepipedal shape. On one of the 4 main surfaces, it shows a U-section hole (22 mm diameter × 11 mm deep) with concentric striations likely resulting from drilling activities. On the same surface, the tool shows a very smoothed and slightly concave area, expanding from the central hole up to one of the tool's ends, which corresponds to another similar, very smoothed and slightly concave area on the opposite surface of the tool. The remaining 2 main surfaces also slow lighter traces of smoothing, while the last two small surfaces at the ends show traces of pecking/battering. It is likely that the tool was used as a pestle and that the smoothing present on its 4 main surfaces may be the result of a prolonged contact with the hand palm/fingers. The abovementioned hole also points to a secondary use of the tool as a small anvil for drilling activities.

The mortar from WG 52 (Figure 163 B), shows a circular shape and small dimensions; it may have been used for non-dietary purposes, and processing non-organic material.

The hammerstone from WG 50 (Figure 163 C) is manufactured in chert, and shows a sub-spherical shape and medium dimensions. The tool shows large and small detachments all over most of its perimeter, resulting from knapping activities.

The two upper grinders from WG 51 (Figure 163 D), both manufactured in quartzitic sandstone, are of medium size and may have been used for cereal processing. The presence of such an activity is also attested by the saddle querns found in previous seasons (Bard and Fattovich 2007: 200) and by the abundant *Triticum dicoccum* and *Hordeum vulgare* remains found in the site.

The large lower grinding stone/anvil from WG 51 (Figure 164), parallelepipedal in shape, shows all the 6 surfaces heavily smoothed and the edges roughly chipped to regularize its shape. The main working surface shows a slight concavity pointing to a prolonged grinding activity. The tool's 4 main surfaces are marked by speckles and micro-fractures resulting from pecking/beating activities by an active stone tool.

Discussion

Analysis of the 2007-2008 lithic assemblage, almost entirely coming from the WG 55 excavation unit, showed a very high percentage of debitage elements in which waste products resulting from knapping activities are the most represented class. This datum, together with the finding of 10 cores, often highly exploited, and the presence of several, even if not numerous, primary flakes and blades, indicate that the WG 55 area could have been devoted to the manufacturing of stone artifacts. The finding of 4 core trimming sides, evidence of a prolonged exploitation practice of the cores, seems to support this hypothesis, although a complete lack of hammerstones has to be stressed as well. As a matter of fact, the only hammerstone found during this field season comes from WG 50, located on the adjacent slope of the terrace.

The retouched tool category, very poor in quantity, does not show a particular standardization of the products. Pieces to be used for scraping activities (denticulates, notches, sidescrapers) represent the majority of the retouched tools; this confirms what already observed during the previous field seasons.

Considering the characteristics of the cores, debitage elements and retouched tools from the 2007-2008 field season, we can confirm the opportunistic traits of the lithic assemblages coming from the WG 55 excavation unit. The high presence of a large quantity of wood debris especially in the SU2 and SU3 of this unit, where the highest amount of the stone artifacts also come from, point to a possible use of these opportunistic items on the ship timbers that needed to be scraped and cleaned from shells which attached to them. Barnacle shells with wood impressions were also found in this unit (Carannante, 2014: 129).

On the other hand, the rare more standardized cores, debitage elements, as well as some of the very well manufactured and bifacially retouched tools found during previous field seasons, are a clear indication that more curated tools were also manufactured by the groups settled in the area. These items, such as the long blades and bifacial tools, could have been devoted to other and more specific activities, such as the exploitation/harvesting of plants, which were carried out in the harbor area.

8.5 Archaeozoology/malacology

8.5.a Archaeomalacology, 2006-2007

ALFREDO CARRANANTE AND CARLA PEPE

Shells of molluscs and other marine invertebrates recovered in archaeological sites supply a double sequence of information. Shell taphonomy may suggest their uses and their role in ancient economies and cultures, while the ecology of the species may supply paleoecological information about the evolution of the local environment, climate and landscape. Molluscs represent, in fact, important climatic and ecological guides more than mammals, birds and fish, for the high degree of sensibility to the conditions that characterize them.

During the 2006-2007 field season archaeomalacological analyses were carried on three lines of research:

1) Study of the big shell midden found on the coast immediately to the north of Wadi Gawasis.
2) Palaeoecological and taphonomical analysis of the shell samples collected from the strata in the geoarchaeological test trenches in the WadiGawasis.
3) Study of the shells found in the inner wadi archeological areas.

Shells middens on the coast

The first line of research line focused on the many big shell remains associated with an ancient oval structure (Feature 1) built along the coast line overlooking the Red Sea. The shells (1132 *Lambis lambis* fragments, 610 MNI; 9 *Tridacna gigas* and 5 *Conus* sp.) were collected from the top of the platform of Feature 1, which has been interpreted as a votive shrine.

40.6% of the *Lambis* shell fragments have bioerosional marks and biological incrustations on the internal side. This demonstrates that many of these shells were collected when the animal was already dead, excluding the alimentary use of these molluscs.

The *Lambis* shell remains show consistent fragmentation patterns, which at first were interpreted as the result of anthropic working of the shell. There are shells lacking a sector on the last whorl, isolated sectors of the last whorl, isolated labial sides adorned with the typical digitations of the species, and shells lacking the whole last whorl. However, even though these patterns are consistent in shapes and dimensions, they are usual in the same shells found dead on the beach and in the fossil ones present in the wadi area.

Thus, it is possible to state that the fragmentation patterns found in the Mersa Gawasis shells from Feature 1 are due to the normal erosional processes on the weak points of the *Lambis* shells and an ancient anthropic working of the shells there can be excluded.

Fresh *Lambis* and *Tridacna* shells are scarce now in the sea of Mersa Gawasis and rare on the beaches there. On the contrary, these shells are abundant in the inner areas of the wadi and in the coves that reach the sea cutting across the coastal fossil coral reef. The abundance of these subfossil shells (even 6 for 100 m^2) in these areas is connected to the differential erosion between shells and fossil corals.This suggests that most of the *Lambis* and *Tridacna* shells were collected in the coves of the fossil coral reef near where the shrine was built.

One hypothesis for the number of shells associated with Feature 1 is that they were included in the walls that surrounded the shrine. This is supported by ethnographic data of shelters built by Red Sea fishermen who use *Lambis* shells as thermal insulation in the walls.

A second and more interesting hypothesis is that the *Lambis* shells were collected at the shrine by ancient Egyptian mariners in a ritual that was perhaps connected to the cult for some deity.

Palaeoecological and taphonomical analyses

The second line of research line conducted in 2006-2007 focused on palaeoecological and taphonomical analyses of shell samples collected from the strata in the Wadi Gawasis.

Several geoarchaeological test trenches were excavated in the Wadi Gawasis during the 2006-2007 field season in order to reconstruct the evolution of the ancient shoreline. Shell samples were collected by the geologists from the strata that revealed rich taphocoenosis.

First analyses were focused on the shells from the samples. Taxonomical identification, fauna biodiversity, degree of fragmentation, degree of water-wearing, degree of bioerosion, and ecology of the species were analyzed for each sample.

Secondly, taphocoenosiswas studied in place in the test trenches, in order to identify the taphonomical processes that produced them.

The results of these analyses are still in progress, but it was possible to identify one of the past shorelines, some beach berms, and a buried patch reef in proximity of the Wadi Gawasis excavation areas. Palaeoecological and taphonomical data allowed us to define the beach profile in excavation units WG18 and WG36.

Archaeomalacological analyses in the western sector of the site

The third line of research line, archaeomalacological analysis of the molluscs and other marine invertebrate shells found in the main excavation areas of the site, continued during the 2006-2007 field season and three categories of shell remains were identified.

The first category is represented by hundreds of organism shells found in proximity of the Wadi Gawasis caves. They consist of small barnacles and *Anomiidae* and *Ostreidae* shells highly fragmented whose bottom side presents evident marks of a wooden substrate. One of the barnacles still has wood fragments attached to it. These shells add to the small barnacles found last year, one of which was found on a small copper alloy band. They represent the community of organisms that populated the submerged part of ship hulls and their presence in the cave area is explainable by the practice of plank cleaning/salvaging. These finds are evidence of the Egyptian ships in sea water. Furthermore,the barnacles on the metallic band testify to the use of copper alloy elements in the ships.

The second category of archaeomalacological remains consists of shells of many different species (at least 57), some of which were perhaps utilized as food (although most of them were not). Bioeroded shells, water-worn shells, and subfossil shells produced by erosion of the fossil coral reef, are, in fact, highly represented.

Many of the gastropods among these shells (particularly *Polinices mammilla* specimens) are still filled with the remains of hermit crabs, generally of the genus *Coenobita*, the so-called "land hermit crabs." The nocturnal habits of these crustaceans, to look for food farther up the inner part of a beach, may explain the find of hundreds of water-worn shells in the site area and in the caves, and also in a large, well preserved jar filled with shells and hermit crabs that was found in 2005-2006.

The third category of archaeomalacological remains is represented by shells that have been drilled or worked. Many shells, particularly *Nerita* sp. and *Polinices* sp. specimens, have evidence of a hole, which is sometimes natural (created by erosion or predation), and sometimes anthropic (made by percussion, abrasion, sawing or drilling). Most of the shells with naturally created holes were certainly introduced in the area by the land hermit crabs, but the ones with holes created by humans are important for other cultural considerations.

The ornamental use of shells at the site is not restricted to the examples with holes, but it is also seen in beads made from massive shells used as raw materials.

Two very small discoid beads made by drilling and sawing, probably from a *Tridacna* shell, were found in 2005-2006. This field season other shell beads have been found: three cylindrical elements made by sawing the top of *Conus* sp. Shells, which is a typical type of Bronze Age ornament, defined "Conus Whorl Bead" by archaeomalacologists.

8.5.b Archaeomalacology, 2007-2008

ALFREDO CARRANANTE

Data collection

In 2007-2008 archaeozoological remains from the excavated areas were taxonomically identified andcatalogued in a database. Data were recorded with information about the archaeological context (excavation unit, square, stratigraphic unit), anatomical identification, presence of marine erosion or bioerosion marks, presence of natural or anthropogenic holes, and information about the sediments context.

The database at present includes information about 3,226 archaeozoological remains: molluscs, crustaceans, and barnacle shells, and also fish and marine reptilebones.Concentrations of large shell remains (mainly *Lambis*) found on the coast of Mersa Gawasis have been studied in addition to studies of the archaeozoological remains from the excavated units during this field season. Large shell remains were recounted,their state of preservation was studied together with bioerosion marks, and their taphonomy was recorded.

Ethnographic information was also collected in interviews with Red Seafishermen and local people in order to verify the present use of *Lambis* sp. molluscs and shells, and the recent distribution of this species.

Preliminary results

<u>WG 32</u>: This excavation unit is in front of Caves 2, 5, and 6, on the top of the sandy terrace slope. A few shells, mainly *Anomiidae* (25 MNI), were found, most of which had woodimpressions on the bottom side. These shells had been scraped away from well planed wood surfaces, probably ship timbers. A few *Nerita* shells (with naturally made holes) were alsofound.

<u>WG 55</u>: This area is contiguous to WG 32 and in front of Cave 7. Several gastropod shells withholes were found there. Most of them had been pierced by predators, but a *Conus* shellwith a drilled hole and a cowrie shell with a percussion hole were also found.

A few *Anomiidae* and barnacle shells with wood impressions were excavated. Also found were several valves of different *Veneridae* species, some gastropods, and two *Sparidae* fish vertebra without erosion marks, which may be the remains of food.

Twenty large fragments of the flat bones of a sea turtle were found at the entranceof Cave 7. The fragments were restored by Pasquale Musella into four parts of a turtle shell from an *Eretmochelys imbricata* specimen: two shields of the lower plastron, a marginal plate, and a costal shield with two ribs from the carapace. The xiphiplastron and hypoplastron show corneous tortoise remains on the external side, while the external side of the dorsal costal shield shows a reddish coloration due to fire exposure. No other turtle bones or tortoise shell fragments have been found in the excavations. Such evidence points to exploitation of the corneous tortoise shell, which was generally obtained by exposingthe carapace to heat.

Five mother-of-pearl spoons made from the nacreous valves of large specimens of *Unioniacea* freshwater species have also been excavated. The spoons, of different sizes, were shaped using a saw and then were ground down to obtain smooth edges. Other fragments of mother-of-pearl suggest that more nacreous spoons had also been made.

Another broken shell spoon, made from the last whorl of a large *Charonia tritonis* shell whose columellar callus is still visible, was also excavated.

<u>WG 45, WG 46, WG 47, WG 49, WG 50, WG 54, WG 57</u>: These excavation units lie in what is believed to be the beach of the "harbor area." Several hearths and many potsherds from at least two occupation phases were excavated there. Many specimens of edible gastropods, several *Circe crocea* valves (MNI 25), many fish bones (mainly parrotfish and sea-bream), and several stingray remains were found in these strata, usually associated with layers of charcoal and ash. They probably represent food remains.

Percussion marks were found on a *Lambis* shell fragment associated with an ash layer, evidence of alimentary use of this species. A few shells have anthropogenic holes (two *Conus* and a *Polinices*).

The most peculiar find was a large valve of a *Tridacna* shell with clear traces offire exposure. Only the internal side of the valve is reddened at the bottom and blackened on the edge. This evidence suggests that the large shell was used as a lamp.

<u>*Lambis* shell middens on the coast</u>: Study of the large shell concentrations on top of the fossil coral terrace which borders the coastline was conducted to explain their use. More than 1,050 *Lambis* shell fragments were found, with a minimum number of individuals (MNI) of at least 703 specimens,which were associated with several *Tridacna* shells. Most of the *Lambis* shells show consistent patterns of fragmentation and only a few are complete. A large part of the assemblage was amassed in a structure made of large blocks of fossil coral. *Lambis* shells were also concentrated in other structures built with large slabs of conglomerate stonecovered by coral blocks.

Different uses have been suggested in order to explain the large shell concentrations:

1) Alimentary use: study of the bioerosion marks revealed that more than the 72% of the *Lambis* shells were collected after the death of the mollusc. Only 17 MNI appear not to be eroded and with a different pattern of fragmentation; they are the only *Lambis* shells that might have been collected alive for food.
2) Use as a raw material: no working marks are present on the Mersa Gawasis remains. *Lambis* shell bangles obtained from the spire or from the last whorl were used in the ancient Egypt and the Near East, but none of these parts of the Mersa Gawasis *Lambis* shells appears to have been worked. Seventy cap portions of the last whorl have been found in the *Lambis* shell concentrations. This evidence excludes the use of this part of the shell to producespoons similar to those found at the site. A survey along the coast and interviews with local people revealed that the constant pattern of fragmentation that characterizes the *Lambis* shell remains from the archaeological site is different from that produced by percussion. The pattern of fragmentation of the archaeological *Lambis* shell remains is typical of *Lambis* shells eroded by waves. Dozens of similar *Lambis* shell fragments can now be collected on the beaches a few kilometers from Mersa Gawasis.
3) se as a building material: along the Red Sea coast fishermen's huts are found which utilize *Lambis* shells as a building material instead of mud-bricks. The Mersa Gawasis *Lambis* shells, however, were found in different contexts: below the coral blocks of the shrine structures, on the top of the structures, and around them. Many of the shells were also found between the coral blocks. Thus, the shells were deposited during the construction of these structures.

Figure 160. *Woven textile fragment with warp threads with seam (a possible repair) from WG 52, surface collection.*

Figure 161. *Fragment of a knife or saw blade from WG 32, A5, SU25.*

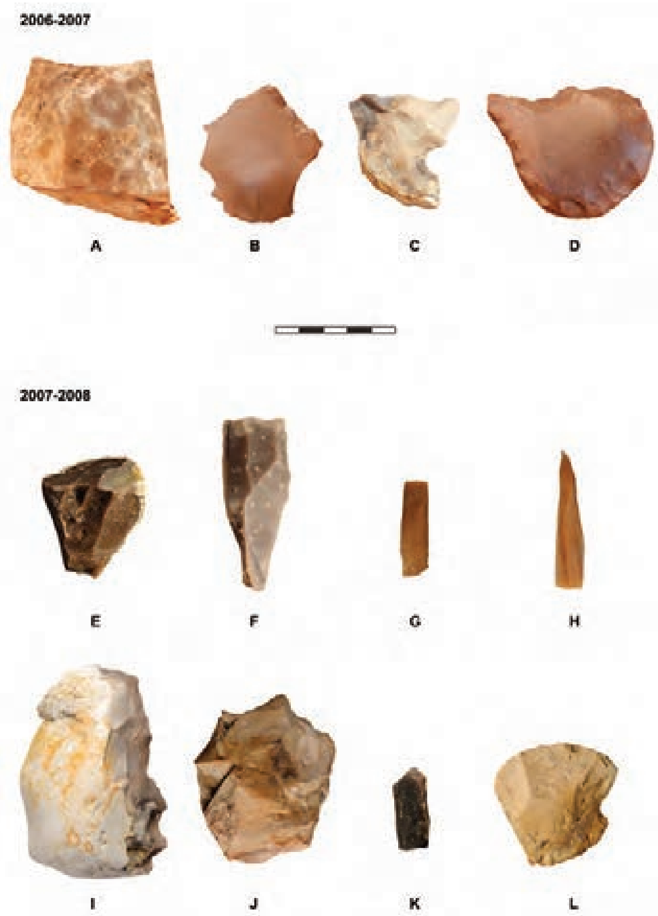


Figure 162: *Lithic artefacts found during the 2006-2007 and 2007-2008 field seasons A) single platform core from WG 26, C4-D4, SU95, B) sidescraper from WG 26, C4-D3, Surface, C) notch from WG 26, C4-D4, SU104, D) perforator/sidescraper from WG 26, C4-D4, SU1, E) single platform core from WG 55, D1-2, SU3, F) Ninety-degree core from WG 55, D1-2, SU2, G) blade from single platform core from WG 54, A2, B2, B3, SU1, H) pointed blade from opposed platform core from WG 32, A5, SU25, I) denticulate from WG 55, D1-2, SU3; J) denticulate from WG 55, C1, SU8, K) perforator from WG 33, SU4, L) sidescraper from WG 57, A5, SU1/2 interface.*

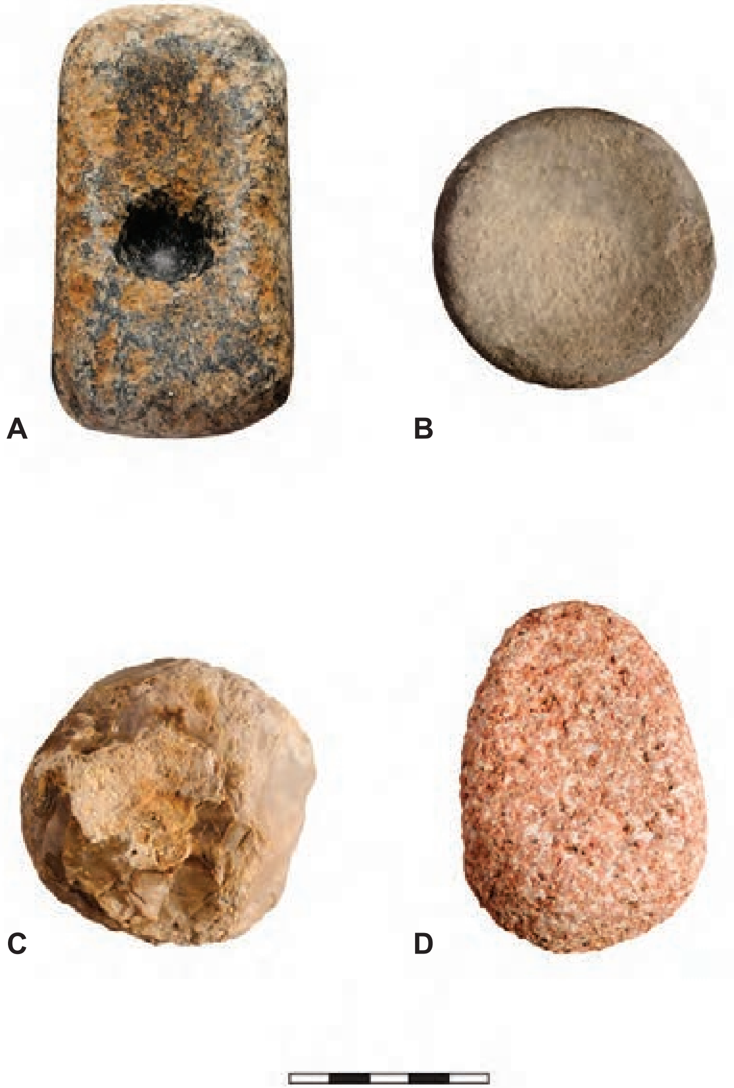


Figure 163. *Macro-lithic tools found during the 2007-2008 field season A) multipurpose tool from WG52, SU1, B) mortar from WG 52, SU1, C) hammerstone from WG 50, Surface, D) Upper grinder from WG 51, SU1.*

Figure 164. *Lower grinding stone/anvil from WG 51, SU1.*

Chapter 9
Textual Evidence and Sealings

In the field seasons 2006–2007 to 2010-2011 three more inscribed wooden boxes (Boxes 21, 40, 41), fifteen stelae (Stelae 14-29), three ostraca (Ostraca 5, 6, 7), 129 sealings bearing complete or fragmentary impressions of seals, and a complete seal were excavated at Mersa/Wadi Gawasis.[1]

9.1 Stelae

ELSAYED MAHFOUZ AND ROSANNA PIRELLI[2]

WG Stela 14 (Figures 165, 166): A medium-sized rectangular stela of limestone, measuring 31.5 cm × 23 cm × 7.5 cm, was found in WG 32, SU1. The rectangular shape with a cavetto cornice at the top is in the style of early Middle Kingdom stelae. The inscribed surface is greatly damaged and most of the inscription, mainly in the lower part on the left, is lost. The relief is divided into an official scene in the upper part and a private scene in the lower part. In the upper part, the god Min is represented facing the royal names of Senusret III (ca. 1870-1831 B.C.). The lower part consists of a text of at least seven columns and concerns two standing officials facing each other. This stela provides new evidence of the expedition of Senusret III to Punt in Year 5, which was also recorded on a hieratic ostracon discovered at Mersa/Wadi Gawasis by Abdel Moneim Sayed in 1977 (Mahfouz 2010: 432). This is the first official stela of this king found at the site (Mahfouz 2015: 269-76) .

WG Stela 15 (Figure 167): This is a small round-topped limestone stela, measuring 25 cm × 16 cm × 4.5 cm, without any inscriptions, from WG 32, A5, SU10. This stela suggests that some expedition members carried blank stelae with them in order to have the stelae inscribed after their safe return to the harbour from the sea voyage.

[1] Preliminary remarks on some of these materials were proposed in several articles such as E. Mahfouz 2008a, 2008b, 2010a, 2010b, 2011, 2012, 2015.
[2] Stelae 14-15 and 30-32 were studied by E. Mahfouz and R. Pirelli, Stelae 16 -29 were studied by E. Mahfouz.

WG Stela 16 (Figures 168, 169): A small round-topped limestone stela, measuring 16.4 cm × 14 cm × 5 cm, from WG 33, SU2, west of the main entrance to the complex of the caves. Most likely, it was originally placed in a niche cut in the coral terrace. It is covered by a text of six horizontal lines of hieroglyphs separated by incised lines, starting with the date on the top and continuing without interruption.

Although the stela is complete, the state of preservation of the text is poor, mainly in the two last lines (Mahfouz 2008: 253- 279).

1) *ḥsbt 23*
2) *r ḥm n Nsw-bjty Ny-mꜣꜥt-rꜥ*
3) *ḥtp dj nsw* (*n*) *Mnw nb Gbtyw*
4) *dj.f t ḥnḳt jḥ ꜣpd šs mnḫt snṯr*
5) *n kꜣ n jry-ꜥt* (*n*) *pr-ꜥꜣ Jmny*
6) *..ẖr ...*

1) Year 23
2) under the majesty of the king of Upper and Lower Egypt Nymaatra
3) The offerings that the king gives to Min lord of Coptos,
4) to give bread, beer, beef, fowl, [vessels of] alabaster, cloth, incense
5) to the ka of the overseer of the great palace Ameny
6) …under ...

WG Stela 18: a rectangular limestone stela, 26 cm × 16 cm × 7 cm. It was reused as a base of a stela in a niche in excavation unit WG 33. It lacks any trace of an inscription.

WG Stela 19 (Figure 170): the upper part of a small round-topped limestone stela, 10.5 cm × 8.6 cm × 5 cm, from excavation unit WG 33, in the same niche where WG Stela 18 was found and not far from the entrance to the cave complex. This fragmentary stela was also reused as a base for a stela. It lacks any trace of an inscription.

WG Stela 22: fragment of a limestone stela, 6 cm × 11 cm × 4.5 cm, from excavation unit WG 33, C1, SU8. A vertical line in relief, which can be seen on the stela, is similar to the ones usually framing the inscribed texts on this kind of monument, but no traces of an inscription are visible.

WG Stela 23 (Figures 171, 172): a round-topped limestone stela, 35 cm × 26.4 cm × 9.0 cm. It is badly damaged except for the three first lines, consisting of hieroglyphs incised in light relief. As well known in the 12th Dynasty stelae, the text is in the upper part, while the lower part has scenes. It was excavated in WG 55, C1, SU8, southeast of the main entrance to the cave complex, and near the entrance to Cave 7 (and not Cave 5, as reported in the 2007-2008 online report). Although found in a vertical position, the stela had fallen into the sand, which was mixed with fragments of coral rock, wood, ropes and sealings. The stela was covered by a salt crust and was resting on top of a big sherd near the entrance to Cave 7 (Mahfouz 2008 : 253- 279).

1) *ḥsbt 41* [*ẖr*]
2) *ḥm n nsw-bjty Ny-m3ˁt-rˁ...*
3) [*Ḥr*] *ˁ3*-[*b3w*] *Ḥr*-[*nbw ˁnḫ*]-*w3ḥ*- *Jṯj-jwˁt*-[*t3wy*] ...

1) Year 41 [under]
2) the majesty of the king of Upper and Lower Egypt Nymaatra ...
3) [Horus] Aa-[baw] Golden Horus Ankhwah itiwa[tawy] ...

WG Stela 24 (Figures 173, 174): a round-topped limestone stela, 54.3 cm × 34 cm × 12.5 cm, from excavation unit WG 55, C1, SU8. Only a sector of the upper part of the stela survives, consisting of a winged sun disc with uraeus and the representation of the god Min with an erect penis, in front of the representation of the king or his names. Min is shown in front of his shrine. This scene occupies two thirds of the surface and it is separated by a line from the text in the lower part of the stela. Unfortunately, the only signs that can be read are: *nfr nṯr* ("good God").

WG Stela 25: a round-topped stela, 67.5 cm × 46 cm × 23 cm. Noteworthy, this stela is made of conglomerate stone. It was found on the southern edge of the coral terrace, not far from where Sayed found the stela of Antefoker-Ameny. The upper part of the stela is badly damaged. The lower part contains a few hieroglyphs and human figures. In the lower left corner there is an image of a standing god with human body and perhaps a falcon head, with the *ˁnḫ* sign in his right hand and a sceptre in his left one. The sign *ḥtp* is visible near the left foot of the god. The text is lightly incised in vertical columns on the surface. The first column ends with the house sign (*pr*) and a vertical stroke. In the middle of the following column is the sign group *Pwnt* with a doubtful reading of *bi͗ꜣwt* before the toponym and *sbi͗* after it. In the third column, the words *ḥm n nsw-bi͗ty*, "the majesty of the king of Upper and Lower Egypt," can be seen. In the middle of the next column the following reading can be suggested: the end of a first cartouche and a second cartouche beginning with the sun disc sign and a vertical line and ending with the word *ḥtp*. In the ninth column is a group of words: *ẖꜣswt r ... ḥꜥw-*, which can be translated as "the foreign lands to ... of the islands." Unfortunately, the rest of the text cannot be read because of the quality of the stone and the fact that it was very lightly incised.

WG Stela 26 (Figure 175): fragment of a limestone stela, 26 cm × 10 cm × 8 cm, found in the third niche near WG 33, to the west of the second large niche carved in the western side of the coral terrace. This fragment is the right lower corner of a stela with the end of two barely visible vertical columns of text:

1) ... ꜥnḫ [ḏt]
2) ... [P]wn[t

1) ... given life [forever]
2) ... [P]wn[t].

WG Stela 28 (Figure 176): a round-topped limestone stela, 18 cm × 10.5 cm × 4.5 cm. It was found in excavation unit WG 55, E1-2-3, SU1. The surface of the stela is divided into two parts: the top part is inscribed with the usual offering formula while the lower part consists of a painted scene of a standing person with arms raised in adoration in front of an anthropomorphic god (Mahfouz 2011 : 7-14). The four horizontal lines of text are as follows:

1) ḥtp dj nsw (n) Wsjr Wꜣḏ-wr
2) Ḥr-wr ...
3) dj.f pr-ḫrw jḥw ꜣpd
4) šs n kꜣ n ...

1) The offerings that the king gives to Osiris Wadj-Wr
2) and to Horus the Great …

3) he gives the offering consisting of cattle, fowl,
4) cloth, for the ka of…

Unfortunately, the name of the person who dedicated the stela is not preserved, and a part of the second line of the text is not clear. The epithet of Osiris "*Wadj-wr*" is original, and, according to my knowledge, it is unique. The context of this epithet is at the site of Mersa/Wadi Gawasis on the Red Sea coast, in an area under the patronage of Min of Coptos. This stela dates to the 12th Dynasty, according to characteristics of the offering formula and the use of the expression *dj.f pr-ḫrw* (Obsomer 1993).

WG Stela 29: a large sandstone stela, 72 cm × 74 cm × 10 cm (Figures 177, 178) found in excavation unit WG 61, E3, SU1. It is likely that the stela had fallen from its original location above the entrance to Cave 8. Fortunately, its inscribed surface was lying in the sand, which resulted in a reasonable preservation of the inscribed text. The stela was covered with a thick crust of salt and sand and required cleaning by conservator Howard Wellman. After cleaning, only the central part of the text, mainly the fourth and fifth lines, were affected by salt and humidity. The upper part of the stela contains some paint, such as the red of the solar disc in the stela's rounded top, and the white in the *nb sign* of the title *nb tȝwy*, at the top of the left column. The stela is divided into two parts: the upper part contains the royal names and epithets, and the lower one focuses on the official who dedicated the stela and was part of an expedition at Mersa/Wadi Gawasis. The decoration framing the upper part of the stela, consisting of a winged sun disc with ureus, is well crafted and is accompanied by the epithet *nṯr ʿȝ* "the great God". The upper part, which contains the royal names and epithets, has larger signs than those in the lower part. In the central area of the upper part is the Horus name of Senusret II, Seshemutawy, inscribed within the serekh/palace façade design, which is surmounted by the Horus falcon with the double crown. The king's Horus name includes two *tȝ* signs, the two lands (i.e., Egypt).

Ḥr sšmw-tȝwy

Horus the one who rules the two lands

On the right side of the Horus name is the royal epithet linking the king to the god Min of Coptos, patron of the Eastern Desert and protector of the Egyptian sailors who went on expeditions to the land of Punt. This epithet is in two columns of text:

dj.f ꜥnḫ nb mry Mnw Gbtyw

Given life, beloved of Min of Coptos.

To the left of the Horus name is the prenomen, followed by the coronation name in two columns:

nfr nṯr ḫꜥ-ḫpr-Rꜥ nb ṯꜣwy dj ꜥnḫ dt

The good god Khakheperra,
Lord of the two lands, given life forever.

Noteworthy, the title *nb ṯꜣwy* replaces the *nsw-bity* name here, which represents a tradition in the protocol of the 12th Dynasty inscriptions from Mersa/Wadi Gawasis, *e.g.*, in WG Stela 6 (Mahfouz 2008 a: 257).

The lower part of the stela contains six lines of smaller signs than in the upper part, oriented from right to left. The left part of the last line is damaged. Moreover, the beginning of each line as well as some central parts are also damaged, which certainly affects the reading of the text:

1) *ḥsbt 2 ḫr ḥm n nṯr pn* [*prt*] *jry-pꜥt ḥꜣty-ꜥ rḫ nsw* [...]
2) *mty mry=f imy-rꜣ sbt* (*n*) *bjꜣw Pwnt ḫsfy* [...]
3) *spr-n=f ḥwt-nṯr Mnw m jb n ḥm=f* [...]*tt jnk wꜥ n nb*
4) *=f* [...] *šmsw=f jr ḫt=f wbꜣ m stp-sꜣ*
5) *mry* [*nsw kmnt*] *tp rnpt n ḥb* [...]*=f iḳr jmy-rꜣ mšꜥ* [...]
6) *gmi ḫꜣst wḥmw Ḥnnw jrw Ḥ*[...]

1) Year 2 under the majesty of the god, the hereditary prince, governor, the one who is known to the king
[…]
2) the precise one, beloved overseer of the expedition to the mines of Punt went out and sailed
[…]
3) He reached the temple of Min in the heart of his majesty […] I am the unique one for his lord.
4) […], his guard who achieves his tasks, the cupbearer in the palace

5) beloved of the king of Egypt in his great annual festival, the excellent one, overseer of the army […]
6) the prospector of the desert, the herald Henenu, born of H[…]

Under the text, there are two different signs which apparently were inscribed later than the inscription. They are the sign for house (*pr*) and a bird-shaped sign.

The stela provides important information on the presence at Mersa/Wadi Gawasis of a high official with the title of herald named Henenu, a very popular name in Middle Kingdom times, in the second year of Senusret II, fourth king of the 12th Dynasty. The official not only bears the usual honorary titles of hereditary prince, governor, the one who is known to the king, but also the executive title of director of an expedition to the mines of Punt, suggesting maritime activity and a remarkable role in the relations between Egypt and Punt during the reign of Senusret II.

Henenu also was directly related to the royal palace and the court by the title cupbearer in the palace. Finally, the title of prospector of the desert shows his role in the desert areas and the possibility that there might have been an institution specialized in this field.

The text of this stela is also the first evidence from Mersa/Wadi Gawasis dating to the second year of Senusret II. Sir Gardner Wilkinson found a stela dating to the first year of this king at Wadi Gasus, but it has been suggested elsewhere that the stela at Wadi Gasus may refer to activities in the mining region of the southern Sinai (Mahfouz 2008 b: 48-55).

This stela shows that an expedition to the mines of Punt, directed by the herald Henenu, was sent there during the reign of Senwsert II. The expedition returned in the second year of this king and it approached a sanctuary of Min. The location of this temple is uncertain, but it may be suggested that it was at Mersa/Wadi Gawasis itself, as is also suggested by some archaeological discoveries at the site.

WG Stela 30 (Figure 179): A greatly damaged medium-sized limestone stela, measuring 36 cm × 23 cm × 10 cm, was found in WG 33 without any preserved evidence of an inscription.

WG Stela 31: a greatly damaged limestone stela, 50 cm × 30 cm × 10 cm in size, from WG 33 SU2 found lying face downward in the sand on its inscribed face. Deterioration of the limestone was too advanced and no inscription was discernable.

WG Stela 32: a greatly damaged limestone stela, 37 cm × 21 cm × 12 cm, from WG 33, SU1, fell down from a niche in the terrace wall. Unfortunately, the inscription and images on the stela are no more discernable.

9.2 Ostraca

ELSAYED MAHFOUZ AND ROSANNA PIRELLI[3]

WG Ostracon 107 bis (Figure 180): this ostracon from WG 26, D5, SU90 measures 12.5 cm × 8.5 cm × 1.5 cm. On a white surface, 13 black lines in a row and two others in the upper part of the fragment can possibly be interpreted as accounting signs.

WG Ostracon 107 ter (Figure 181): this ostracon from WG 37, A4, SU25 measures 20 cm × 12 cm × 1.5 cm and is characterized by a white surface with a red draw, possibly representing an animal with four legs.

WG Ostracon 107 quater (Figure 182): this ostracon,6 cm × 4 cm × 1 cm, from WG 40, SU2 is characterized by the occurrence of red lines and black unreadable signs on the external surface.

WG Ostracon 108 (Figure 183): this ostracon, 14 cm × 18.5 cm × 1 cm, was found in excavation unit WG 55, D3, SU2. It has hieroglyphs written in black ink on the yellow surface of the sherd. The visible signs are a part of two parallel horizontal signs, most likely the hieratic form of  followed by the hieratic form of the vessel and a big vertical line, i.e.,  . This may be interpreted as a name ending with double n or the determinative of liquids and a vessel followed by a numeral.

[3] Ostraca 107 bis, ter and quater were studied by E. Mahfouz and R.Pirelli, Ostraca 108-114 were studied by E. Mahfouz.

WG Ostracon 109 (Figure 184): this ostracon, 3.8 cm × 3.5 cm × 1.5 cm, was collected in excavation unit WG 55, C1, SU8. The drawing is in black ink on a reddish surface of a fine ware sherd.

WG Ostracon 110: this ostracon, 13 cm × 9.7 cm × 0.9 cm, was found in excavation unit WG 55, C1, SU8. It has traces of a hieratic text, most likely consisting of three groups of signs in black ink on the yellowish-white surface of the sherd. Each group consists of a horizontal line and a numeral, which suggests that this was an accounting text.

WG Ostracon 111 (Figures 185, 186): this ostracon, 11.1 cm × 7 cm × 1 cm, was collected in excavation unit WG 47, SU2. The hieratic text consists of three lines in black ink on the white surface of the sherd. The second month of season *Šmw* and Year 8, and possibly a name of Amenemhat IV, are mentioned, followed by a list with quantification of commodities (Mahfouz 2010: p. 165-175).

1) [*ḥsbt*] *8 ꜣpd 2 Šmw*
2) ...[*Mꜣꜥt-ḫ*]*rw*-[*rꜥ*]
3) ...[*r*]*m 300*

1) [Year] 8, second month of summer
2) … Maatkherura
3) ... fish rem 300

WG Ostracon 112: this ostracon, 10.5 cm × 9.4 cm × 0.7 cm, was found in excavation unit WG 55, SU2. The signs are almost completely effaced.

WG Ostracon 113: this ostracon, 7.2 cm × 9.1 cm × 0.7 cm, was found in excavation unit WG 55, SU2. The signs are almost completely effaced.

WG Ostracon 113 bis (Figure 187): this ostracon, 13 cm × 7 cm × 1.5, was collected in excavation unit WG 61, D4-E4, SU82. The text consists of a single column traced with black ink on the whitish surface of the sherd. The text is not complete and just a few words can be read:

... m tꜣ rm 30 m niwt.

… from the land, 30 rem fish from the city.

WG Ostracon 114 (Figure 188): this fragmentary ostracon, 9.5 cm × 5.5 cm × 1 cm, was collected in between excavation units WG 61, D2-3/E2-3 and WG 65, A2-3, in SU45. The text consists of four incomplete lines traced with black ink on a red surface. These words can be read:

1) *ḥsbt 6, ꜣpd 1 Šmw*
2) *in ḥꜣty-ꜥ*
3) *tr 5*
4) *rm*

1) Year 6, first month of summer…
2) the governor has brought …
3) 5 tr…
4) fish

9.3 Papyri and inscribed fabric

ELSAYED MAHFOUZ

WG Papyrus 1 (Figure 189): this papyrus, 10.5 cm × 4 cm, was found in excavation unit WG 56, SU8. It contains a hieratic text divided into two columns, whose upper part is badly damaged.

1) *... nbt-pr sꜣt-jn-ḥrt ḥnꜥ.s ...*
2) *... Wꜣ-nbw mj mrr.f*

1) ... the lady of the house Satinheret with her ...
2) ...Wanebu as he likes.

This papyrus may be identified as a private letter.

WG Papyrus 2: this papyrus, 4 cm × 6 cm, was found in excavation unit WG 56, SU8.

WG Papyrus 2 bis (Figure 190): this papyrus, 3.5 cm × 7 cm, was found in excavation unit WG 61, C2, SU21. It has three columns of text in black ink. These are translated as follows:[4]

1) …like Thot …

[4] This is a preliminary translation as the study of this papyrus is still in progress.

2) …the official of the domain …
3) …may he live, be prosperous and healthy [king ?]…

WG Papyrus 3 bis (Figure 191): a few fragments of papyrus from excavation unit WG 61, D4-E4, SU82. The two main fragments have a column of hieratic text: unfortunately, it is too fragmentary to be read.

WG Papyrus 4: this papyrus, 5.5 cm × 4 cm, was found in excavation unit WG 56.

WG Papyrus 5 (Figure 192): fragment of papyrus, 14.25 cm × 7 cm, from excavation unit WG 61, C2-C3, SU49. The text consists of three lines: it is incomplete with gaps in the middle and at the end of the second and third lines:

1) Jnt n ḥry-pr S3-nbs
2) ᶜf3 ẖrš hnw? 500
3) sjp n jry-ᶜt Nḫt-p(w)j

1) brought by the butler Sa-Nebes
2) clover bundles: 500 *hn*?
3) counted by [the one] responsible of the store Nakht-pwi

WG Fabric 1 (Figure 193): it is a piece of linen fabric, 20 cm × 4 cm, from excavation unit WG 56, SU7. It is characterized by a vertical hieratic inscription.

9.4 Cargo box inscriptions

ELSAYED MAHFOUZ AND ROSANNA PIRELLI

WG Box 21 (Figures 194, 195): this box from WG 32, SU10 was very badly preserved. The text was written on the short side of the box, which is made of acacia wood covered with a layer of white plaster and a layer of red ochre. The damaged text consists of four horizontal lines in the center of the middle plank, recording an expedition to Punt in Year 8 of the reign of the last king of the 12th Dynasty, Amenemhat IV (ca. 1786-1777 B.C.). This expedition was also recorded on Box 2 discovered in the 2005–2006 field season (Bard and Fattovich 2007: 238 ; Mahfouz 2010 : 165-175).

1) [*ḥsbt*] *8 ẖr ḥm n*
2) [*nsw-bἰty*] *M3ʿt-ḫrw*-[*rʿ*] *dἰ ʿnḫ*
3) *ἰnw* [*bἰ3wt*] *Pwnt*
4) *n* [*ẖrp*] *nfrw sš nsw Ḏdἰ*

1) Year 8 under the majesty of
2) the king of Upper and Lower Egypt Maatkherura
3) wonderful things of Punt brought
4) by the overseer of the recruits, the royal scribe Djedy

WG Box 40: A horizontal line of hieroglyphic signs was found in the center on a short side of this box. This line is greatly damaged and only a few signs can be distinguished, suggesting the name of a product such as leather or a kind of metal.

WG Box 41: On short side of this box a group of two probably hieroglyphic signs suggest the name of a vegetal product.

9.5 Sealings and seal

9.5.a Inventory

ELSAYED MAHFOUZ, ANDREA MANZO AND ROSANNA PIRELLI[5]

WG Sealing 01: found in excavation unit WG 55, SU2. It has the complete impression of a 4 cm × 1.8 cm seal. No inscription occurs, but the design consists of scrolls. Perhaps it was used to seal a papyrus.

WG Sealing 02: fragment of a sealing, 1.5 cm × 1.3 cm × 0.7 cm, with the badly preserved and fragmentary impression of a seal with traces of scrolls from WG 32, C5, SU28. On the opposite side the impression of a peg occurs.

[5] Sealings 1, 4-9 were recorded and studied by E. Mahfouz, Sealings 160, 148, 159-176, 178-183, 284-317 were recorded and studied by R. Pirelli. The remaining sealings and Seal 1 were recorded and studied by A. Manzo. The inventory presented here was dressed by A. Manzo.

WG Sealing 03: fragment of a sealing, 2 cm × 1.3 cm × 0.5 cm, with the badly preserved and fragmentary impression of a seal with traces of scrolls from WG 32, C5, SU28. On the opposite side the impression of a peg occurs.

WG Sealing 04 (Figure 196 A): this sealing contains a 3.1 cm × 1.7 cm seal impression, and was found in excavation unit WG 55, SU8. It consists of a title of an official: *i͗my-r md̠ꜣt* (*n*) *ḥwt*-[*nṯr*] (*n*) *ni͗wt*, "overseer of the archive of the temple of the city." The impression of a second smaller oval seal characterized by a scroll pattern also occurs. The impression on the back side suggests that the sealing may have been used to seal the peg of a box.

WG Sealing 05: this sealing, 1.5 cm × 2 cm, was found in excavation unit WG 55, SU8. It contains a barely visible seal impression with some hieroglyphic signs, *w*, *t*, possibly a part of sign *st* or *ḥwt*, and two vertical signs, one of them possibly a part of the hieroglyph sign representing a roll of papyrus.

WG Sealing 06 (Figure 196 B): this sealing, 3.1 cm × 1.7 cm, is from excavation unit WG 55, SU8. The hieroglyphic signs in the seal impression are very intriguing as they represent a boat and three strokes marking a plural word, which in this specific context may be translated as "the fleet". This group of signs is followed by the signs *sw* and t: they form the word *nsw*, "king." The two words *ḥꜥw nsw* can be translated as "the royal fleet." The inscription is framed by the scroll design, which occurs widely on Egyptian seals from the mid-12th Dynasty.

WG Sealing 07: this sealing, 2.1 cm × 1.5 cm, was found in excavation unit WG 56, SU5. It has the overlapping impressions of more than one seal. The sign *ni͗wt*, "city," also used as a determinative, can be seen.

WG Sealing 08: this sealing, 1.7 cm × 1.8 cm, was found in excavation unit WG 56, SU5. In the impression of the seal the following signs can be read: *ḥwt*-[*nṯr*] (*n*) *njwt*, "the temple of the city." It is possibly part of the same inscription on WG Sealing 04. It originally sealed some string, perhaps closing a box.

WG Sealing 09: this sealing, 2.9 cm × 2.9 cm, was found in excavation unit WG 56, SU2. Only the sign of the owl, *m*, can be perceived.

WG Sealing 10: this sealing, 2 cm × 1.8 cm with a fragmentary impression of a seal, was found in excavation unit WG 55, D1/2, SU2. The seal is framed by scrolls, and contained a *mi͗* sign. On the back are the impressions of string and a flat surface, suggesting that it may have sealed the peg of a box.

WG Sealing 11: this sealing, 2.4 cm × 2.8 cm × 0.8 cm, was found in excavation unit WG 55, D1/2, SU2. The seal is framed by scrolls. On the back are the impressions of string and a flat surface, suggesting that it may have sealed the peg of a box.

WG Sealing 12: this sealing, 2.4 cm × 1.4 cm × 0.7 cm, was found in excavation unit WG 55, D1/2, SU2. The seal is framed by scrolls and contains some unclear signs. On the back are the impressions of string.

WG Sealing 13: this sealing, 2.5 cm × 1.2 cm × 0.8 cm, was found in excavation unit WG 55, D1/2, SU2. The seal is framed by scrolls and contains some unclear signs. On the back are impressions of string and a peg, suggesting that it may have sealed a box.

WG Sealing 14 (Figure 197 A): this sealing, 2.5 cm × 2.2 cm × 1.2 cm, was found in excavation unit WG 55, D1/2, SU2. The seal is framed by scrolls and contains a *pr* sign. The horizontal line delimiting the bottom of the seal suggests that this was the impression of an institutional shield-shaped seal. On the back are the impressions of string.

WG Sealing 15: this sealing, 2.0 cm × 1.5 cm × 0.7 cm, was found in excavation unit WG 55, D1/2 SU2. The seal is framed by scrolls. On the back are the impressions of string.

WG Sealing 16: this sealing, 1.9 cm × 1.4 cm × 0.8 cm, was found in excavation unit WG 55, D1/2, SU2. The oval seal, 1.5 cm × 1.1 cm, has an "8"-shaped pattern containing some unclear, most likely protective signs. On the back are the impressions of a basket or mat.

WG Sealing 17: this sealing, 1.25 cm × 0.9 cm × 0.7 cm, was found in excavation unit WG 56, E2, SU5. The seal is framed by small scrolls. On the back are the impressions of thin strings.

WG Sealing 18: this sealing, 1.3 cm × 1.35 cm × 0.45 cm, was found in excavation unit WG 56, A2, SU7. The sealing has the partially preserved impressions of two seals, a larger one and a smaller one with a pattern consisting of small scrolls. On the back are the impressions of string.

WG Sealing 19: this sealing, 2 cm × 1.2 cm × 0.5 cm, was found in excavation unit WG 56, A2, SU7. The sealing contains the impression of a seal framed by scrolls. On the back are the impressions of strings and a flat wood surface, suggesting that it may have sealed a box.

WG Sealing 20: this sealing, 1.4 cm × 1.2 cm × 0.65 cm, was found in excavation unit WG 55, C1, SU11. The seal is framed by scrolls. On the back is an impression of folded fabric.

WG Sealing 21: this sealing, 2.1 cm × 1 cm × 0.5 cm, was found in excavation unit WG 55, C1, SU11. The seal has a decoration of scrolls and an unclear sign. On the back are the impressions of strings.

WG Sealing 22: this sealing, 3.2 cm × 4.2 cm × 1.3 cm, was found in excavation unit WG 55, C1, SU11. The seal, 2.2 cm × 1.6 cm, is oval. Unfortunately, no signs of its decoration are visible. On the back are the impressions of a peg and a flat surface, suggesting that it may have sealed a box.

WG Sealing 23: this sealing, 2.6 cm × 2 cm × 1.5 cm, was found in excavation unit WG 55, C1, SU11. The impression of a seal is only partially preserved, but its dimensions, larger than 2.8 cm × 1.5 cm, suggest a large, perhaps institutional seal. Unfortunately, only some scrolls and part of a sign *pr* can be observed. On the back are the impressions of string.

WG Sealing 24 (Figure 196 C): this sealing, 2.4 cm × 1.4 cm × 1.3 cm, was found in excavation unit WG 55, C1, SU11. The impression of the seal is only partially preserved, but its dimensions, ca. 2.2 cm × 1.7 cm, and decoration with "8"-shaped signs inscribed in ovals, and *wꜣḏ* signs, suggest a personal seal. Its reconstruction (Figure 197 B) was suggested on the basis of a more complete impression preserved on WG Sealing 54. On the back is the impression of a peg, suggesting that it may have sealed a box.

WG Sealings 25, 26, 27: these sealings, 2.4 cm × 1.4 cm × 1 cm, 2.1 cm × 1.4 cm × 0.55 cm, and 1.2 cm × 1.1 cm × 0.5 cm, respectively, were found in excavation unit WG 55, C1, SU11. They consist of impressions of the same seal as WG Sealing 54. On the back of 25 and 26 are the impressions of string, while the back of 27 is not preserved.

WG Sealing 28: this sealing, 2 cm × 2.1 cm × 1 cm, was found in excavation unit WG 55, C1, SU11. The impression of a seal framed by large scrolls is only partially preserved. On the back are traces of impressions of wood and string, suggesting that it may have been used to seal a box.

WG Sealing 29: this sealing, 1.4 × 1.4 cm, was found in excavation unit WG 55, C1, SU11. The partially preserved impression of a seal with unclear linear signs can be seen. On the back are traces of impressions of folded leather and string.

WG Sealing 30 (Figure 197 C): this sealing, 1.7 cm × 1.3 cm × 0.8 cm, was found in excavation unit WG 55, C1, SU11. The partially preserved impression of a seal consists of scrolls and vegetal patterns. On the back are the impressions of string.

WG Sealing 31: this sealing, 2.6 cm × 1.1 cm × 0.8 cm, was collected in excavation unit WG 55, C1, SU11. The partially preserved impression of a seal consists of scrolls. On the back are the impressions of string.

WG Sealing 32: this sealing, 1.9 cm × 1.2 cm × 0.6 cm, was found in excavation unit WG 55, C1, SU11. The partially preserved impression of a seal consists of scrolls. On the back are the impressions of a mat or basket.

WG Sealing 33: this sealing, 1.7 cm × 1.1 cm × 0.3 cm, was found in excavation unit WG 55, C1, SU11. The partially preserved impression of the seal is framed by scrolls. On the back are the impressions of string.

WG Sealing 34: this sealing, 2.5 cm × 1.7 cm × 1.4 cm, was found in excavation unit WG 55, C1, SU11. The partially preserved impression of the seal is framed by scrolls. On the back are the impressions of string and wood, suggesting that it may have sealed a box.

WG Sealing 35: this sealing, 2 cm × 1.3 cm × 0.75 cm, was found in excavation unit WG 55, C1, SU7. The partially preserved impression of the seal is framed by scrolls. On the back are the impressions of string and wood, suggesting that it may have sealed a box.

WG Sealing 36: this sealing, 2.8 cm × 1.4 cm × 1.3 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of the seal contains *mi* signs. On the back are the impressions of string and wood, suggesting that it may have sealed a box.

WG Sealing 37: this sealing, 2.7 cm × 1.9 cm × 1 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of the seal is similar to that of WG Sealing 54. On the back are the impressions of rope and wood, suggesting that it may have sealed a box.

WG Sealing 38: this sealing, 3.8 cm × 1.8 cm × 2 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of a seal is similar to that of WG Sealing 54. On the back are the impressions of rope and a peg, suggesting that it may have sealed a box.

WG Sealing 39: this sealing, 1.6 cm × 1.7 cm × 0.6 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of the seal is similar to that of WG Sealing 54. On the back are the impressions of string and a peg, suggesting that it may have sealed a box.

WG Sealing 40: this sealing, 2 cm × 1.7 cm × 1.5 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of the seal is similar to that of WG Sealing 54. The impression of the seal is almost complete, allowing the reconstruction of its dimensions: ca. 2.1 cm × 1.7 cm. On the back no impressions occur, as it is badly damaged.

WG Sealing 41: this sealing, 3.4 cm × 3.8 cm × 1.5 cm, was found in excavation unit WG 55, C1, SU8. It consists of the partially preserved impressions of two different seals, both with scroll patterns. On the back are the impressions of string.

WG Sealing 42: this sealing, 3.4 cm × 1.7 cm × 1.1 cm, was found in excavation unit WG 55, C1, SU8. It consists of a partially preserved impression of a seal without any trace of signs. On the back are the impressions of string and a peg, suggesting that it may have sealed a box.

WG Sealing 43 (Figure 196 D): this sealing, 2 cm × 1.9 cm × 0.8 cm, was found in excavation unit WG 55, C1, SU8. It consists of the partially preserved impressions of two different seals, one with a scroll pattern, and the second similar to that of WG Sealing 54. There are no impressions on the back.

WG Sealing 44: this sealing, 1.6 cm × 1.2 cm × 0.6 cm, was found in excavation unit WG 55, C1, SU8. The partially preserved impression of the seal is similar to that of WG Sealing 54. There are no impressions on the back, as it is badly damaged.

WG Sealing 45: this sealing, 1.5 cm × 1 cm × 0.9 cm, was found in excavation unit WG 5, C1, SU8. It consists of the partially preserved impression of a seal with large scrolls. There are no impressions on the back, as it is badly damaged.

WG Sealing 46: this sealing, 1.3 cm × 0.8 cm × 0.5 cm, was found in excavation unit WG 55, D1-2, SU3. It consists of the partially preserved impression of a seal with large scrolls. On the back are the impressions of string.

WG Sealing 47: this sealing, 1.1 cm × 1 cm × 0.5 cm, was found in excavation unit WG 5, C1, SU8. It consists of the partially preserved impression of a seal with large scrolls. On the back are the impressions of string.

WG Sealing 48: this sealing, 1.6 cm × 1.8 cm × 0.8 cm, was found in excavation unit WG 55, A3, SU8. It consists of the partially preserved impression of a seal with large scrolls. On the back are the impressions of a peg and a wood surface, suggesting that it may have sealed a box.

WG Sealing 49: this sealing, 3.6 cm × 1.8 cm × 1 cm, was found in excavation unit WG 55, C3, SU1-2. It consists of the partially preserved impression of a seal with large scrolls. On the back are the impressions of wood and possibly of a peg, suggesting that it may have sealed a box.

WG Sealing 50 (Figure 196 E): this sealing, 2.2 cm × 1.6 cm × 0.8 cm, was found in excavation unit WG 55, C3, SU1-2. It consists of the partially preserved impressions of a seal with small scrolls and a seal with the signs for *ḥwt* and *niwt*, the same as that of the WG Sealing 08, but different. On the back are the impressions of string.

WG Sealing 51: this sealing, 2.5 cm × 2 cm × 1.3 cm, was found in excavation unit WG 55, E3, SU5. It consists of the partially preserved impressions of a seal with small scrolls. On the back are the impressions of string and folded leather, possibly suggesting that it originally sealed a leather bag.

WG Sealing 52: this sealing, 2.9 cm × 2.3 cm × 1.2 cm, was found in excavation unit WG 55, E3, SU5. It consists of the partially preserved impressions of a seal with small scrolls and a bigger ovoid seal without any clear signs. On the back there are also no clear impressions.

WG Sealing 53: this sealing, 2.5 cm × 1.8 cm × 0.5 cm, was found in excavation unit WG 55, E3, SU5. It consists of the partially preserved impressions of a seal with small scrolls. On the back is the impression of a flat surface, suggesting that it may have sealed a box.

WG Sealing 54 (Figure 196 F): this sealing, 3.8 cm × 3.1 cm × 2.3 cm, was found in excavation unit WG 32, SU46. It consists of the almost complete impression of an oval seal, 2.4 cm × 1.5 cm, with "8"-shaped signs and the *wꜣḏ* sign. The same seal also occurs on WG Sealing 24 and other partially preserved sealings. On the back are the impressions of wood and string, suggesting that it may have sealed a box.

WG Sealings 55, 56, 57, 58, 59: these sealings, 2.3 cm × 2.5 cm × 1.8 cm, 3.2 cm × 3.2 cm × 0.9 cm, 3.1 cm × 1.4 cm × 0.9 cm, 2.5 cm × 1.8 cm × 1.2 cm, and 1.4 cm × 2.1 cm × 0.8 cm, respectively, were foundd in excavation unit WG 32, SU46. They consist of fragmentary impressions of the same seal as WG Sealing 54. On the back of Sealings 55 and 57 are the impressions of wood and string, suggesting that they may have sealed a box. On the back of Sealings 56 and 59 there are only impressions of string. On the back of Sealing 58 there are no clear impressions.

WG Sealings 60, 61, 62, 63: these sealings, 2.1 cm × 1.7 cm × 0.75 cm, 2.1 cm × 1.5 cm × 1.5 cm, and 2.1 cm × 2.2 cm × 1 cm, 1.7 cm × 2.2 cm × 1.5 cm, respectively, were found in excavation unit WG 32, SU46. They consist of fragmentary impressions of the same seal as that of WG Sealing 54. On their backs are the impressions of wood and string, and occasionally a peg, suggesting that they may have sealed boxes.

WG Sealing 64: this sealing, 3.9 cm × 2.4 cm × 0.8 cm, was found in excavation unit WG 32, SU46. It consists of the fragmentary impressions of a big seal with large scrolls and a smaller oval seal with scrolls. On the back there are no clear impressions.

WG Sealing 65: this sealing, 1.6 cm × 1.5 cm × 1 cm, was found in excavation unit WG 55, C1, SU8 (Cave 7, entrance). It consists of the impressions of a small seal with no preserved impressions of signs. On the back is the impression of a peg, suggesting that it may have sealed a box.

WG Sealing 66: this sealing, 2.6 cm × 2 cm × 0.9 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of the fragmentary impressions of the same seal of WG Sealing 54. On the back is the impression of a string, possibly around a peg, suggesting that it may have sealed a box.

WG Sealing 67 (Figure 197 D): this sealing, 4 cm × 2.2 cm × 1.3 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of impressions of a seal with scrolls and part of the title of an official, *ỉmy-r pr* followed by a "X" sign. On the back are the impressions of string, wood and a peg, suggesting that it may have sealed a box.

WG Sealings 68, 69, 70, 71, 72: these sealings, 3.2 cm × 2 cm × 1.2 cm, 2 cm × 1.8 cm × 0.9 cm, 2.5 cm × 2.9 cm × 1 cm, 2.7 cm × 1.9 cm × 0.9 cm, and 2.9 cm × 2 cm × 1.2 cm, respectively, were found in excavation unit WG 32, SU46 (Cave 6, entrance). They consist of impressions of the same seal as that of WG Sealing 54. On the back are the impressions of string and a peg, suggesting that they may have sealed a box.

WG Sealing 73: this sealing, 3.8 cm × 2.8 cm × 1.8 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of impressions of two seals, a bigger one with scrolls and a smaller one whose pattern is not preserved. On the back are the impressions of string, wood and a peg, suggesting that it may have sealed a box.

WG Sealing 74: this sealing, 2 cm × 2 cm × 1.1 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of the impression of a small seal whose pattern is not preserved. On the back are the impressions of string, wood and a peg, suggesting that it may have sealed a box.

WG Sealing 75: this sealing, 2.5 cm × 1.3 cm × 1.2 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a big seal with scrolls. On the back are impressions of string, wood and a peg, suggesting that it may have sealed a box.

WG Sealing 76: this sealing, 2.7 cm × 1.1 cm × 1.1 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of the same seal of WG Sealing 54. On the back no clear impressions can be seen.

WG Sealing 77: this sealing, 2 cm × 1.1 cm × 1 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a big seal with scrolls. On the back are the impressions of string.

WG Sealing 78: this sealing, 1.7 cm × 1.3 cm × 0.7 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a big seal with scrolls. On the back are the impressions of string.

WG Sealing 79: this sealing, 2.4 cm × 2.4 cm × 1.4 cm, was found in excavation unit WG 55, C1, SU1 (Cave 7, outside). It consists of very fragmentary impressions of a small seal with badly preserved signs, although perhaps the pattern of the *sm3 t3wy*, uniting of the two lands, can be perceived. On the back are the impressions of fabric and string.

WG Sealing 80: this sealing, 1.7 cm × 1.5 cm × 0.85 cm, was found in excavation unit WG 55, C1, SU1 (Cave 7, outside). It consists of the badly and partially preserved impression of a seal. On the back is the impression of wood.

WG Sealing 81: this sealing, 2.2 cm × 1.4 cm × 0.7 cm, was found in excavation unit WG 55, C1, SU1 (Cave 7, outside). It consists of fragmentary impressions of a seal framed by scrolls. On the back are the impressions of fabric and string.

WG Sealing 82: this sealing, 1.1 cm × 1.1 cm × 0.5 cm, was found in excavation unit WG 55, C1, SU1 (Cave 7, outside). It consists of fragmentary impressions of a big seal framed by scrolls. On the back are the impressions of fabric.

WG Sealing 83: this sealing, 3.2 cm × 2.6 cm × 1.2 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of the same seal of WG Sealing 54. On the back are the impressions of a peg and string, suggesting that it may have been used to seal a box.

WG Sealing 84: this sealing, 2 cm × 1.9 cm × 1 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a small seal without any clear sign. On the back is the impression of a peg, suggesting that it may have been used to seal a box.

WG Sealing 85: this sealing, 2.3 cm × 1.5 cm × 1.3 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a seal framed by big scrolls. On the back are the impressions of string.

WG Sealing 86: this sealing, 2 cm × 1 cm × 0.8 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a seal framed by big scrolls. On the back are the impressions of string.

WG Sealing 87: this sealing, 2.5 cm × 1.1 cm × 0.7 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of the same seal as that of WG Sealing 54. The back is badly damaged, but the shape of the sealing suggests that it may have been used to seal a box.

WG Sealing 88: this sealing, 1.9 cm × 1.7 cm × 1 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of the same seal as that of WG Sealing 54. On the back are the impressions of a peg and string, suggesting that it may have been used to seal a box.

WG Sealing 89: this sealing, 1.6 cm × 1.1 cm × 0.6 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of fragmentary impressions of a seal framed by big scrolls. On the back are the impressions of string.

WG Sealing 90: this sealing, 2 cm × 1.8 cm × 1 cm, was found in excavation unit WG 32, SU46. It consists of fragmentary impressions of the same seal as that of WG Sealing 54. On the back are the impressions of a peg and string, suggesting that it may have been used to seal a box.

WG Sealing 91: this sealing, 1.8 cm × 0.8 cm × 1.2 cm, was found in excavation unit WG 32, SU46. It consists of fragmentary impressions of a small oval seal. On the back are the impressions of wood. The shape of the sealing suggests that it may have been used to seal a box.

WG Sealing 92: this sealing, 2.6 cm × 1.2 cm × 0.8 cm, was found in excavation unit WG 55, C2, SU2. It consists of fragmentary impressions of a seal framed by big scrolls. On the back are the impressions of string and fabric.

WG Sealing 93 (Figure 197 E): this sealing, 2.1 cm × 1.8 cm × 0.75 cm, was found in excavation unit WG 55, C2, SU2. It consists of the partially preserved impression of a seal possibly framed by big scrolls and with the signs *ỉr* (eye) and *nỉwt* (city), and perhaps a x. On the back are the impressions of string.

WG Sealing 94: this sealing, 1.8 cm × 1.8 cm × 0.9 cm, was found in excavation unit WG 55, C2, SU2. It consists of the partially preserved impression of a seal framed by big scrolls and with the signs *pr* (house). On the back are the impressions of string. The shape of the sealing suggests that it may have been used to seal a box.

WG Sealing 95: this sealing, 2.4 cm × 1.1 cm × 0.7 cm, was found in excavation unit WG 55, C2, SU2. It consists of the partially preserved impression of a seal with two horizontal strokes, perhaps for *tꜣwy*, the two lands. On the back are the impressions of string.

WG Sealing 96: this sealing, 1.75 cm × 0.9 cm × 0.7 cm, was found in excavation unit WG 55, C2, SU2. It consists of the partially preserved impression of a seal without any clear sign. On the back are the impressions of string.

WG Sealing 97: this sealing, 1.8 cm × 1.7 cm × 1.1 cm, was found in excavation unit WG 55, C2, SU2. It consists of the partially preserved impression of a seal framed by big scrolls. On the back are the impressions of string and fabric.

WG Sealing 98: this sealing, 2.5 cm × 1.3 cm × 0.5 cm, was found in excavation unit WG 56, E3, SU5. It consists of the partially preserved impression of a seal with a badly preserved scroll pattern. On the back are the impressions of string.

WG Sealing 99: this sealing, 1.9 cm × 1.2 cm × 0.75 cm, was found in excavation unit WG 56, E3, SU5. It consists of the partially preserved impression of a big seal with a scroll pattern. On the back are the impressions of string.

WG Sealing 100 (Figure 197 F): this sealing, 2.2 cm × 1.8 cm × 0.7 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the completely preserved impression of an oval 1.5 cm × 1.1 cm seal with the inscription *sš Ỉmnmḥꜣt*, scribe Amenemhat, the signs *kꜣ* and *nfr*, and a badly preserved scroll pattern. On the back are the impressions of string.

WG Sealing 101: this sealing, 2.5 cm × 1.5 cm × 0.9 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the partially preserved impression of the same seal of that of WG Sealing 100. On the back are the impressions of string and fabric.

WG Sealing 102: this sealing, 1.6 cm × 0.9 cm × 0.55 cm, was found in the area between excavation units WG 61, D-E3-2 and WG 65, A2-3, SU45. It consists of the badly preserved impression of a seal, and, on the back, the impressions of string.

WG Sealing 103: this sealing, 1.4 cm × 1.15 cm × 0.7 cm, was found in the area between excavation units WG 61, D-E3-2 and WG 65, A2-3, SU45. It consists of the badly preserved impression of a small oval seal. On the back are the impressions of string and papyrus, suggesting that it may have sealed a papyrus roll.

WG Sealing 104: this sealing, 1.2 cm × 1.6 cm × 0.7 cm, was found in the area between excavation units WG 61, D-E3-2 and WG 65, A2-3, SU45. It consists of the fragmentary impression of a seal with scrolls and possibly the *nfr* sign. On the back are the impressions of string.

WG Sealing 105 (Figure 196 G): this sealing, 1.8 cm × 1.3 cm × 0.5 cm, was found in the area between excavation units WG 61, D-E3-2 and WG 65, A2-3, SU45. It consists of the partially preserved impression of a small oval seal with the signs *nbw*, *ʿnḫ*, and perhaps *nfr*, framed by a line along the edge of the impression with two scrolls at the two extremities. On the back are the impressions of string and fabric.

WG Sealing 106: this sealing, 1.9 cm × 1.3 cm × 0.9 cm, was found in the area between excavation units WG 61, D-E3-2 and WG 65, A2-3, SU45. It consists of the partially preserved impression of the same seal as that of WG Sealing 100, but only a part of the signs *sš* and *kꜣ* can be perceived. On the back are the impressions of string, wood and a peg, suggesting that it may have sealed a box.

WG Sealing 107: this sealing, 1.1 cm × 1 cm × 0.4 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the impression of an oval seal without any clear sign. On the back are the impressions of string.

WG Sealing 108: this sealing, 1.4 cm × 1 cm × 0.45 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the impression of a seal framed by a pattern of small scrolls. On the back are the impressions of papyrus.

WG Sealing 109: this sealing, 1.3 cm × 0.6 cm × 0.3 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the impression of the same seal as that of WG Sealing 54. On the back are the impressions of string.

WG Sealing 110: this sealing, 1.35 cm × 1.4 cm × 0.5 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the fragmentary impression of a seal. On the back are the impressions of string.

WG Sealing 111: this sealing, 1.5 cm × 1.1 cm × 0.5 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the fragmentary impression of a seal with big scrolls. On the back there are no clear impressions.

WG Sealing 112: this sealing, 1.6 cm × 1 cm × 0.5 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the impression of a seal with no preserved signs. On the back are the impressions of string.

WG Sealing 113 (Figure 196 H): this sealing, 4.2 cm × 1.2 cm × 0.6 cm, was found in excavation unit WG 61, E4-5, SU46, It consists of the complete impression of a 1.7 cm × 0.8 cm seal with two symmetrical signs, perhaps *ḏd*, flanked by two *nfr* signs. On the back are the impressions of papyrus.

WG Sealing 114: this sealing, 1.9 cm × 1.6 cm × 0.55 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the fragmentary impression of a seal with symmetrical scrolls. On the back are the impressions of papyrus and its fastening.

WG Sealing 115: this sealing, 2 cm × 0.9 cm × 0.6 cm, was found in excavation unit WG 61, E4-5, SU46. It consists of the fragmentary impressions of two seals, the first one with a continuous pattern of small scrolls, and the second one with a line of unconnected small double scrolls. On the back are the impressions of string.

WG Sealing 116: this sealing, 2.8 cm × 1.1 cm × 0.6 cm, was found in excavation unit WG 61, D2, SU45. It consists of the almost complete impression of a ca. 1.1 cm × 0.8 cm seal with a very badly preserved, apparently asymmetrical, pattern of scrolls. On the back are the impressions of papyrus.

WG Sealing 117: this sealing, 3.2 cm × 1.25 cm × 0.9 cm, was found in excavation unit WG 61, D2, SU45. It consists of the fragmentary impression of a seal framed by a pattern of big scrolls. On the back are the impressions of string.

WG Sealing 118: this sealing, 2 cm × 1.4 cm × 0.7 cm, was found between excavation units WG 61, D2-3 and WG 65, A-B2-3, SU45. It consists of a completely damaged impression of a seal. On the back are the impressions of fabric and string.

WG Sealing 119: this sealing, 2.5 cm × 1.8 cm × 0.55 cm, was found between excavation units WG 61, D2-3 and WG 65, A-B2-3, SU45. It consists of a fragmentary impression of a small oval seal with scroll pattern. On the back are the impressions of fabric and string. The shape of the sealing suggests that it was originally sealing a flask closed with fabric.

WG Sealing 120 (Figure 197 G): this sealing, 4.2 cm × 1.8 cm × 0.6 cm, was found in excavation unit WG 61, D3, SU45. It consists of a complete impression of a small 1.6 cm × 1 cm oval seal with a scroll pattern framing a *nfr* sign, with two *nb* signs on top and under it. On the back are the impressions of papyrus and its fastening.

WG Sealing 121: this sealing, 3 cm × 1.5 cm × 1.2 cm, was found in excavation unit WG 61, D-E2-3, SU19. It consists of a completely damaged seal impression. On the back are the impressions of a peg and string, suggesting that it may have sealed a box.

WG Sealing 122: this sealing, 3.5 cm × 2.5 cm × 1.4 cm, was found in excavation unit WG 61, D-E2-3, SU19. It consists of a badly damaged seal impression framed by a scroll pattern. On the back are the impressions of linen and string.

WG Sealing 123 (Figure 196 I): this sealing, 3.8 cm × 1.5 cm × 0.6 cm, was found between excavation units WG 61, A2-3 and WG 65, D-E2-3, SU19. It consists of an almost complete impression of an oval seal with a circle in the center and two lines departing from it along the main axis of the seal, all framed by a scroll pattern. On the back are the impressions of papyrus and its fastening.

WG Sealing 124 (Figure 198 A): this sealing, 4.6 cm × 1.9 cm × 0.6 cm, was found in excavation unit WG 61, B-C2-3, SU19. It consists of a complete impression of a 1.9 cm × 1.1 cm oval seal with the *ʿnḫ* and *nfr* signs along the main axis of the seal framed by a scroll pattern. On the back are the impressions of papyrus and its fastening.

WG Sealing 125: this sealing, 3.4 cm × 1.5 cm × 0.6 cm, was found in excavation unit WG 65, D-E4, SU32. It consists of an impression of the same seal as that of WG Sealing 124. On the back are the impressions of papyrus and its fastening.

WG Sealing 126 (Figure 198 B): this sealing, 2.6 cm × 2.3 cm × 0.8 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of the partially preserved impression of two different seals: the first with large scrolls framing the signs …*n niwt rsy*, …of the southern city (Fig. 197 H), and the second one with an *ʿnḫ* sign framed by a continuous pattern of scrolls delimiting the seal (Fig. 197 I). On the back are the impressions of a peg and string, suggesting that it may have sealed a box.

WG Sealing 127 (Figure 197 L): this sealing, 2.3 cm × 2.2 cm × 0.75 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of the partially preserved impression of a seal with small scrolls framing the signs *imy-r pr* … [*sn*]*wsrt*…, Steward … Senusret. On the concave back are the impressions of wood, while a hole for a passing rope is also seen.

WG Sealing 128: this sealing, 3.2 cm × 2.5 cm × 1.8 cm, was found in excavation unit WG 32, SU46 (Cave 6, entrance). It consists of the partially preserved impression of a small 1.4 cm × 1 cm seal with scrolls framing a *ḏd* sign on the main axis of the seal. On the back are the impressions of a peg and string, suggesting that it may have sealed a box.

WG Sealing 129 (Figure 197 M): this sealing, 2.5 cm × 1.7 cm × 0.9 cm, was found in excavation unit WG 31, SU1. It consists of the partially preserved impression of a small seal with two connected scrolls at the base, and, above them, the partially preserved lower part of a pr or similar sign and a part of a circular sign, perhaps a *ẖ* or a *niwt* (city). On the back are the impressions of papyrus and its fastening.

WG Sealing 130: this sealing, 2.7 cm × 2.4 cm × 0.7 cm, was found in excavation unit WG 32, A5, SU10. It consists of an almost circular sealing without seal impression. On the back are the impressions of a wood, suggesting that it may have sealed a box.

WG Sealing 131: this fragment of depurated clay for sealing with just very few some mineral and organic inclusions, 3.3 cm × 2.9 cm × 2.3 cm, was found in excavation unit WG 32, C5, SU25.

WG Sealing 132: this fragment of sealing, 0.9 cm × 0.7 cm × 0.5 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of big scrolls, possibly delimiting the seal impression.

WG Sealing 133: this fragment of sealing, 2.4 cm × 2.4 cm × 0.7 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of big scrolls, possibly delimiting the seal impression. It has a triangular section and on two sides the impressions of strings and of wood occur, suggesting that it may have sealed the peg of a box. Traces of white powder occurs on the area with seal impression.

WG Sealing 134: this fragment of sealing, 2.5 cm × 1.9 cm × 0.8 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of big scrolls, possibly delimiting the seal impression. It has a triangular section and on two sides the impressions of strings and of wood occur, suggesting that it may have sealed the peg of a box. Traces of white powder occurs on the area with seal impression.

WG Sealing 135: this fragment of sealing, 1.6 cm × 1.2 cm × 0.7 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of scrolls, possibly delimiting the seal impression. It has a triangular section and on two sides the impressions of strings and of wood occur, suggesting that it may have sealed the peg of a box.

WG Sealing 136: this fragment of sealing, 1.6 cm × 1.3 cm × 0.5 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of scrolls, possibly delimiting the impression of a small oval seal. It has traces of impressions of string and fabric.

WG Sealing 137: this fragment of sealing, 1.9 cm × 1.2 cm × 0.5 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved pattern of scrolls, possibly filling the impression of a small oval seal. It has traces of impressions of strings.

WG Sealing 138: twenty four fragments of depurated clay, max. dimensions 5.5 cm × 5 cm × 2.2 cm, with traces of dermatoglyphs, from WG 32, C5, SU28.

WG Sealing 139: this fragment of sealing, 1.2 cm × 1.2 cm × 0.5 cm, was found in excavation unit WG 32, C5, SU28 and is characterized by the partially preserved impression of an oval seal with sign characterized by a loop, possibly an *ʿnḫ* or a *ḫtm* sign. Indeed, the dimensions of the seal, suggested by the surviving part of the line delimiting it and the dimensions of the fragmentary sing itself suggest that it may have been an institutional seal.

WG Sealing 140: flat fragment of a sealing, 1.5 cm × 1.5 cm × 0.3 cm, with impressions of fabric on a side, from WG 32, C5, SU28.

WG Sealing 141: fragment of a sealing, 1.3 cm × 1.2 cm × 0.6 cm, with impressions of strings on a side, from WG 32, C5, SU28.

WG Sealing 142: fragment of a sealing, 2.3 cm × 1.3 cm × 0.7 cm, with impressions of strings and wood on a side, from WG 32, C5, SU28. The triangular section suggests that it may have been used to seal the peg of a box.

WG Sealing 143: rectangular fragment of a sealing, 1.8 cm × 1.2 cm × 0.65 cm, with impressions of string on a side, from WG 32, C5, SU28.

WG Sealing 144: fragment of a sealing, 1.1 cm × 0.8 cm × 0.3 cm, with impressions of strings and wood on a side, from WG 32, C5, SU28. The triangular section suggests that it may have been used to seal the peg of a box.

WG Sealing 145: fragment of a sealing, 3.7 cm × 2.7 cm × 1.8 cm, with impressions of a seal framed by a scroll pattern, and on the other side impressions strings, a peg and wood, from WG 32, C5, SU28. The triangular section confirms that it may have been used to seal the peg of a box.

WG Sealing 146: two fragments of a sealing, 1.6 cm × 1.5 cm × 1.4 cm and 2.8 cm × 1.4 cm × 0.9 cm, with impressions of leather on a side, from WG 32, C5, SU25. They may have been used to seal a leather bag.

WG Sealing 147: fragment of a sealing, 2 cm × 1.7 cm × 0.8 cm, with impressions of a seal framed by a scroll pattern from WG 32, B4, SU10.

WG Sealing 148: fragment of a rounded sealing of a stopper of a jar, 7.3 cm × 6.7 cm × 1.8 cm, consisting of depurated clay mixed with vegetal inclusions from WG 32, A5-B5, SU25/10.

WG Sealing 149: fragment of a sealing, 1.6 cm × 0.9 cm × 0.35 cm, with impressions of a seal framed by a pattern of large scrolls, and on the other side impressions strings, from WG 32, B5, SU25.

WG Sealing 150: fragments of three rounded sealing of stoppers of a jars, 2.8 cm × 1.7 cm × 1.1 cm, 5.9 cm × 3.2 cm × 2.7 cm and 4.7 cm × 4.6 cm × 0.73 cm, consisting of depurated clay mixed with vegetal inclusions from WG 32, A5-B5, SU25/10.

WG Sealing 151: twenty one fragments of depurated clay, max. dimensions 4.4 cm × 3.7 cm × 2.4 cm, from WG 32, B5, SU25.

WG Sealing 152: thirty five fragments of sealings, max. dimensions 2.6 cm × 2.4 cm × 0.9 cm, with impressions of multiple and parallel strings from WG 32, B5, SU25.

WG Sealing 153: fragment of a sealing, 2.5 cm × 2.4 cm × 0.4 cm, with damaged seal impression on one side and of strings and wood on the other, from WG 32, B5, SU25. Its triangular shape suggests that it may have sealed the peg of a box.

WG Sealing 154: five fragments of sealings, max. dimensions 2.6 cm × 2.4 cm × 0.5 cm, with impressions of multiple and parallel strings and wood from WG 32, B5, SU25.

WG Sealing 155: three fragments of sealings, max. dimensions 3 cm × 2.5 cm × 0.8 cm, with impressions of multiple and parallel strings and fabric from WG 32, B5, SU25.

WG Sealing 156: two fragments of sealings, max. dimensions 2.3 cm × 1.3 cm × 1 cm, with impressions of leather on one side, from WG 32, B5, SU25.

WG Sealing 157: fragment of a sealing, 3.2 cm × 2.7 cm × 1.1 cm, with damaged impression of a large institutional seal framed by a scroll pattern and of a smaller oval personal seal on one side and of strings and wood on the other, from WG 32, B5, SU25. Its triangular shape suggests that it may have sealed the peg of a box.

WG Sealing 158: fragment of a sealing, 2.3 cm × 2.2 cm × 0.6 cm, with impressions of strings on both sides associated on a side with impressions of fabrics, from WG 32, C4, SU1.

WG Sealing 159: fragment of a sealing, 2.2 cm × 2.2 cm × 0.75 cm, with impressions of wood and small pieces of plaster of a box on a side and badly damaged impression of a seal on the other, from WG 32, C5, SU25. The triangular sections suggests it may have sealed the peg of a box.

WG Sealing 160 (Figure 198 C): fragment of a sealing, 2.3 cm × 1 cm × 0.5 cm, with impressions of a seal without scrolls and at least one, perhaps two *kꜣ* signs under other fragmentary signs on one side and of fabric on the other, from WG 32, C5, SU25. No clear impression occurs on the back.

WG Sealing 161: fragment of a sealing, 2 cm × 1.4 cm × 0.6 cm, from WG 32, C5, SU25. It is characterized by impressions of a seal with the sing *nb* and on top of it the heraldic plants of Upper and Lower Egypt as in WG Sealing 166. On the other side impressions of strings and possibly wood. Its triangular section may suggest that it was used to seal the peg of a box.

WG Sealing 162: fragment of a sealing, 3 cm × 1.8 cm × 1.1 cm, characterized by the impression of a big institutional seal framed by scrolls and, on the other side, of strings and wood, from WG 32, C5, SU25. Its triangular section may suggest that it was used to seal the peg of a box.

WG Sealing 163: fragment of a sealing, 2.7 cm × 2.4 cm × 1.5 cm, from WG 32, C 5, SU25, with the impression of wood.

WG Sealing 164 (Figure 197 N): fragment of a sealing, 2 cm × 1.3 cm × 0.6 cm, from WG 32, C5, SU25, with impressions of an oval seal with the sign *t* and, under it *nbw*, while on the right a *mr* sign may be recognized. On the other side impressions of strings occur. Its shape may suggest that it was sealing the peg of a box.

WG Sealing 165: fragment of a sealing, 2 cm × 1.3 cm × 0.5 cm, from WG 32, C5, SU25, with impressions of a small seal with a scroll pattern with some dermatoglyphs and on the opposite side of some strings.

WG Sealing 166: fragment of a sealing, 1.6 cm × 1.3 cm × 0.5 cm, from WG 32, C5, SU25, with impression of a small seal with the heraldic plants of Upper and Lower Egypt in the middle, whose complete decoration can be reconstructed also on the basis of Sealings 161 and 173 (Figure 197 O). On the opposite side impressions of multiple strings occur.

WG Sealing 167: fragment of sealing, 2 cm × 1.1 cm × 0.9 cm, from WG 32, C5, SU25, with impressions of an oval seal with the sign *šn* or *ḥ* on top of a sign *š*. On the back of the sealing, the impressions of strings occur.

WG Sealing 168: fragment of sealing, 2 cm × 1.8 cm × 0.8 cm, from WG 32, C5, SU25, with the possible impression of a sign *ỉmy-r* perhaps followed by a corner of a squared sign, perhaps a *pr* sign, framed by big scrolls suggesting that this was an institutional seal. On the back are impressions of wood.

WG Sealing 169 (Figure 198 D): fragment of a sealing, 1.8 cm × 1.1 cm × 0.8 cm, from WG 32, C5, SU25, with the impression of a small personal seal with scroll pattern and, on the opposite side, impressions of wood. The shape of the sealing suggests that it may have sealed the peg of a box.

WG Sealing 170 (Figure 198 E): fragment of a sealing, 1.7 cm × 1.2 cm × 0.5 cm, from WG 32, C5, SU25, characterized by the partially preserved impression of a small oval seal with a scroll pattern and some dermatoglyphs. On the back the impression of two parallel strings occurs.

WG Sealing 171: fragment of a sealing, 2.9 cm × 1.8 cm × 0.9 cm, from WG 32, C5, SU25, characterized by the same impression of a personal oval seal of sealing WG Sealing 24. On the back impressions of knots and wood occur. The shape of the sealing may suggest that it was used to seal the peg of a box.

WG Sealing 172: fragment of a sealing, 4.5 cm × 3.6 cm × 0.7 cm, from WG 32, C5, SU25, characterized by the impression of an oval seal with some badly preserved signs. On the back impressions of a basket.

WG Sealing 173: fragment of a sealing, 1.8 cm × 1.15 cm × 0.8 cm, with the impression of the same seal of WG Sealing 166, from WG 32, C5, SU25. Irregular impressions on the back.

WG Sealing 174: fragment of a sealing, 1.6 cm × 1.2 cm × 0.6 cm, with the badly preserved impression of a small oval seal, from WG 32, B4, SU10. Impression of a string on the back.

WG Sealing 175: fragment of a sealing, 3 cm × 2.3 cm × 1.9 cm, with the very fragmentary impression of a seal with a scroll pattern, from WG 32, C5, SU28. On the back, impressions of strings occur.

WG Sealing 176: fragment of a sealing, 1.9 cm × 1.35 cm × 0.5 cm, with very badly preserved impression of a seal, from WG 32, B4, SU10. On the back there is the impression of two parallel strings.

WG Sealing 177: fragment of a sealing, 1.8 cm × 1.3cm × 0.35 cm, from WG 32, B4, SU10, characterized by impressions of strings on the back.

WG Sealing 178: fragment of a sealing, 1.8 cm × 1.3 cm × 0.8 cm, with the impression of strings and wood on the back from WG 32, B4, SU10.

WG Sealing 179: fragment of a sealing, 3 cm × 1.8 cm × 0.8 cm, characterized by a badly damaged impression of a seal and with the impressions of a string and leather on the back, from WG 32, C5, SU25.

WG Sealing 180: fragment of a sealing, 1.9 cm × 1 cm × 0.75 cm, with the very fragmentary impression of a seal and on the back the impression of two parallel strings, from WG 32, B5, SU10.

WG Sealing 181: fragment of a sealing, 2.3 cm × 1.3 cm × 0.85 cm, characterized by the impression of seal whose only a part of a sing, perhaps an *ʿnḫ*, can be seen, from WG 32, B5, SU10. On the back, possible impression of basket can be perceived.

WG Sealing 182: fragment of a sealing, 1.6 cm × 1 cm × 0.4 cm, with part of the impression of a seal with a scroll, from WG 32, C5, SU25. On the back, the impression of a string occurs.

WG Sealing 183 (Figure 197 P): fragment of a sealing, 1.52 cm × 1.1 cm × 0.5 cm, from WG 32, C4, SU1, with the partially preserved impression of a small seal delimited by a pattern of flatted scrolls where the sign *wḥm* occurs. On the back, the impressions of strings occur.

WG Sealing 184: fragment of a sealing, 2.8 cm × 1.8 cm × 0.7 cm, from WG 32, C4, SU25, characterized by the badly preserved impression of a seal with the signs *mr*, *nỉwt* and perhaps a lacunous *pr* sign (Figure 197 Q). On the back, the impression of a string and fabric occurs.

WG Sealing 185: six fragments of depurated clay for sealing, apparently not used, max. dimensions 2.9 cm × 1.7 cm × 1.4 cm, from WG 32, C4, SU25.

WG Sealing 186: fragment of a sealing, 3 cm × 2 cm × 1 cm, characterized by the impression of a squared institutional seal bordered by a scroll pattern, from WG 32, C4, SU25. On the back, impressions of three parallel strings occur.

WG Sealing 187: fragment of a sealing, 3.5 cm × 1.6 cm × 0.9 cm, characterized by the impression of a small oval seal with a badly preserved and lacunous scroll pattern from WG 32, C4, SU25. On the opposite side, the impressions of three parallel strings occur.

WG Sealing 188: fragment of a sealing, 2.7 cm × 1.4 cm × 0.7 cm, characterized by the impression of a large institutional seal framed by a big scrolls pattern from WG 32, C4, SU25. On the back impressions of strings occur.

WG Sealing 189: fragment of a sealing, 2.5 cm × 1.5 cm × 0.7 cm, with the badly preserved impression of a seal from WG 32, C4, SU25. On the back the impression of two parallel strings and fabrics.

WG Sealing 190: fragment of a sealing, 2.4 cm × 1.4 cm × 0.75 cm, with the badly preserved impression of a large institutional seal framed by big scroll pattern from WG 32, C4, SU25. On the back the impression of three parallel strings occur.

WG Sealing 191: fragment of a sealing, 2 cm × 1.3 cm × 0.8 cm, with the partially preserved impression of an oval seal with the same pattern of sealing WG Sealing 24 from WG 32, C4, SU25. On the back the impressions of three parallel strings occur.

WG Sealing 192: fragment of a sealing, 2.2 cm × 1.7 cm × 0.5 cm, with the badly preserved and lacunous impression of a seal from WG 32, C4, SU25. On the opposite side the impressions of five parallel strings occur.

WG Sealing 193: fragment of a sealing, 2 cm × 1.2 cm × 0.75 cm, with the badly preserved and lacunous impression of a seal from WG 32, C4, SU25. On the opposite side the impressions of strings.

WG Sealing 194: fragment of a sealing, 1.7 cm × 1.5 cm × 0.5 cm, with the partially preserved impression of a seal characterized by a single *pr* sign from WG 32, C4, SU25. On the back, the impressions of two parallel strings occur.

WG Sealing 195: fragment of a sealing, 1.7 cm × 1.7 cm × 0.8 cm, with the badly preserved and very lacunous impression of a small oval seal with scroll pattern from WG 32, C4, SU25. On the opposite side the impression of strings occur.

WG Sealing 196: fragment of a sealing, 2.3 cm × 1.2 cm × 0.6 cm, with the very lacunous impression of an oval seal with possible scroll pattern from WG 32, C4, SU25. On the other side impressions of strings occur.

WG Sealing 197: fragment of a sealing, 1.4 cm × 1 cm × 0.7 cm, with the partially preserved impression of a large seal bordered by a pattern of big scrolls from WG 32, C4, SU25. On the back the impression of two parallel strings occurs.

WG Sealing 198: fragment of a sealing, 1.3 cm × 1 cm × 0.3 cm, with the partially preserved impression of a seal with small scrolls from WG 32, C4, SU25. On the opposite side the impression of two parallel strings occurs.

WG Sealing 199: fragment of a sealing, 1.6 cm × 1.2 cm × 0.8 cm, with the very lacunous impression of a seal with possible scroll pattern from WG 32, C4, SU25. On the other side impressions of strings occur.

WG Sealing 200: fragment of a sealing, 2.5 cm × 2 cm × 1.1 cm, with the partially preserved impression of an oval seal with the same pattern of sealing WG Sealing 24, from WG 32, C4, SU25. On the back the impressions of strings and wood occur. The triangular section of the sealing suggests that it may have been used to seal the peg of a box.

WG Sealing 201: fragment of a sealing, 3 cm × 2.2 cm × 0.75 cm, with the partially preserved impression of an oval seal with the same pattern of sealing WG Sealing 24, from WG 32, C4, SU25. On the back the impressions of strings and wood occur. The triangular section of the sealing suggests that it may have been used to seal the peg of a box.

WG Sealing 202: four fragments of sealing, max. dimensions 3.2 cm × 1.4 cm × 0.8 cm, from WG 32, C4, SU25. On the back the impressions of wood and strings occur.

WG Sealing 203: fragment of a sealing, 1.7 cm × 1.7 cm × 1 cm, with completely damaged impression of a small oval seal, from WG 32, C4, SU25. On the back the impressions of strings. The triangular section of the sealing suggests that it may have originally sealed the peg of a wooden box.

WG Sealing 204: six fragments of depurated for sealing, apparently not used, max. dimensions 3.2 cm × 2.9 cm × 1.6 cm, from WG 32, C5, SU25.

WG Sealing 205: four fragments of sealings for vessel, consisting of depurated clay mixed with vegetal materials, max. dimensions 4.4 cm × 2.7 cm × 1.7 cm, from WG 32, C5, SU25.

WG Sealing 206 (Figure 197 R): fragment of sealing, 1.9 cm × 1.3 cm × 0.4 cm, with the partially preserved impression of a seal with the heraldic plants of Upper and Lower Egypt and the *smꜣ tꜣwy*, from WG 32, C5, SU25. On the back, the impressions o parallel strings occur.

WG Sealing 207: fragment of sealing, 1.7 cm × 1.3 cm × 1.1 cm, with badly preserved impression of a seal, from WG 32, C5, SU25. On the back impressions of strings occur.

WG Sealing 208 (Figure 197 S): fragment of sealing, 1.4 cm × 1.1 cm × 0.7 cm, with impression of a seal characterized by a scroll pattern framing a *ꜥnḫ* and a *nfr* sign, from WG 32, C5, SU25. On the back impressions of parallel strings occur.

WG Sealing 209: fragment of a sealing, 1.9 cm × 1 cm × 0.4 cm, with impression of a seal with very few and lacunous traces of signs, from WG 32, C5, SU25. On the opposite side the impressions of two parallel strings occur.

WG Sealing 210: fragment of a sealing, 2 cm × 1.6 cm × 0.5 cm, with impression of a seal framed by big scrolls, from WG 32, C5, SU25. On the opposite side there are the impressions of three parallel strings.

WG Sealing 211: fragment of a sealing, 2.2 cm × 1.8 cm × 0.8 cm, with impression of an oval seal with some very fragmentary signs, from WG 32, C5, SU25. On the back the impression of strings occurs.

WG Sealing 212: fragment of a sealing, 1.2 cm × 0.9 cm × 0.3 cm, with impression of a seal with some very fragmentary signs, from WG 32, C5, SU25. On the back the impression of a string occurs.

WG Sealing 213: fragment of a sealing, 1.6 cm × 0.8 cm × 0.3 cm, with impression of a seal framed by big scrolls, from WG 32, C5, SU25. On the opposite side the impression of three parallel strings occurs.

WG Sealing 214: fragment of a sealing, 2 cm × 1.1 cm × 0.6 cm, with impression of a seal framed by big scrolls, from WG 32, C5, SU25. On the opposite side the impression of two parallel strings occurs.

WG Sealing 215: eleven fragments of sealings, max. dimensions 2.2 cm × 1.7 cm × 1.4 cm, with impressions of strings and fabrics and whose shape suggests that they may have been part of sealings of vessels, from WG 32, C5, SU25.

WG Sealing 216: fragment of sealing, 2.5 cm × 1.5 cm × 0.6, with impression of a small oval seal framed by a pattern of small flat scrolls, from WG 32, C5, SU25. On the opposite side, impressions of strings and fabrics occur. The shape of the sealing suggests that it may have been part of a sealing of a vessel.

WG Sealing 217: fragment of a sealing, 1.8 cm × 1.8 cm × 0.7 cm, with a badly preserved and lacunous impression of a seal, from WG 32, C5, SU25. On the back, the impression of a fabric occurs.

WG Sealing 218: fragment of a sealing, 1.8 cm × 1.8 cm × 0.8 cm, with the impression of a seal characterized by scroll pattern, from WG 32, C5, SU25. On the back, the impression of a fabric occurs.

WG Sealing 219: five fragments of sealings, max. dimensions 2-8 cm × 2.2 cm × 1.3 cm, with the impression of leather and strings, possibly originally used to seal leather bags, from WG 32, C5, SU25. On a single case also traces of a seal with scroll pattern occur.

WG Sealing 220 (Figure 197 T): fragment of a sealing, 2.6 cm × 2.3 cm × 1.3 cm, with the impression of a seal with two *ꜥnḫ* signs flanking a *nfr* sign and, underneath, a fragmentary horizontal sign perhaps a *mn* or a *nbw*, from WG 32, C5, SU25. On the opposite side there are impressions of leather.

WG Sealing 221: eighteen fragments of sealings with impressions of strings and wood from WG 32, C5, SU25. A single fragment, 2.2 cm × 1.2 cm × 0.9 cm, is also characterized by the badly preserved and lacunous impression of a seal.

WG Sealing 222: fragment of a sealing, 1.2 cm × 1.2 cm × 0.9 cm, with impression of an oval seal with the same pattern of sealing WG Sealing 24, from WG 32, C5, SU25. On the back the impressions of two parallel strings and wood occur. The triangular section of the sealing suggests that it may have been used to seal the peg of a box.

WG Sealing 223: a fragment of sealing, 3 cm × 2.1 cm 1.2 cm, with impressions of fabrics and ropes and shape suggesting that it may have sealed a vessel, from WG 32, C5, SU25.

WG Sealing 224: a fragment of sealing, 1.6 cm × 1.3 cm × 0.5 cm, with impression of a seal characterized by a scroll pattern from WG 32, C5, SU25.

WG Sealing 225 (Figure 197 U): fragment of a sealing, 1.8 cm × 1.4 cm × 0.7 cm, with impression of an oval seal characterized by the sign *ḫtm*, "seal", from WG 32; C5, SU25. On the flat back the impression of a single straight string occur.

WG Sealing 226: fragment of sealing, 2 cm × 1.6 cm × 1.5 cm, with a very badly preserved impressions of a seal and, on the back, impressions of wood, from WG 32, B4, SU25.

WG Sealing 227: fragment of sealing, 1.2 cm × 1 cm × 0.5 cm, with impressions of strings on the back from WG 32, B4, SU25.

WG Sealing 228: fragment of sealing, 3.2 cm × 1.1 cm × 1 cm, with a badly damaged impression of a seal from WG 32, B4, SU25. On the back impressions of strings and wood occur.

WG Sealing 229: fragment of sealing, 2.3 cm × 1.4 cm × 1.2 cm, with impressions of strings from WG 32, B4, SU25.

WG Sealing 230: fragment of a sealing, 1.7 cm × 1 cm × 0.5 cm, with a partially preserved impression of a seal framed by a pattern of big scrolls from WG 32, B4, SU25. On the back the impression of a fabric occurs.

WG Sealing 231: fragment of a sealing, 4.8 cm × 2.3 cm × 1.4 cm, very rich in organic inclusions and whose shape suggests that it may have been a jar stopper from WG 32, A4, SU31.

WG Sealing 232: fragment of a sealing, 2.7 cm × 2.4 cm × 1.6 cm, with few remains of a seal impression from WG 32, A4, SU31. On the back, the impressions of strings and wood occur.

WG Sealing 233: fragment of sealing, 1.1 cm × 0.9 cm × 0.4 cm, with very badly preserved impression of a seal from WG 32, A4, SU31. On the back the impressions of parallel strings occur.

WG Sealing 234: fragment of a sealing, 2.2 cm × 1.2 cm × 0.5 cm, with impression of papyrus on the back from WG 32, A4, SU31.

WG Sealing 235 (Figure 197 V): fragment of a sealing, 1.35 cm × 1.1 cm × 0.45 cm, with fragmentary impression of an oval seal with, on an upper register a partially preserved sign, a *dšrt* crown and an *ʿnḫ* sing, on the lower register a fragmentary bird, possibly a *w* sign, facing left, from WG 32, A4, SU31. The *ʿnḫ* sing and the red crown are characterized by a distinctive angular shape. On the opposite side, impressions of strings occur.

WG Sealing 236: fragment of sealing, 3.7 cm × 2.1 cm × 1.3 cm, with fragmentary impressions of a badly preserved small oval seal and o a larger seal framed by a large scroll pattern, from WG 32, A4, SU31. The impressions of strings and wood and the triangular section suggest that it may have sealed the peg of a wooden box.

WG Sealing 237: fragment of a sealing, 3.5 cm × 2 cm × 0.4 cm, with fragmentary impression of a seal with a scroll pattern from WG 32, A4, SU31. On the opposite side impressions of strings occur.

WG Sealing 238: fragment of a sealing, 2.2 cm × 1.7 cm × 1 cm, with the partially preserved impression of a seal delimited by a scroll patter from WG 32, A4, SU31. On the back, the impression of a folded fabric occurs.

WG Sealing 239: fragment of a sealing, 2.8 cm × 2.5 cm × 0.8 cm, with the partially preserved impression of a big seal bordered by a scroll pattern from WG 32, A4, SU31. On the back, the impression of papyrus occurs.

WG Sealing 240: fragment of a sealing, 3.3 cm × 2.7 cm × 0.8 cm, with the badly preserved impression of a large seal bordered by a scroll pattern and whose few fragmentary signs also survive from WG 32, A4, SU31. On the opposite side, the impressions of strings occur.

WG Sealing 241(Figure 197 W): fragment of a sealing, 2.7 cm × 2.2 cm × 0.5 cm, with the fragmentary impression of a big seal framed by scrolls and three signs, an horizontal one, perhaps a *š*, a bird, perhaps a *wr* sign, and a human head, perhaps a *tp* sign, facing left from WG 32, A4, SU31. On the back, the impression of a fabric occurs.

WG Sealing 242 (Figure 198 F): fragment of a sealing, 1.9 cm × 0.7 cm × 0.5 cm, with the fragmentary impression of a seal bordered with scrolls and characterized by the sing of the granary *šnwt* from WG 32, A4, SU31. On the back the impression of strings occurs.

WG Sealing 243 (Figure 197 Z): fragment of a sealing, 1.9 cm × 1.9 cm × 0.9 cm, with the impression of a big seal delimited by the scroll pattern and characterized by the partially preserved title *ỉmy-r pr* from WG 32, A4, SU31. On the opposite side the impression of a fabric occurs.

WG Sealing 244 (Figure 197 X): fragment of a sealing, 2.5 cm × 1.7 cm × 0.7 cm, with the impression of the same big seal delimited by scrolls of WG Sealing 243 and characterized by the partially preserved title *ỉmy-r pr*, Steward, followed by a X shaped sign, a circle and two vertical strokes from WG 32, A4, SU31. It reminds of the same title followed by a X shaped sign occurring on Sealing 67, but the seal is certainly not the same. On the back, the impression of a wooden surface occurs.

WG Sealing 245: fragment of a sealing, 2.8 cm × 2.2 cm × 0.8 cm, with the badly preserved impression of a big seal bordered by a scroll pattern from WG 32, A4, SU31. On the opposite side, the impression of a folded fabric occurs.

WG Sealing 246: fragments of four sealings, max. dimensions 2.7 cm × 2.2 cm × 0.8 cm, with badly preserved impressions of seals from WG 32, A4, SU31. On their back the impressions of fabrics occur.

WG Sealing 247: fragments of two sealings, max. dimensions 2 cm × 2 cm × 1 cm, with on the back impressions of wood from WG 32, A4, SU31.

WG Sealing 248: fragment of a sealing, 2 cm × 1.2 cm × 0.8 cm, with impression of a seal delimited by a pattern of flat small scrolls from WG 32, A4, SU31. No preserved impressions occur on the back.

WG 249: two fragments of two sealings, max. dimensions 2.5 cm × 1.7 cm × 0.9 cm, with impressions of the same seal of WG Sealing 24 from WG 32, A4, SU31. On the opposite sides they are characterized by the impressions of strings in one case, and wood in the other.

WG Sealing 250: a fragmentary sealing, 1.5 cm × 1.4 cm × 0.5 cm, with badly preserved impression of a small seal bordered by a scroll pattern from WG 32, A4, SU31. It is characterized by a passing hole for a string and impressions of papyrus on the opposite side.

WG Sealing 251: a fragmentary sealing, 1,7 cm × 1.4 cm × 0.5 cm, with the partially preserved impression of a seal with inscription …n *nỉwt rsy* similar to the one characterizing WG Sealing 126, from WG 32, A4, SU31, but the seal does not seem to be the same. On the back, impression of strings occur.

WG Sealing 252: fragment of a sealing, 2.2 cm × 1.7 cm × 0.9 cm, with the partially preserved impression of a small oval seal characterized by a barely visible scroll pattern from WG 32, A4, SU31. On the opposite side no impressions are preserved.

WG Sealing 253: fragment of a sealing, 3.7 cm × 3 cm × 1.5 cm, with badly preserved impression of a seal from WG 32, A4, SU31. On the back impressions of fabric occur.

WG Sealing 254: fragment of a sealing, 1.8 cm × 1 cm × 0.6 cm, with the fragmentary impression of a seal characterized by the clump of papyrus sign and other badly preserved signs from WG 32, A4, SU31. On the back impressions of strings occur.

WG Sealing 255: four fragments of sealings, max. dimensions 4 cm × 2.6 cm × 1.4 cm, whose shape suggests that they may have been used to seal jars from WG 32, A4, SU31. On the back impressions of fabric occur.

WG Sealing 256 (Figure 198 G): a fragmentary sealing, 1.4 cm × 1.3 cm × 0.5 cm, characterized by the partially preserved impression of a seal delimited by a big scroll pattern and the inscription *ḫtm n šnwt*, "seal of the granary", from WG 32 A3-B4, box 21, SU10. On the opposite side the impressions of string occur.

WG Sealing 257: a fragmentary clay jar stopper, 4.6 cm × 3.4 cm × 3.2 cm, characterized by the occurrence of vegetal inclusions, from WG 32, A3, SU23.

WG Sealing 258: a fragmentary sealing, 2.5 cm × 2.5 cm × 1.8 cm, characterized by the impression of a peg and strings on the back from WG 32, B4, SU25.

WG Sealing 259: a fragment of sealing, 2.3 cm × 2.7 cm × 0.8 cm, characterized by the impressions of strings on the back from WG 32, B4, SU25.

WG Sealing 260: a fragment of clay stopper of a jar, 3.7 cm × 2.9 cm × 1.7-0.5 cm, characterized by the occurrence of vegetal inclusion, from WG 32, C4, SU25.

WG Sealing 261: fragment of a sealing, 2 cm × 1.5 cm × 0.5 cm, characterized by the impression of a seal delimited by big scrolls and the title *ỉmy-r pr*, possibly the same of WG Sealings 243 and 244, from WG 32, C4, SU25. On the opposite side, impressions of strings and fabric.

WG Sealing 262: a fragmentary sealing, 2 cm × 2 cm × 2 cm, with the impression of a seal framed by big scroll pattern and the partially preserved word *pr-ḥḏ*, "treasury", from WG 32, C4, SU25. The shape of the sealing and the impressions of strings on the back suggest that it may have sealed a wooden box.

WG Sealing 263: a fragmentary sealing, 2 cm × 2 cm × 1 cm, with the impression of a seal framed by a big scroll pattern and the sings *mr* and perhaps *kꜣ* (?), from WG 32, C4, SU25. The shape of the sealing and the impressions of strings on the back suggest that it may have sealed a wooden box.

WG Sealing 264 (Figure 198 H): fragment of a sealing, 3.5 cm × 2.2 cm × 1.2 cm, characterized by the impression of seal framed by big scrolls and the *ỉmy-r pr*, from WG 32, C4, SU25. On the opposite side the impressions of strings and wood occur.

WG Sealing 265: fragmentary sealing, 2.5 cm × 1.8 cm × 1.2 cm, with the impression o a seal delimited by a pattern of big scrolls from

WG 32, C4, SU25. On the back the impressions of strings and wood occur. The shape of the sealing suggests that it may have sealed the peg of a wooden box.

WG Sealing 266: fragment of a sealing, 1.8 cm × 1.7 cm × 0.6 cm, characterized by the impressions of strings and wood from WG 32, B4, SU25.

WG Sealing 267: fragment of a rounded clay stopper, diameter 10-12 cm, 3 cm × 1.2-0.4 cm, with impressions of strings and fabric, from WG 32, B4, SU25. Its shape suggests that it was used to seal a jar.

WG Sealing 268: a chunk of depurated clay for sealing, 5 cm × 4 cm × 3 cm, from WG 32, B4, SU25.

WG Sealing 269: twenty-three fragments of depurated clay for sealing, max. dimensions 6.3 cm × 3.6 cm × 1.3 cm, from WG 32, C5, SU25.

WG Sealing 270: seven fragments of sealings, max. dimensions 2.3 cm × 1.7 cm × 0.7 cm, characterized by the impressions of strings from WG 32, C5, SU25.

WG Sealing 271 (Figure 198 I): a fragment of sealing, 1.6 cm × 0.9 cm × 0.7 cm, with the impression of a small oval seal characterized by the sign *nbw*, from WG 32, C5, SU25. On the opposite side the impressions of strings occur.

WG Sealing 272: fragment of a sealing, 2.3 cm × 1.9 cm × 0.4 cm, with the lacunous impression of a seal framed by a big scroll pattern from WG 32, C5, SU25. On the back the impression of strings and a peg suggesting that it may have been use to seal a wooden box.

WG Sealing 273: fragment of a sealing, 2.4 cm × 1.3 cm × 0.9 cm, with the partially preserved impression of a seal without the usual scroll pattern frame from WG 32, C5, SU25. On the back the impressions of strings and fabric occur.

WG Sealing 274: four fragments of sealings, max. dimensions 3.2 cm × 2 cm × 0.9 cm, with the impressions of folded fabrics and strings on the back, from WG 32, C5, SU25.

WG Sealing 275: fragment of a sealing, 3.2 cm × 2.2 cm × 1 cm, with the completely damaged impression of a small oval seal from WG 32, C5, SU25. It is characterized by a passing single string. The shape of the sealing suggests that it was originally used to seal a papyrus.

WG Sealing 276: fragment of a sealing, 1.6 cm × 1.3 cm × 0.6 cm, with the badly damaged impression of a small oval personal seal associated with the impression of a larger seal delimited by a pattern of big scrolls from WG 32, C5, SU25. On the back impressions of strings occur.

WG Sealing 277: fragmentary sealing, 1.6 cm × 0.9 cm × 0.7 cm, with the very lacunous impression of a small seal delimited by a pattern of small flat scrolls from WG 32, C5, SU25. On the opposite side, no impressions occur, but its shape suggests that it may have been used to seal a papyrus.

WG Sealing 278: fragment of a sealing, 1.7 cm × 1.4 cm × 0.6 cm, with the badly damaged and lacunous impression of a small oval seal from WG 32, C5, SU25. On the back impressions of papyrus and a passing string in the sealing.

WG Sealing 279: fragment of a sealing, 2.3 cm × 1.7 cm × 0.6 cm, with impressions of strings on the back from WG 32, C5, SU25.

WG Sealing 280: four fragments of sealings, max. dimensions 2-9 cm × 1.4 cm × 1.25 cm, with impressions of wood, pegs and strings on the back from WG 32, C5, SU25.

WG Sealing 281: fragment of a sealing, 2.2 cm × 1.9 cm × 1.2 cm, with the badly preserved impressions of a small oval seal and a bigger seal from WG 32, C5, SU25. On the opposite side impressions of strings, wood and a peg occur.

WG Sealing 282: two fragments of sealings, max. dimensions 2.6 cm × 1.4 cm × 1.3 cm, with impressions of folded leather on the back from WG 32, C5, SU25.

WG Sealing 283 (Figure 197 Y): a fragment of sealing, 2 cm × 1.8 cm × 0.5 cm, with the only partially preserved impression of a seal framed by a pattern of big scrolls and the word *pr-ḥḏ*, "treasury", from WG 32, C5, SU25. On the opposite side impressions of several parallel strings occur. The shape of the sealing suggests that it may have been used to seal the peg of a wooden box.

WG Sealing 284: a fragment of sealing, 2.15 cm × 1.6 cm × 1 cm, with the partially preserved impression of a seal framed by a pattern of big scrolls and other badly preserved signs, from WG 32, C4, SU10. On the other side impressions of fabric and a string occur.

WG Sealing 285: a fragment of sealing, 2.3 cm × 1.5 cm × 1 cm, with a badly preserved and fragmentary seal impression from WG 32, B5, SU10. On the back no clear impressions are preserved.

WG Sealing 286: a fragment of sealing, 3.9 cm × 2.1 cm × 0.8 cm, with the impression of a seal framed by a pattern of big scrolls from WG 32, B4, SU10. On the opposite side, impressions of fabric and a string occur.

WG Sealing 287: a fragment of sealing, 2.8 cm × 1.2 cm × 0.6 cm, with the badly and partially preserved impression of a seal bordered by a pattern of big scrolls from WG 32, B4, SU10. On the other side the impressions of fabric and a string occur.

WG Sealing 288: a fragment of sealing, 2.5 cm × 2.3 cm × 1.2 cm, with the badly and partially preserved impression of a seal bordered by a pattern of big scrolls from WG 32, B4, SU10. On the opposite side, the impression of wood and strings occurs.

WG Sealing 289 (Fig. 199 A): a fragment of sealing, 3 cm × 2.85 cm × 1.2 cm, with the fragmentary and badly preserved impression of a large institutional seal framed by a pattern of big scrolls and with the words *n nỉwt rsy*, "…of the southern city," perhaps similar to the one of WG Sealings 126 and 251, from WG 32, C5, SU25. On the back, the impression of a flat surface occurs.

WG Sealing 290: a fragment of sealing, 1.5 cm × 1 cm 0.2 cm, with the badly and partially preserved impression of a seal bordered by a pattern of big scrolls from WG 32, C5, SU25. On the back the impressions of strings occur.

WG Sealing 291: a fragment of sealing, 2.1 cm × 2 cm × 0.5 cm, with the lacunous impression of a large institutional seal bordered by a pattern of big scrolls from WG 32, C5, SU25. On the back no clear impressions are preserved.

WG Sealing 292: a fragment of a sealing, 2.1 cm × 2.1 cm 0.5 cm, with the extremely fragmentary and badly preserved impression of a seal bordered with a scroll pattern from WG 32, C5, SU25. On the back the impression of a flat surface occurs.

WG Sealing 293: a fragment of a sealing, 2 cm × 1.8 cm × 1.3 cm, with the badly preserved partially overlapping impression of a larger seal bordered by a pattern of big scrolls and a small seal with traces of small scrolls from WG 32, C5, SU25. On the opposite side no clear impression is preserved.

WG Sealing 294: a fragment of sealing, 2 cm × 1 cm × 0.6 cm, with two badly preserved and very fragmentary impressions of seal from WG 32, C5, SU25. On the back, the impression of strings occur.

WG Sealing 295: a fragment of sealing, 2.4 cm × 1.9 cm × 1.2 cm, with the impression of a seal with two incomplete and badly preserved signs from WG 32, C5, SU25. On the back, no clear impressions are preserved.

WG Sealing 296: fragment of a sealing, 2.5 cm × 1.8 cm × 1.6 cm, with the impression of a small oval seal with badly preserved signs from WG 32, C5, SU25. On the back the impression of a flat wooden surface occurs.

WG Sealing 297: a fragment of sealing, 2.5 cm × 1.5 cm × 1 cm, with the fragmentary impression of a seal framed by a pattern of big scrolls from WG 32, C5, SU25. On the opposite side the possible impression of a string occurs.

WG Sealing 298: a fragment of sealing, 1.1 cm × 0.8 cm × 0.2 cm, with the impression of a seal characterized by a partially preserved sign from WG 32, C5, SU25. On the opposite side the impression of a string occurs.

WG Sealing 299: fragment of a sealing, 1.3 cm × 1.1 cm × 0.6 cm, with the lacunous impression of a seal with a scroll pattern from WG 32, C5, SU25. On the back the possible impression of a string occurs.

WG Sealing 300: a fragment of sealing, 1.8 cm × 0.8 cm × 0.4 cm, with the very fragmentary impression of a seal bordered by a pattern of big scrolls from WG 32, C5, SU25. On the opposite side, the impression of a flat wooden surface occurs.

WG Sealing 301: a fragment of a sealing, 2.1 cm × 1.2 cm × 0.6 cm, with two fragmentary overlapping impressions of seals, at least one characterized by a pattern of big scrolls from WG 32, C5, SU25. On the back the impressions of parallel strings occur.

WG Sealing 302: fragment of sealing, 1.6 cm × 1.1 cm × 0.8 cm, with the fragmentary and badly preserved impression of a seal bordered by a pattern of big scrolls from WG 32, C5, SU25. On the opposite side the impression of a flat wooden surface occurs.

WG Sealing 303: fragment of a sealing, 1.8 cm × 1 cm × 0.8 cm, with the fragmentary and badly preserved impression of a seal from WG 32, C5, SU25. On the back the impression of a string occurs.

WG Sealing 304: a fragment of a sealing, 1.8 cm × 1.6 cm × 0.9 cm, with the badly preserved and very fragmentary impression of a seal from WG 32, C5, SU25. On the opposite side the impression of two parallel strings occurs.

WG Sealing 305: fragment of a sealing, 1.5 cm × 1.2 cm × 0.9 cm, with the fragmentary and badly preserved impression of a small oval seal from WG 32, C5, SU25. On the back the impression of a string occurs.

WG Sealing 306: a fragment of a sealing, 1.5 cm × 1.2 cm × 0.8 cm, with the fragmentary and badly preserved impression of a small oval seal from WG 32, C5, SU25. On the back no clear impressions occur.

WG Sealing 307: fragment of a sealing, 1.7 cm × 1.2 cm × 0.6 cm, with the badly preserved and fragmentary impression of a seal from WG 32, C5, SU25. On the opposite side no clear impressions occur.

WG Sealing 308: fragment of a seal, 1.5 cm × 1 cm × 0.5 cm, with the badly preserved and fragmentary impression of a seal from WG 32, C5, SU25. On the opposite side no clear impressions occur.

WG Sealing 309: a fragment of sealing, 1.8 cm × 1.3 cm × 0.6 cm, with the badly preserved and fragmentary impression of a seal with traces of scrolls from WG 32, C5, SU25. On the opposite side the possible impression of a string occurs.

WG Sealing 310: fragment of a sealing, 1.6 cm × 1.5 cm 0.5 cm, with the with the badly preserved and fragmentary impression of a seal with traces of scrolls from WG 32, C5, SU25. On the opposite side the possible impression of a string occurs.

WG Sealing 311: fragment of a sealing, 2 cm × 1.4 cm × 1 cm, with the badly preserved and fragmentary impression of a seal with traces of scrolls from WG 32, C5, SU25. On the opposite side the possible impression of strings and a flat surface occurs.

WG Sealing 312: fragment of a sealing, 1.3 cm × 0.8 cm × 0.5 cm, with the partially preserved impression of an oval small seal bordered by a pattern of small flat scrolls from WG 32, C5, SU25. On the back the impression of a string occurs.

WG Sealing 313 (Figure 199 B): fragment of a sealing, 2.2 cm × 1.4 cm × 0.4 cm, with the partially preserved impression of an oval small seal characterized by a decorative pattern consisting of interwoven scrolls from WG 32, C5, SU28. On the opposite side the impression of parallel strings occurs.

WG Sealing 314 (Figure 199 C): fragment of a sealing, 2.15 cm × 1.6 cm × 1 cm, with a very partially preserved impression of a seal bordered by large scrolls from WG 32, C4, SU10. On the left a signs with a loop on the top, perhaps the seal *ḫtm* can be seen, perhaps followed by a very schematic *ḥ3t* sign and an animal shaped (the hare, *wn*?) sign. Other very lacunous signs can be seen below. On the back, the impression of fabric and a string occurs.

WG Sealing 315: fragment of a sealing, approx. dimensions 0.9 cm × 0.8 cm × 0.6 cm, with the partially preserved impression of a sealing with a sign *ʿnḫ* and a partially preserved sign *nfr* from WG 32, C5, SU25. Most likely, this is the impression of the same seal occurring on WG Sealing 220. On the opposite side the impressions of parallel strings occur.

WG Sealing 316 (Figure 199 D): fragment of a sealing, approx. dimensions 2.3 cm × 1.9 cm × 0.8 cm, with a very partially preserved impression of a seal bordered by large scrolls from WG 32, C4, SU25. The upper part of the impression is lost, in the remaining lower part the name of *Pwn*[*t*] followed by the determinative of the foreign lands can be seen. On the back, the impression of fabric and a string occurs.

WG Sealing 317 (Figure 199 E): fragment of a sealing, approx. dimensions 1.8 cm × 1.7 cm × 1.6 cm, from WG 32, C5, SU25, with two very partially preserved impressions of the same seal with the sign representing the clump of papyrus, also occurring on WG Sealing 254 and referring to Lower Egypt, and a further unclear sign. Possibly this was a part of a composition with the heraldic plants of Upper and Lower Eygpt. On the back, no clear impression are preserved.

WG Sealing 318 (Figure 199 F): fragment of a sealing, approx. dimensions 4.1 cm × 1.8 cm × 0.8 cm, from WG 55, D1, SU2, with the complete impression of an oval seal characterized by a symmetrical scroll pattern. A passing string was embedded in the sealing and on the back impressions of papyrus occurs.

WG Seal 1 (Figure 199 G-I): this 1.5 cm × 1 cm × 0.9 cm faïence scarab seal, with a perforation along its longer axis and well represented dorsal lines, was found in excavation unit WG 61, E4, SU45. The seal consists of a complex pattern of symmetrical scrolls with two *nfr* signs within the scrolls. The type of back and profile are characteristic of known classes of Middle Kingdom scarabs (see Martin 1971, Pl. 51 d and Pl. 54, Typology of the profiles d, e), dating to the 12th Dynasty (Ward 1987: 513, 517-518, Fig. 1).

9.5.b Preliminary remarks on the sealings

ANDREA MANZO

The sealings and the seal discovered in the 2006-2007 to 2010-2011 field seasons at Mersa/Wadi Gawasis considerably enlarged the number of identified institutions and officials that were involved in the organization, administration, and management of the seafaring expeditions at *Saww*, and provide insights into the functional organization of the harbor. In general, from a chronological point of view, as already shown by the proposed comparisons, all of the sealings fit well in the Middle Kingdom.

It should be stressed that from 2006-2007 to 2010-2011 sealings were collected in excavations WG 31, 32, 55-56, and 61/65, all of which are located along the western edge of the coral terrace, delimiting the ancient bay to the south, where also the entrances to some of the caves were recorded. As excavation units WG 61/65 are in front of the entrance to Cave 8, WG 55-56 are in front of Cave 7, and WG 32 is located in front of Cave 5 and Cave 6, this confirms what was remarked on the basis of the results of the 2001-2002 to 2004-2005 field seasons, i.e., that administrative activities were taking place on mid-slope terraces in front of some of the caves (Bard and Fattovich 2007: 237; Manzo and Pirelli 2006: 90, 93, 95-96). Moreover, as excavation unit WG 55-56 also provided evidence of a shrine and some inscriptions, there administrative activities may have been associated with the ceremonial ones or, perhaps, the function of this spot changed through time. Of course, caves are not always related to administrative activities, as for example in the case of Cave 1 (Bard and Fattovich 2007: 70-72), where no sealings or other traces of administration were found. Although in general administrative activities were preferentially taking place in front of the entrances of the caves, at least for the area investigated by excavation unit WG 31, this may not have been the case. Sealings were found in WG 31 in 2005-2006 and others were discovered there in 2010, but no evidence of a cave was found so far in that sector.

As far as the types of seals whose impressions were found, the main classes already identified in excavation units WG 16/24 and WG 32 also were recorded in 2006-2007 to 2010-2011 (Bard and Fattovich 2007: 232-233; Manzo and Pirelli 2006: 67): 1) institutional shield-shaped seals; 2) private oval seals with inscriptions; 3) private oval seals with decorative patterns and protective hieroglyphic signs; and 4) private oval seals with decorative patterns.

As in the previous field seasons (Bard and Fattovich 2017: 234-235; Manzo and Pirelli 2006: 87-89), traces of different materials occur on the back of the sealings: 1) wood and/or peg impressions (Figure 200 A) often associate with impressions of strings (Figure 200 B), suggesting that the sealings may have sealed boxes; 2) string(s) and fabric (Figure 200 C), suggesting that the sealings may have sealed containers for dry commodities; 3) vegetal fibres or mats (Figure 200 D), suggesting that the sealings may have sealed containers for liquid commodities; 4) leather (Figure 200 E), suggesting that the sealings may have sealed leather bags. The impressions of baskets and rope bags (Bard and Fattovich 2007: 235; Manzo and Pirelli 2006: 89) are very rare and fragmentary in the sealings collected from 2006-2007 to 2010-2011. It should be also stressed that while no "noduli", i.e., clay sealings without the impression of sealed objects (Bard and Fattovich 2007: 235), were recorded in the field seasons 2006-2007 to 2010-2011, for the first time clear impressions of papyrus were recorded at Mersa/Wadi Gawasis (Figure 200 F). This confirms that sealed papyri arrived and were opened there. Indeed, the large number of sealings for papyrus together with the fragments of papyrus discovered in WG 61/65 shows that letters and despatches were regularly sent to Mersa/Gawasis on the occasion the seafaring expeditions, and most likely that answers were sent back to the Nile Valley. Perhaps a kind of regular delivery service, similar to the one between Egypt and the Nubian fortresses, may have existed when the seafaring expeditions were taking place. Finally, the 2006-2007 to 2010-2011 sealing assemblages are also characterized by the occurrence of examples of double sealing, i.e., of the use of two seals, usually the institutional seal associated with the one of an official, a practice well known at Mersa/Wadi Gawasis and other Middle Kingdom sites (Bard and Fattovich 2007: 234; Manzo and Pirelli 2006: 48, 52, 70). Moreover, the fact that containers or documents were not only opened but also sealed at the site of the ancient harbor, as was already suggested (Bard and Fattovich 2007: 237; Manzo and Pirelli 2006: 90), is now confirmed, not only by the discovery of more fragments of prepared clay, but also by the scarab seal from WG 61, E4, SU45.

The distribution of the types of sealings is not homogeneous in the different assemblages (Table 20). In 2005-2006, it was remarked that two distinct phases of administrative use of the area were occurring in WG 16/24 and WG 32, near the entrances of Caves 2 and 5 (Bard and Fattovich 2007: 237; Manzo and Pirelli 2006: 94-95). The later phase is characterized by a larger variety of containers opened, among which occurs a large number of sealings for wood boxes. The discovery of the boxes themselves in association with the sealings suggests that in the later phase of administrative use of the area near the entrances of Caves 2 and 5, the management of commodities imported from Punt, which arrived at Mersa/Wadi Gawasis in boxes and had to be sent to the Nile Valley, was taking place there. On the contrary, the sealings from the earlier phase, found only in excavation unit WG 16/24, were mainly related to the opening of containers of supplies arriving at Mersa/Wadi Gawasis from the Nile Valley. The sealing assemblages investigated in 2006-2007 to 2010-2011, in excavation units WG 32, WG 53, WG 55, and WG 56, are characterized by a larger variety in terms of impressions of the sealed containers and a large number of sealings with impressions of pegs and wooden surfaces, similar to the assemblages of sealings from the latest phase of use of the sectors of WG 32 and WG 16/24. Noteworthy, despite this similarity, all the assemblages from WG 32 investigated from 2006-2007 to 2010-2011 with the only exception of the one from SU1 amd SU10 can certainly be ascribed to a phase of use of the spot earlier than the one associated with the wood boxes discovered in front of Caves 2 and 5. On the contrary, the occurrence in WG 32 SUs 23, 25 and 28 of fragments of clay stoppers of jars and in WG 32 SUs 25 and 46 of sealings of mats and basket containers may suggest a relation with the earlier phase brought to light in WG 16/24. Also the sealing assemblages in excavation units WG 61/65, near Cave 8, are characterized by sealings for containers for liquids, such as in the case of the earlier phase of use revealed in excavation unit WG 16/24, suggesting that in that area supplies arriving from the Nile Valley could have been opened. In addition, a remarkable occurrence of sealings for papyrus characterizes WG 61/65, suggesting that despatches from the Nile valley were opened there, while just a few sealings used for papyrus occur in the assemblages of WG 32 investigated in 2006-2007 to 2010-2011.

As far as the institutions and titles recorded for the first time at Mersa/Wadi Gawasis are concerned, the possible mention of *ḥʿw nsw* "the royal fleet" on Sealing WG 6 from WG 55, SU8 is intriguing. The mention of boats is not unknown in Middle Kingdom seals with names and titles of officials (see Martin 1971: Pl. 12, 9, Pl. 13, 13-14, Pl. 15, 11, Pl. 16, 19; Pl. 37, 29), as are titles referring to boats/ships (Ward 1982: 14, # 66-67, # 69), but boats are never found with the adjective "royal" or the genitive "of the king," which characterizes the fragmentary sealing from Mersa/Wadi Gawasis, except in the case of an official named *imy-r ḥʿw wr n pr-nsw*, "Chief overseer of the ships of the palace," or of a *ḥry-tp ḥʿw bity*, "Great overlord of the ships of the king of Lower Egypt" (Fischer 1985: 25). Moreover, if the fragmentary sign read as *nsw* is given its phonetic value of *sw*, it may also be part of the name of the official, *e.g.*, in the case of *imy-r pr ḥsb ḥꜤw Nb-swmnw* (Martin 1971: Pl. 12, 9).

Assemblage	**Institutional**	**Inscribed Personal**	**Decorative with signs**	**Decorative**	**Double sealing**	**Peg**	**Wood and string(s)**	**Fabric and string(s)**	**Clay and mat stopper**	**Basket-Mat**	**Leather**	**Rope bag**	**Papyrus**	**Chalk**	**Raw sealing clay**
WG31 SU1													X		
WG32 SU1		X													
WG32 SU10	X						X	X			X				
WG32 SU23									X						
WG32 SU25	X		X	X	X	X	X	X	X	X	X		X		X
WG32 SU28	X			X		X		X						X	X
WG32 SU31	X		X		X	X	X	X	X				X		
WG32 SU46	X	X	X	X	X	X	X			X		X			X
WG53 SU10							X			X					
WG55 SU1-2	X					X									

WG55 SU2	X	X	X	X?		X	X	X		X	X		X	X	X
WG55 SU3	X					X									
WG55 SU5				X	X	X	X flat surface	X			X				
WG55 SU6								X							
WG55 SU8	X		X	X	X	X	X			X				X	
WG55 SU11	X		X	X		X	X	X		X	X			X	
WG56 SU5	X	X	X	X	X	X	X	X							
WG56 SU7			X?	X?			X	X						X	
WG56 SU8	X					X									
WG56 SU11								X							
WG61 SU32			X						X						
WG61 SU46	X?	X	X	X?	X		X flat surface	X	X	X			X		X
WG65-61 SU19				X			X						X		
WG65-61 SU32													X		X
WG65-61 SU45	X?	X	X	X				X	X				X		

Table 20. *Distribution of the types of sealings in the different assemblages.*

Fragmentary sealings WG Sealing 08 (from WG 56, SU5) and WG Sealing 50 (from WG 55, C3, SU1-2) mention *ḥwt* (*n*) *niwt*, which can be read as "the estate" or "the temple of the city," if we assume that the word *nṯr*, to form the term *ḥwt*-[*nṯr*], originally preceded *ḥwt* but is not preserved. In the case of WG Sealing 04 (from WG 55, SU8), the institution is apparently associated with the title of an official: *imy-r mḏꜣt* (*n*) *ḥwt* (*n*) *niwt*, "Overseer of the archive of the temple of the city," according to the preliminary reading provided for this sealing by El-Sayed Mahfouz.

An institution whose name included *pr* and *niwt* may also occur on the fragmentary WG Sealing 129 (from WG 31, SU1). If we admit that the first fragmentary sign is not a *pr* but rather a *tꜣ* (Gardiner O17)[6], whose upper part is lost, followed by a *niwt*, we may have part of the title *sꜣb tꜣyty niwt rsy*, "Chief Justice of Thebes", occurring on a seal, notably characterized by a similar scroll pattern at the bottom, whose impression is known from Uronarti (Martin 1971: 142, n. 1845, Pl. 47, 9; Reisner 1955: 54, 8; Ward 1982: 148, n. 1277). A further institution or official related to a city, …*n niwt rsy*, in this case "… of the Southern City," i.e., Thebes (see Ward 1982: 164, 184), is also mentioned on WG Sealings 126, 251 and 289 (from WG 32, SU46, WG 32, SU31, and WG 32, SU25, respectively).

The impressions of seals with inscriptions mentioning the *šnwt*, "the granary" occur on WG Sealing 242 from WG 32, A4, SU31 and on WG Sealing 256 from WG 32, A3-B4, box 21, SU10. Seals mentioning the granary are well known, in particular on WG Sealing 256 the sequence *ḫtm n šnwt*, "seal of the granary" was recorded on seals from the Nubian fortresses (see *e.g.* Martin 1971: 145, n. 1869, 1872b, Pl. 42 B, 8, Pl. 43, 9).

The impressions of seals mentioning the *pr-ḥḏ*, "the treasury" characterize WG Sealing 262, from WG 32, C4, SU25, and WG Sealing 283, from WG 32, C5, SU25. The mention of this institution was already recorded on sealings from Mersa/Wadi Gawasis (Manzo and Pirelli 2006: 67).

The title *imy-r*…, "Steward…" (see Ward 1982: 21, n. 132), certainly followed by other signs expressing the rest of the title or the name of the official (see *e.g.* Martin 1971: Pl. 1, 20-23) occurs on WG Sealing

[6] All the references to the Gardiner list of signs are made to the third edition of the *Egyptian Grammar*.

168 from WG 32, C5, SU25, WG Sealing 243 from WG 32, A4, SU31 and WG Sealing 264 from WG 32, C4, SU25.

In the case of WG Sealing 244 from WG 32, A4, SU31, the title *imy-r pr*, "Steward", is followed by a X shaped sign and a circle. It reminds of the same title followed by a X shaped sign occurring on Sealing 67, from WG 32, SU46 (Cave 6, entrance), although the seal is certainly not the same. The sequence of signs reminds the one occurring on a seal from a tumulus in Kerma and bearing the title *imy-r pr* (*n*) *ḫbsw*, "Steward of the plowed fields" (Martin 1971: 122, n. 1590, Pl. 40, 6; Ward 1982: 26, n. 174). Alternatively, the reading *ḫnrw,* "prisoners" or "conscript labourers" can be proposed for the X shaped sign and a circle (see *e.g.* Ward 1982: 40, n. 298), which may fit well also with the fact that two vertical strokes appear following the circular sign on WG Sealing 244. Nevertheless, it should be remarked that on seals usually the sign Gardiner U31 is used in the word *ḫnrw* (see *e.g.* Martin 1971: Pl. 3, 25, Pl. 30, 13, Pl. 15, 35): apparently on seals this word is not written with an X shaped sign Gardiner Z9 as it is sometimes elsewhere (Ward 1982: 40, n. 298, 302). Moreover, the hypothetical title *imy-r pr* (*n*) *ḫnrw*, "Steward of the conscript labourers" is not known on other documents so far, therefore the reading of the title on these sealings remains doubtful.

Institutional seals whose inscription ending with a place name followed by the determinative of the foreign lands like in WG Sealing WG Sealing 316 from WG 32, C4, SU25, are well known (see *e.g.* Reisner 1955: 53, n. 14), but in this specific case the occurrence of the place name *Pwn*[*t*], which was suggested by Rosanna Pirelli, is so far unique. It certainly fits well with all the evidence referring to this specific region characterizing the site of the Middle Kingdom, harbor to the land of Punt, and suggests that specific branches of the administration were established for managing the expeditions to Punt or at least some activities related to the expeditions to Punt.

Some of these sealings may have been contained the personal name of officials. Noteworthy, sealings with personal names also provide important chronological insights, as scarab seals with names and titles of officials are not attested in assemblages earlier than the late 12th Dynasty, and their use may be connected to administrative changes during the reigns of Senusret III and Amenemhat III (Johnson 1977: 142; Martin 1971: 175-187, Pl. XII; Williams 1977: 136-137). WG Sealing 106 (from WG 61, D-E3-2/WG

65, A2-3, SU45), and WG Sealing 100 and 101 (both from WG 61, E4-5, SU46) mention *sš Ỉmnmḥ3t*, "scribe Amenemhat," followed by the frequent goodwill epithet *k3 nfr* (see Marin 1977: 188). WG Sealing 127 (from WG32, SU46), mentions *ỉmy-r pr* [...*Sn*]*wsrt*, "the steward [...Sen]usret".

WG Sealing 183 from WG 32, C4, SU1 is characterized by the partially preserved impression of a seal with the sign *wḥm*, which, as it is likely located in the lower part or a seal cannot be part of the title herald, can be likely a part of the well-known epithet *wḥm ꜥnḫ,* "repeating of life" (see Martin 1971: 187-188). This epithet, occurring in late Middle Kingdom times, was already recorded on a sealing collected in excavation unit WG 32 and at Wadi/Mersa Gawasis and always related to the latest phase with evidence of administrative activities in the area (Manzo and Pirelli 2006: 61), which also yielded WG Sealing 183. Most likely the epithet was preceded by the name of an official.

Certainly personal seals are the ones that are related to the fragmentary sealings with decorative patterns and well-wishing hieroglyphic signs, such as WG Sealing 104 with scrolls and possibly a sign *nfr* (from WG 61, D-E3-2/WG 65, A2-3, SU45); WG Sealing 105 (from WG 61, D-E3-2/WG 65, A2-3, SU45) with the *nbw*, *ꜥnḫ*, and perhaps *nfr* signs; WG Sealing 164 from WG 32, C5, SU25 and WG Sealing 271 from WG 32, C5, SU25 with patterns consisting of a *nbw* sign; WG Sealing 120 (from WG 61, D3, SU45) with a scroll pattern framing a *nfr* sign, with *nb* signs on top and beneath it; WG Sealing 126 (from WG 32, SU46) with an *ꜥnḫ* sign framed by a continuous scroll pattern; or the almost complete WG Sealing 124 (from WG 61, B-C2-3, SU19), with the impression of an oval seal with a *ꜥnḫ* sign and a *nfr* sign along the main axis, framed by a scroll pattern; and also WG Sealing 125 (from WG 65, D-E4, SU32); WG Sealing 206 WG 32, C5, SU25 with the *sm3 t3wy*, "Union of the Two Lands" symbol; WG Sealing 220 from WG 32, C5, SU25, and WG Sealing 315 from WG 32, C5, SU25, and perhaps WG Sealing 208 from WG 32, C5, SU25, with a *nfr* sign symmetrically flanked by two *ꜥnḫ* signs; WG Sealing 235 from WG 32, A4, SU31 with a symmetrical compositions of signs including the *dšrt* crown and an *ꜥnḫ* sing; WG Sealing 161, WG Sealing 166 from WG 32, C5, SU25 and perhaps WG Sealing 254 from WG 32, A4, SU31 and WG Sealing 317 from WG 32, C5, SU25 all characterized by patterns with the heraldic plants of Upper and Lower Egypt; WG Sealing 170 from WG 32, C5, SU25 , WG Sealing 318 from WG 55, D1, SU2 , WG Sealing 313 from WG 32, C5, SU28 with different complex patterns of symmetrical scrolls. The seal of WG Sealing 113 (from WG 61, E4-5, SU46), whose impression is almost complete and is has two symmetrical *ḏd* signs flanked by two *nfr* signs, can be ascribed to the same class of personal sealings.

WG Sealing 24 (from WG 55, C1, SU11), WG Sealings 25-27 (from WG 55, C1, SU11), WG Sealings 54-63 (from WG 32, SU46), WG Sealings 68-72 (from WG 32, SU46), and WG Sealing 109 (from WG 61, E4-5, SU46), and WG Sealings 171, 200 and 222 (from WG 32, SU25), and 249 (from WG 32 SU31) are all characterized by the impressions of the same personal seal with a decoration consisting of "8"-shaped signs, inscribed in ovals and symmetrically organized, and two *wȝḏ* signs on the longer axis. The widespread distribution of the impressions of this personal seal allows us to relate the different assemblages in which it occurs, not only located near the entrances of Cave 6 and Cave 7, but also near the entrance of Cave 8. In WG 32, the impressions of this specific seal were from assemblages of a phase earlier than the one associated to a concentration of wooden boxes and sealings related to the expedition of Year 8 of Amenemhat IV. Therefore, this evidence may suggest that WG 32 and the area to the south of it were also used for administrative purposes also earlier than the Year 8 of Amenemhat IV. The occurrence there two well distinct phases of administrative use of the area is confirmed also by the fact that no impressions of the types of seals characterizing the phase of use related to the expedition of Year 8 of Amenemhat IV (see Bard and Fattovich 2007: 233-234; Manzo and Pirelli 2006: 69) were recorded in the assemblages the earlier phase investigated from 2006-2007 to 2010-2011.

Figure 165. *WG Stela 14 from WG 32, SU1 (photo)*.

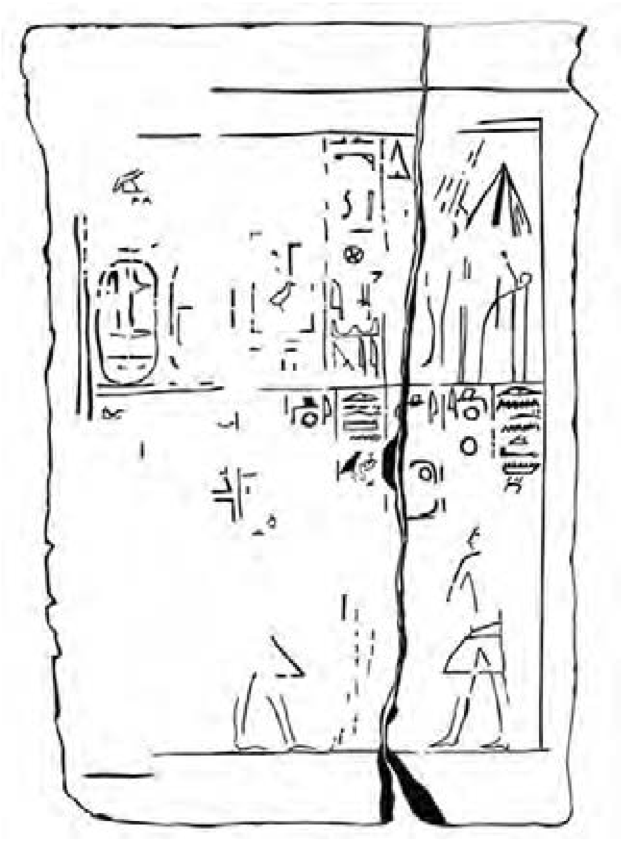


Figure 166. *WG Stela 14 from WG 32, SU1 (drawing).*

Figure 167. *WG Stela 15 from WG 32, A5, SU10.*

Figure 168. *WG Stela 14 from WG 32, SU1 (photo).*

Figure 166. *WG Stela 14 from WG 32, SU1 (drawing).*

Figure 170. *WG Stela 19 fromWG 33.*

Figure 171. *WG Stela 23 from WG 55, C1, SU8 (photo).*

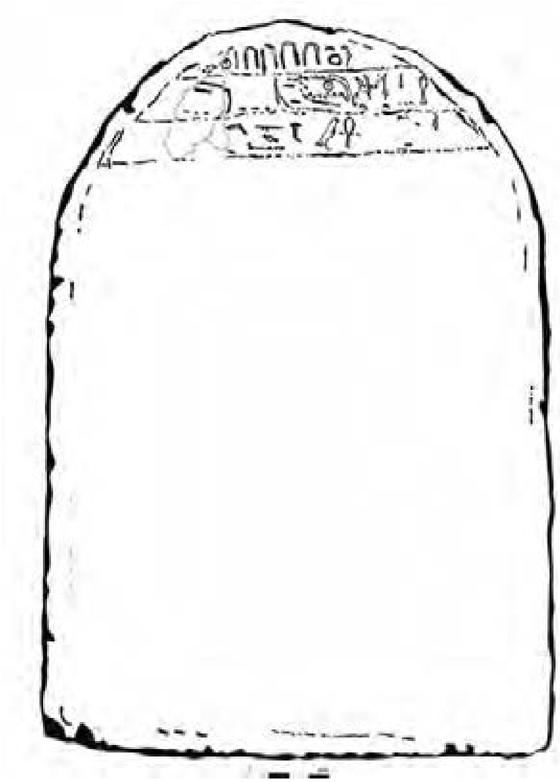


Figure 172. *WG Stela 23 from WG 55, C1, SU8 (drawing).*

Figure 173. *WG Stela 24 from WG 55, C1, SU8 (photo).*

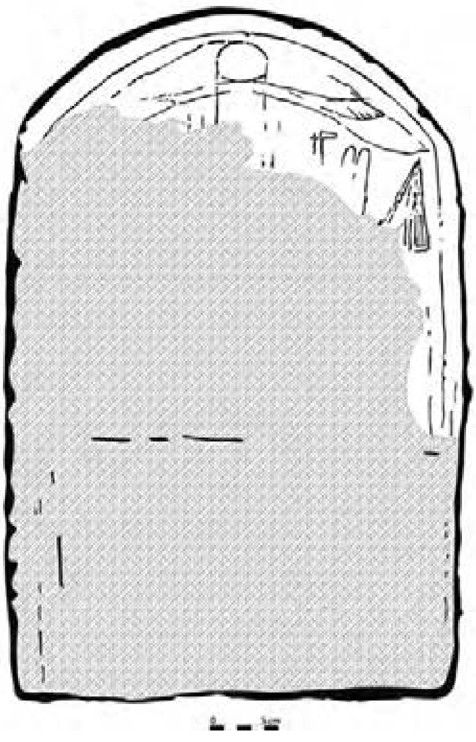


Figure 173. *WG Stela 24 from WG 55, C1, SU8 (drawing).*

Figure 175. *WG Stela 26 from WG 33.*

Figure 176. *WG Stela 28 from WG 55, E1-2-3, SU1.*

Figure 177. *WG Stela 29 from WG 61, E3, SU1 (photo).*

Figure 178. *WG Stela 29 from WG 61, E3, SU1 (drawing).*

Figure 179. *WG Stela 30 from WG 33.*

Figure 180. *WG Ostracon 107 bis from WG 26, D5, SU90.*

Figure 181. *WG Ostracon 107 ter from WG 37, A4, SU25.*

Figure 182. *WG Ostracon 107 quater from WG 40, SU2.*

Figure 183. *WG Ostracon 108 from WG 55, D3, SU2.*

Figure 184. *WG Ostracon 109 from WG 55, C1, SU8.*

Figure 185. *WG Ostracon 111 from WG 47, SU2 (photo).*

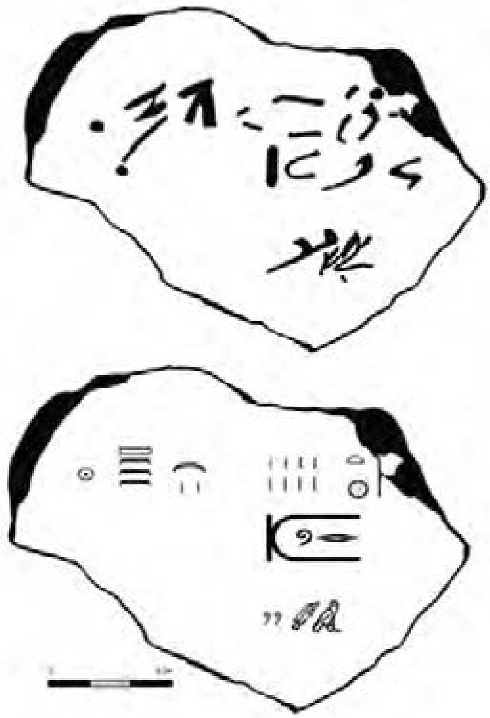


Figure 186. *WG Ostracon 111 from WG 47, SU2 (drawing).*

Figure 187. *WG Ostracon 113 bis from WG 61, D4-E4, SU82.*

Figure 188. *WG Ostracon 114 from between excavation units WG 61, D2-3/E2-3 and WG 65, A2-3, SU45.*

Figure 189. *WG Papyrus 1 from WG 56, SU8.*

Figure 190. *WG Papyrus 2 bis from WG 61, C2, SU21.*

Figure 191. *WG Papyrus 3 bis from WG 61, D4-E4, SU82.*

Figure 192. *WG Papyrus 5 from WG 61, C2-C3, SU49.*

Figure 193. *WG Fabric 1 from WG 56, SU7.*

Figure 194. *WG Box 21 from WG 32, SU10 (photo).*

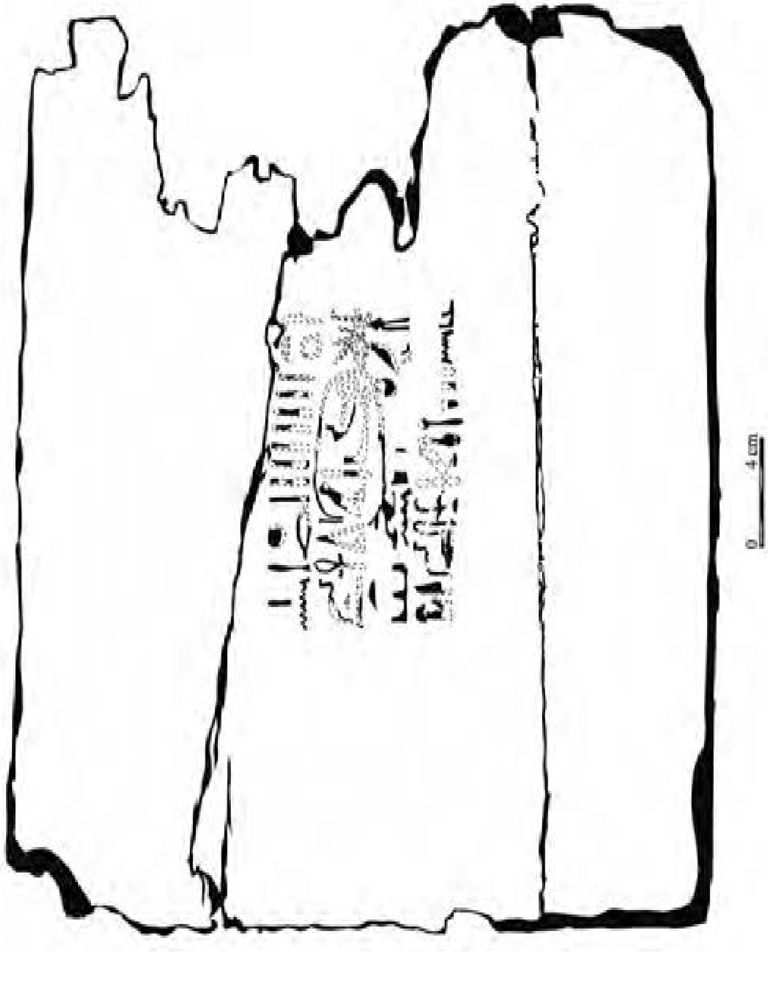


Figure 195. *WG Box 21 from WG 32, SU10 (drawing).*

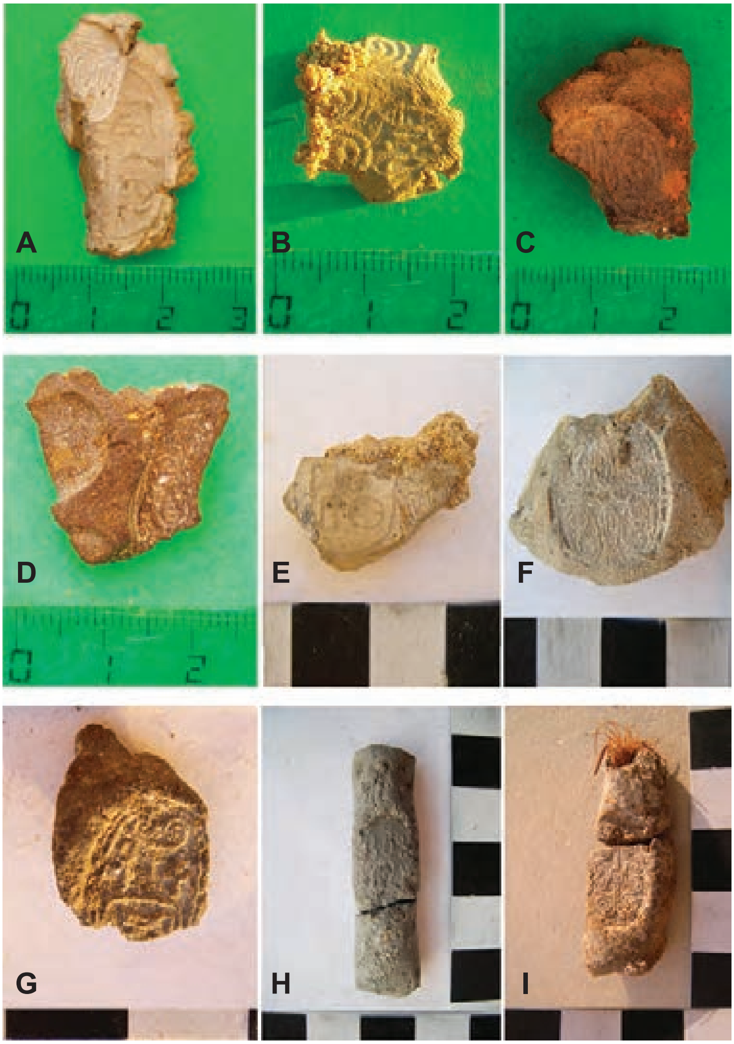


Figure 196: *Sealings with impression of seals A) WG Sealing 04 from WG 55, SU8; B) WG Sealing 06 from WG 55, SU8; C) WG Sealing 24 from WG 55, C1, SU11; D) WG Sealing 43 from WG 55, C1, SU8; E) WG Sealing 50 from WG 55, C3, SU1-2; F) WG Sealing 54 from WG 32, SU46; G) WG Sealing 105 from WG 61, D-E3-2/WG 65, A2-3, SU45; H) WG Sealing 113 from WG 61, E4-5, SU46; I) WG Sealing 123 from WG 65, D-E2-3, SU19.*

Figure 197: *Impressions of seals from sealings (for the dimensions see the description) A) WG Sealing 14 from WG 55, D1/2, SU2; B) Reconstruction of the seal related to WG Sealing 24 from WG 55, C1, SU11, also based on the impression from WG Sealing 54; C) WG Sealing 30 from WG 55, C1, SU11; D) WG Sealing 67 from WG 32, SU46; E) WG Sealing 93 from WG 55, C2, SU2; F) WG Sealing 100 from WG 61, E4-5, SU46; G) WG Sealing 120 from WG 61, D3, SU45; H) Impression of the first seal on WG Sealing 126 from WG 32, SU46 (Cave 6, entrance); I) Impression of the second seal on WG Sealing 126 from WG 32, SU46 (Cave 6, entrance); L) WG Sealing 127 from WG 32, SU46 (Cave 6, entrance); M) WG Sealing 129 from WG 31, SU1; N) WG Sealing 164 from WG 32, C5, SU25; O) Reconstruction of the seal related to WG Sealing 166 from WG 32, C5, SU25 also on the basis of WG Sealings 161 and 173; P) WG Sealing 183 from WG 32, C4, SU1; Q) WG Sealing 184 from WG 32, C4, SU25; R) WG Sealing 206 from WG 32, C5, SU25; S) WG Sealing 208 from WG 32, C5, SU25; T) WG Sealing 220 from WG 32, C5, SU25; U) WG Sealing 225 from WG 32; C5, SU25; V) WG Sealing 235 from WG 32, A4, SU31; W) WG Sealing 241 from WG 32, A4, SU31; Z) WG Sealing 243 from WG 32, A4, SU31; X) WG Sealing 244 from WG 32, A4, SU31; Y) WG Sealing 283 from WG 32, C5, SU25.*

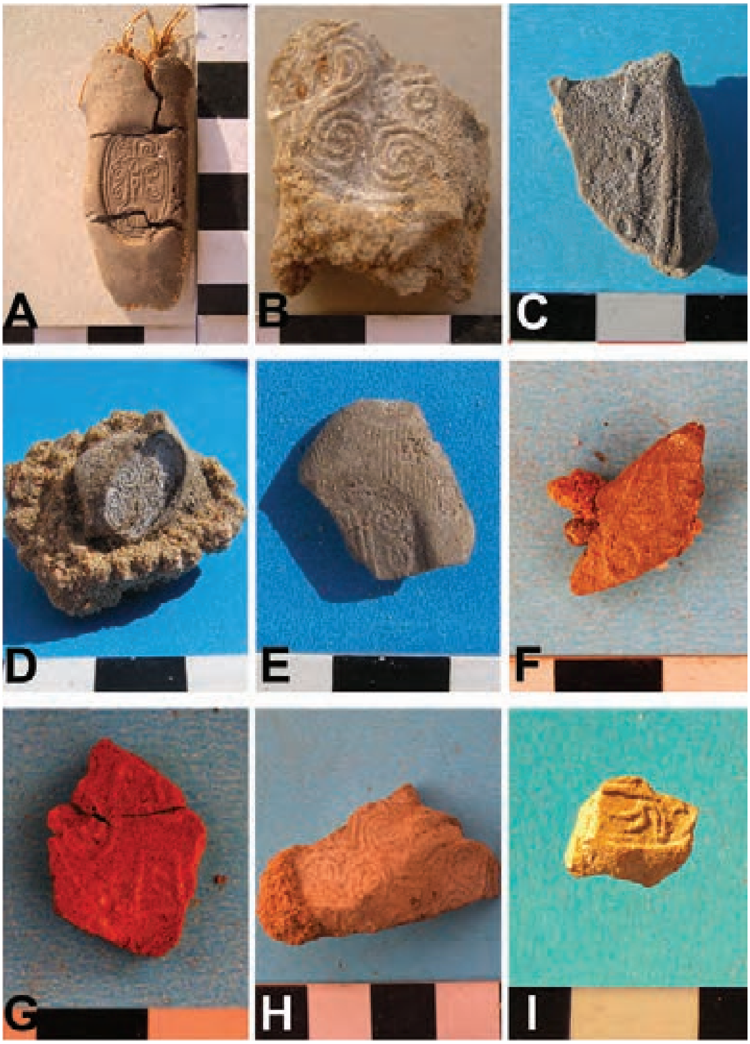


Figure 198: *Sealings with impression of seals A) WG Sealing 124 from WG 61, B-C2-3, SU19; B) WG Sealing 126 from WG 32, SU46 (Cave 6, entrance); C) WG Sealing 160 from WG 32, C5, SU25; D) WG Sealing 169 from WG 32, C5, SU25; E) WG Sealing 170 from WG 32, C5, SU25; F) WG Sealing 242 from WG 32, A4, SU31; G) WG Sealing 256 from WG 32, A3-B4, Box 21, SU10; H) WG Sealing 264 from WG 32, C4, SU25; I) WG Sealing 271 from WG 32, C5, SU25.*

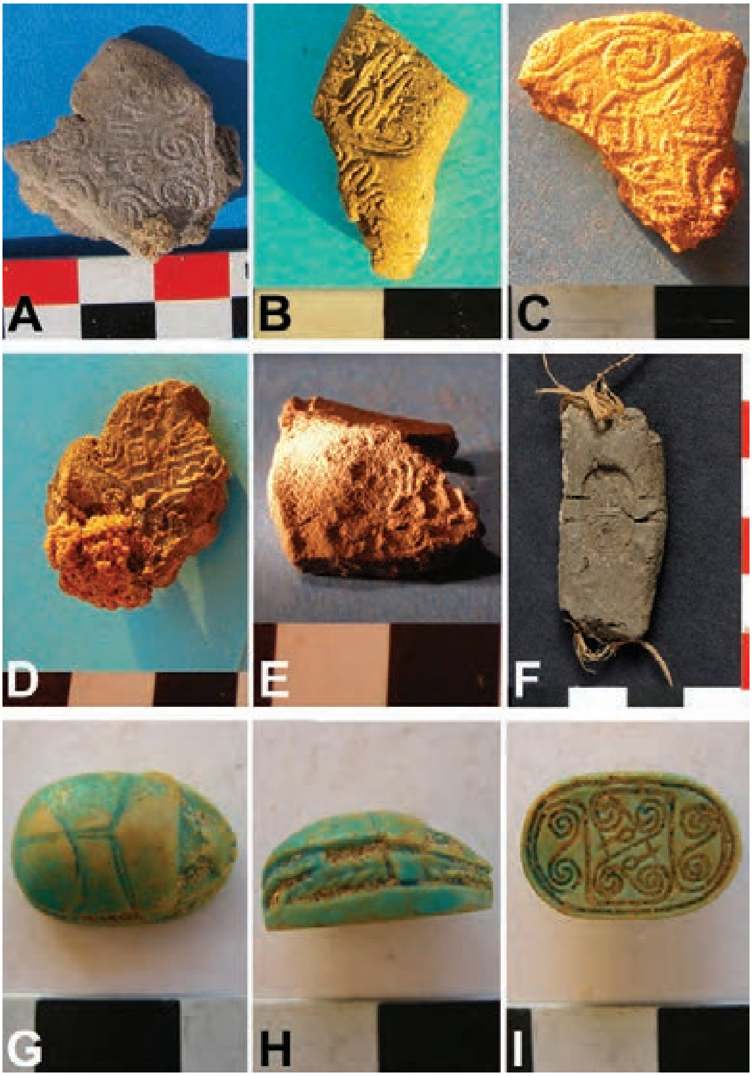


Figure 199: *Sealings with impressions of seals and a seal A) WG Sealing 292 from WG 32, C5, SU25; B) WG Sealing 313 from WG 32, C5, SU28; C) WG Sealing 314 from WG 32, C4, SU10; D) WG Sealing 316 from WG 32, C4, SU25; E) WG Sealing 317 from WG 32, C5, SU25; F) WG Sealing 318 from WG 55, D1, SU2; G-I) WG Seal 1.*

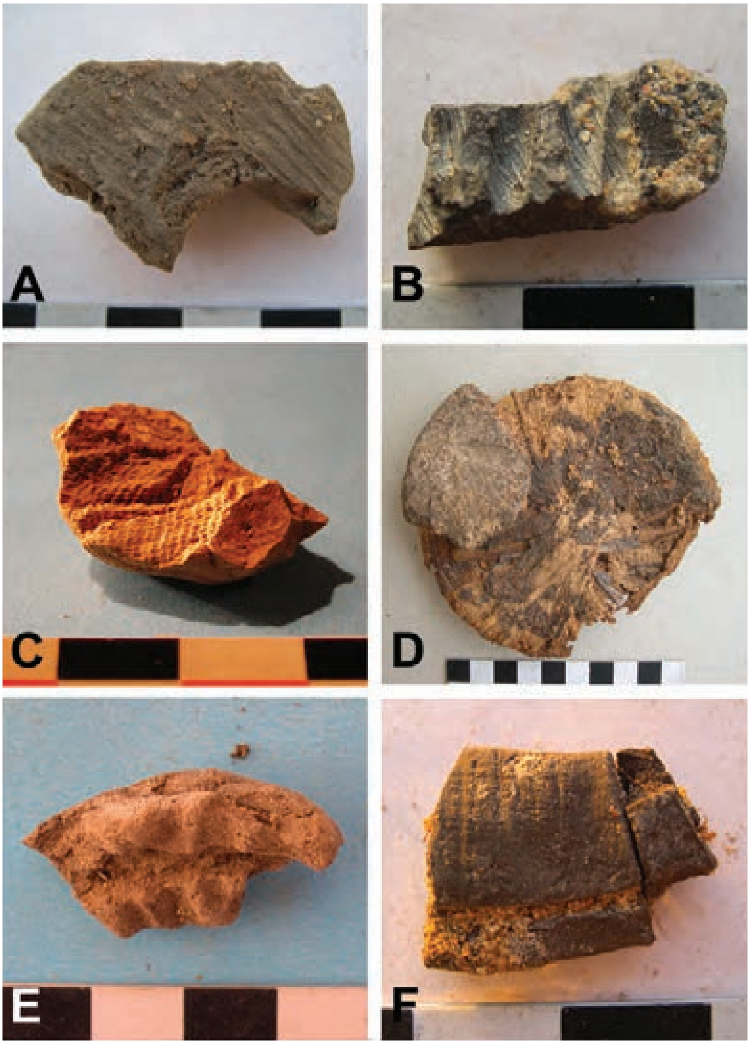


Figure 200: *Impressions on the back of sealings A) wood and peg impressions on a sealing from WG 32, SU46 (Cave 6 entrance); B) impression of strings on a sealing from WG 32, SU46 (Cave 6 entrance); C) impression of string and fabric on a sealing from WG 32, C5, SU25; D) Stopper of vegetal fibres or mats sealed with mud from WG 61, D-E2-3, SU45; E) impression of folded and fastened leather from WG 32, C4, SU25; F) impression of papyrus from WG 61, D-E2-3 /WG 65, A2-3, SU45.*

Chapter 10
Dating of the Site

10.1 Material culture

RODOLFO FATTOVICH AND ANDREA MANZO

The material culture excavated at Mersa/Wadi Gawasis, especially the pottery and the sealings, offers insights into the phases of use of the different sectors of the site investigated in 2006-2007 to 2010-2011.

Indeed, the chronology of the different Stratigraphic Units and excavation units can be at least sometimes suggested on the basis of the comparisons between the ceramic assemblages that they yielded and the Egyptian ceramics from other sites in the Nile Valley (see 4.1 Egyptian Pottery and Wallace-Jones 2018: 7-13).[1] The chronology of the Stratigraphic Units suggested by the associated ceramic assemblages is summarized in Table 21. It should be stressed that the assemblages not listed in this table can be generically ascribed to the Middle Kingdom lacking of types distinctive of specific phases, or should be regarded as mixed.

Excavation units	**Chronology**
WG 19/25/26-27 SU95	Early to mid-12th Dynasty
WG 61/65 *Fire*-pit, SU3, SU7, SU19, SU20, SU32, SU45	Early to mid-12th Dynasty
WG 71 SU6	Early to mid-12th Dynasty
WG 19/25/26-27 all SUs except SU95	Late 12th Dynasty-early 13th Dynasty
WG 39 all SUs	Late 12th Dynasty-early 13th Dynasty
WG 53 SU10	Late 12th Dynasty-early 13th Dynasty
WG 56 SU2	Late 12th Dynasty-early 13th Dynasty
WG 70-72-73 SU3	Late 12th Dynasty-early 13th Dynasty

[1] Nevertheless, it is noted that a new assessement of the ceramic assemblages is due, also considering the need of conducting a more systematic and accurate comparative analysis with finds from reliable assemblages in the Nile valley, and a quantitative diachronic and synchronic analysis of the distribution of the types in the assemblages at Mersa/Wadi Gawasis. This implies to go back to the materials: so far, unfortunately, it was not possible to access the materials after 2011. On the relevance of these aspects see Gallorini 2018.

WG 71 SU5	Late 12th Dynasty-early 13th Dynasty
WG 74 SU1	Late 12th Dynasty-early 13th Dynasty
WG 32 SU1	Late 12th Dynasty-13th Dynasty
WG 33 SU2, SU3	Late 12th Dynasty-13th Dynasty
WG 55/56 SU7	Late 12th Dynasty-13th Dynasty
WG 69 SU1, SU2, SU3	Late 12th Dynasty-13th Dynasty
WG 75 SU1	13th Dynasty

Table 21. *Chronology of the Stratigraphic Units suggested by the ceramic assemblages.*

The fact that many other assemblages[2] are characterized by the occurrence of types dating to the first phases of the 12th Dynasty togheter with types dating to the late 12th and 13th Dynasty can be in general explained by the reuse of structures and spaces of the site on the occasion of the subsequent expeditions. Therefore, all the remaining assemblages should be regarded as basically dating to the late 12th-13th Dynasty, althought the occurrence of early to mid-12th Dynasty types suggests an earlier use of these specific spots of the site.

To sum up, the pottery from Mersa/Wadi Gawasis excavated in the 2006-2007 to 2010-2011 field seasons can be dated to the Middle Kingdom, more precisely from the early 12th Dynasty to the 13th Dynasty. Moreover, the lack of specific types, such as fish dishes, suggests that there was no late 13th Dynasty use of the site (see also Wallace-Jones 2018: 8). Just a few sporadic finds suggest that the site was used in early 18th Dynasty and in Old Kingdom-First Intermediate Period times (Wallace-Jones 2018: 12). Indeed, this chronological profile basically agrees with the one proposed for the assemblages investigated from the 2001-2002 to 2005-2006 field seasons (Bard and Fattovich 2007: 110-125).

[2] WG 32 SUs 10, 33, 46; WG 36; WG 43 SUs 1, 2; WG 45 SUs 1, 2; WG 46 SUs 1, 2; WG 47 SUs 1, 2; WG 49 SUs 1, 2; WG 50 SUs 1, 2; WG 51 SUs 1, 2, 3; WG 52, SU1; WG 53 SUs 1, 25; WG 54 SU1; WG 55 SUs 1, 2, 4, 8; WG 56 SU1; WG 57 SU1/2 interface; WG 61 SUs 2, 10, 21; WG 63, SUs 1, 2; WG 65 SU2; WG 66 SUs 2, 3; WG 67 SU31; WG 70 all SUs except SU3; WG 70, 72-73 SU2.

As far as the sealings are concerned, as previously discussed (see 9.5.b Preliminary remarks on the sealings), the assemblages excavated in excavation units WG 32, SU1, SU25, SU46; WG 55, SU2, SU5, SU8; WG 56, SU5; WG 61/65, SU45, SU46 are not earlier than the mid/late 12th Dynasty, and fit well in what it is known of the administrative practices from the reign of Senusret III onward. This basically agrees with the absolute chronology suggested by the pottery for these assemblages. Noteworthy, the crossing of the evidence provided by the sealings with the one provided by the associated pottery, characterized by classes and types dating from the early to the mid-12th Dynasty, strongly suggest that the assemblages in WG 61/65 SUs 45 and 46 may date precisely around the reign of Senusret III.

10.2 Textual evidence

Rodolfo Fattovich and Andrea Manzo

The royal names occurring on texts discovered at Mersa/Wadi Gawasis 2006-2007 to 2010-2011 can be ascribed to the following kings (see 9.1 Stelae, 9.2 Ostraca and 9.4 Cargo box inscriptions):

- Senusret II (WG Stela 29, dated to Year 2)
- Senusret III (WG Stela 14, dated to Year 5)
- Amenemhat III (WG Stela 16, dated to Year 23; WG Stela 23, dated to Year 41);
- Amenemhat IV (WG Box 21, dated to Year 8; WG Ostracon 111, dated to day 8, second month of summer: *shemu*).

The expeditions to Punt and royal activities at the site of *Saww* mentioned in these documents should be added to the ones mentioned in the inscriptions recorded by the expedition of the University of Naples "L'Orientale" and Boston University in 2001-2002 to 2005-2006 (see Bard and Fattovich 2007: 217-238), by Abdel Moneim A.H. Sayed in 1976 (Sayed 1977, 1978), and in the stelae from Wadi Gasus mentioning the name of *Saww*. (Sayed 1977, 1978), going back to the reigns of Senusret I, Amenemhat II, Amenemhat III, and Amenemhat IV. Interestingly, before the discovery of Stela 14, the only evidence that could be ascribed to Senusret III was an ostracon dated to Year 5, which mentions the funerary temple of Senusret II and an official active under Senusret III (Mahfouz 2010: 432). The hypothesis that this ostracon may refer to an expedition/activity that took place in Year 5 of Senusret III may be now supported by WG Stela 14, precisely dated to Year 5 of Senwsret III.

Therefore, the inscriptions discovered at Mersa/Wadi Gawasis in from 2006-2007 to 2010-2011 provide the first direct evidence of royal activities at the site by Senusret II and confirm that the site was used under Senusret III. To sum up, considering all the available data, textual evidence points to the use of the site under all the rulers of the 12th Dynasty, with the only exception of the first, king Amenemhat I, and the last one, queen Sobekneferu.

10.3 Radiocarbon dates[3]

RODOLFO FATTOVICH AND ANDREA MANZO

Ten samples of charcoal, timber and shells were submitted to the Laboratory of the Institut Français d'Archéologie orientale (IFAO), Cairo, for radiocarbon dating. Six samples of charcoal were from archaeological contexts (IFAO 205, 206, 207, 211, 213, 214) (Table 22). Four samples were from geological test-pits in the wadi sediments (IFAO 208, IFAO 209, IFAO 210, IFAO 212) (Table 23).

IFAO 205 - WG 16, tr 1-2, SU77/81
Conventional 14C age:
2934 ± 56 BP . (13 C measured of 24,931% vs PDB).
Calibrated 14C Date :[4]
68.2% probability (1σ): 1220 BC-1050 BC
95.49% probability (2σ): 1300 BC- 976 BC

IFAO 206 - WG 39, SU11
Conventional 14C age : 3680 ± 53 BP (13 C measured of 25,112% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 2140 BC-1970 BC
95.49% probability (2σ): 2210 BC-1910 BC

[3] This is a largely revised version of the text published in the book K.A. Bard and R. Fattovich, *Seafaring Expeditions to Punt in the Middle Kingdom. Excavations at Mersa/Wadi Gawasis, Egypt* (Brill, 2018), in Chapter 2, 9, "Chronology of the Harbor Site", pp. 31-35.
[4] The calibration was performed with the calibration curve published by Reimer *et al.* 2013 by means of the OxCal v. 3.10 software.

IFAO 207 - WG 39, SU14, 2 living floor
Conventional 14C age : 3407 ± 47 BP . (13 C measured of 25,372% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1770 BC-1630 BC 68.2%
95.49% probability (2σ): 1880 BC-1610 BC

IFAO 211 - WG24, timber 21
Conventional 14C age : 3404 ± 48 BP . (13 C measured of 23,899% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1760 BC-1630 BC
95.49% probability (2σ): 1880 BC-1610 BC

IFAO 213 - WG 33, hearth 2
Conventional 14C age : 3519 ± 48 BP . (13 C measured of 26,674% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1910 BC-1760 BC
95.4% probability (2σ): 1980 BC-1730 BC 93% - 1720 BC-1690 BC 2.4%

IFAO 214 - WG 56, A3, SU9
Conventional 14C age : 3517 ± 47 BP (13 C measured of 25,047% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1900 BC-1760 BC
95.4% probability (2σ): 1970 BC : 1730 BC 92.8% - 1720 BC : 1690 BC 2.6%

Table 22. *Radiocarbon dates from archaeological contexts.*

IFAO 208 - geological test-pit wg T7, 155 cm
Conventional 14C age : 3455 ± 47 BP . (13 C measured of 1,953% vs PDB).
Calibrated 14C Date :[5]
68.2% probability (1σ): 1440 BC-1320 BC
95.49% probability (2σ): 1500 BC-1260 BC
IFAO 209 - geological test-pit wg T6, 125 cm
Conventional 14C age : 3411 ± 46 BP . (13 C measured of 0,044% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1400 BC-1280 BC
95.49% probability (2σ): 1450 BC-1200 BC

[5] In the case of the samples from geological test pits, the calibration was performed with the calibration curve for marine samples as they consisted of sea shells.

IFAO 210 - geological test-pit wg T7 AI, 175 cm
Conventional 14C age : 3884 ± 48 BP . (13 C measured of 1,011% vs PDB).
Calibrated 14C Date:
68.2% probability (1σ): 1990 BC-1830 BC
95.49% probability (2σ): 2040 BC-1740 BC

IFAO 212 - Geological test-pit wg T6, 175 cm
Conventional 14C age : 3528 ± 48 BP . (13 C measured of 1,589% vs PDB).
Calibrated 14C Date :
68.2% probability (1σ): 1520 BC-1400 BC
95.49% probability (2σ): 1600 BC-1360 BC

Table 23. *Radiocarbon dates from geological test-pits.*

The samples from the geological test pits provided a chronological framework for the paleoenvironmental reconstruction of the site and are dealt with in the 2011 article by Hein *et al.* (see also 2.3 Coastal geology in this book). The five samples from archaeological excavations (IFAO 206, 207, 211, 213, 214) provided radiocarbon dates which are consistent with the use of the harbor in the first half of the 2nd millennium BC, and with the available radiocarbon dates associated with kings ranging from the end of the 11th to the beginning of the 12th Dynasty, to the early 13th Dynasty (Shortland and Ramsey 2013: Table 2). Therefore, radiocarbon dates seem to support the general chronology of the site as suggested by the evidence of the ceramic assemblages.

In particular, two samples (IFAO 206, 207) were collected in association with two living floors inside the gallery Cave 3 (excavation unit WG 39, see 3.2.e Excavations, western terrace slope, Cave 3/WG 39), and suggest that the cave was used during the whole Middle Kingdom (Shortland and Ramsey 2013: Table 2). The dating of sample IFAO 207 is consistent with the ceramics, which point to a use of the gallery-cave in the late 12th to early 13th Dynasties (see 4.1.a Egyptian ceramics, 2006-2007), while the dating of sample IFAO 206 possibly suggests an earlier use of the gallery-cave in the late 11th to early 12th Dynasties. It is possible, however, that a discarded timber from an earlier expedition was used for fuel there. The dating of the sample of wood (IFAO 211) from a timber at the entrance to the Cave 2 suggests that the entrance to the gallery was reinforced in the early 13th Dynasty (Shortland and Ramsey 2013: Table 2).

A charcoal sample (IFAO 213) was collected in a hearth associated with Canaanite ceramics at the top of the deposit covering the entrance to the gallery Cave 3 and is consistent with the associated ceramics, which have been ascribed to the late 12th to early 13th Dynasties (see 4.1.b_Egyptian ceramics, 2007-2008).

A sample from a hearth associated with a the "alcove shrine" to the south of Cave 7 (IFAO 214) suggests use of the shrine at the time of Amenemhat III (Shortland and Ramsey 2013: Table 2), as perhaps also confirmed by Stela 23 discovered in that area.

Only a sample from a transect in front of the entrance to Cave 2 (IFAO 205) provided a much later date and thus might be intrusive, as the ceramics in the gallery date to the Middle Kingdom (Bard and Fattovich 2007: 117). This sample, however, might point to the re-use of the site in the New Kingdom (Shortland and Ramsey 2013: Table 2), but in a phase even later than the one suggested by some early 18th Dynasty sherds collected in that area (Bard and Fattovich 2007: 117).

10.4 Dendrochronology

Otto Cichocki

Samples of cedar were collected and examined in 2006-2007 and 2007-2008 with the ultimate aim of providing evidence for a dendrochronological dating of the assemblages investigated at Mersa/Wadi Gawasis.

These samples were most likely from ship timbers with joints and pegs, and smaller wooden chips without any attributable function. Based on macroscopic identification, most of the bigger timbers were made of cedar wood. For some samples these identifications were supported by microscopic identification by Rainer Gerisch. Preservation of some of the examined cedar fragments was due to their dry condition, or that they were partially soaked with sea salt water. Some of the fragments were also partially charred.

For both dry and wet samples, the flat surfaces were cleaned and some were cut with a razor blade to see the ring borders as clearly as possible. For some samples the longitudinal side was better suitable. These surfaces were scanned with a flatbed scanner to produce a picture with high magnification of the tree rings and their ring borders. With special software the widths of these tree rings were measured one by one with an accuracy of 1/100 mm. The results were data lists of each sample with the exact ring width of their tree rings.

Only samples with more than 15 rings were investigated, as dendrochronology is a statistical method and needs random samples with patterns large enough to be identified statistically. Usually this number is more than 60 rings, but as most likely several parts were cut off the same original piece, the similarity between single pieces might be higher (Cichocki 2000, 2004, 2006). The examined samples are listed in Table 24.

Excavation Unit	Assemblage	Number of rings	Notes
WG 2005-06	Surface collection	46	
WG 24	Cave 2, Room 1 test trench, SU34	47	Timber 10
WG 39	Cave 3, surface collection	24	W176 1
WG 39	Cave 3, surface collection	18	W176 2
WG 39	Cave 3, surface collection	24	W176 3
WG 24	Cave 2, Room 1	95	Timber 51 1
WG 24	Cave 2	26	Timber 39 outside
WG 24	Cave 2	92	Timber 39 inside
WG 24,	Cave 2, Room 1, SU57	135	Timber 28 outside
WG 24,	Cave 2, Room 1, SU57	135	Timber 28 inside
WG 24	Cave 2, Room 1, SU57	63	Timber 27 chip
WG 24	SU34	56	Timber 9
WG 24	SU57	169	Timber 27
WG 30	D5, SU5	112	Timber 25
WG 30	SU50	107	Timber 26
WG 39	Cave 3, A8, SU15	19	W240 2
WG 39	Cave 3, A8, SU11	45	

WG 39	Cave 3, A8, SU15	13	W245 sample 1
WG 39	Cave 3, A8, SU15	27	W245 sample 2
WG 39	Cave 3, A8, SU15	16	W245 sample 3
WG 39	Cave 3, A8, SU15	14	W245 sample 4
WG 39	Cave 3, A8, SU15	17	W245 sample 5
WG 39	Cave 3, A8, SU15	19	W245 sample 6
WG 39	Cave 3, A9, SU11	23	W233 outside
WG 39	Cave 3, A9, SU11	39	W233 inside
WG 39	Cave 3, B10, surface	46	
WG 39	Cave 3, A8/B8 surface	96	W236
WG 39	Cave 3, A8, SU14	20	
WG 39	Cave 3, A8, SU14	19	Sample 2
WG 39	Cave 3, B2, SU9	41	Timber 52
WG 24	Cave 2, room 1, SU47	41	Timber 16
WG 24	Cave 2 entrance	324	Timber 20
WG 24	Cave 2 entrance	304	Timber 21
WG 16/WG 30	SU50, between caves 3 and 4	45	Timber 32 (core)
WG 39	Cave 3, SU18	138	Timber 64 (core)
WG 39	Cave 3, SU18	93	Timber 65

Table 24. *Samples submitted for dendrochronological studies.*

To synchronize the data sets of different samples, a special software is used to compare the rings in a certain position to each other and calculates the percentage of rings with increasing or decreasing width in the data sets. This number is then verified by several statistical tests. Results might be a significant similarity of ring patterns in a certain position to each other. In other cases it is not possible to find a matching position. A first test of the synchronization of the data sets from Mersa/Wadi Gawasis shows great similarities between patterns of some sets.

As no standard for dating of cedar wood from excavations of ancient Egyptian sites exists at present, and a proper dendrochronological sequence of cedar is on the way to be built, it is hoped that in the future this methodology will contribute to the establishment of the chronology of the investigated assemblages at Mersa/Wadi Gawasis. For the present (2008), the data from Mersa/Wadi Gawasis are contributing to the reconstruction of the dendrochronological sequence for cedar in the framework of the Project 7 of SCIEM 2000, “The Synchronization of Civilizations in the Eastern Mediterranean in the Second Millennium BC” (see Cichocki *et al.* 2004), aimed at collecting data sets to construct a standard for absolute dating reaching back from modern times to the 2nd millennium BC.

Chapter 11
Conservation

11.1 Conservation, 2006-2007

Consolidation of the caves and preservation of ropes, timber, wood and stelae were a relevant component of the project in 2006-2007.

Giuseppe Morganti, an architect with the Archaeological Superintendence, Rome (Italy), visited Mersa/Wadi Gawasis to consult on conserving the cave rooms. Pasquale Musella, chief conservator with the National Archaeological Museum, Naples (Italy) was in charge of the preservation of artifacts.

11.1.a Caves

GIUSEPPE MORGANTI

An assessment of the state of preservation of the rock-cut caves confirmed what was already remarked in 2005-2006:

1) Exterior wall and entrances of Caves 2-7: along the exterior wall of the fossil coral terrace large cracks have developed, which may have worsened due to the removal of sand deposits during the excavations. Parts of the terrace wall at the entrances to the cave rooms need to be propped up with wooden buttresses. All of the entrances to the cave rooms need to be supported by a series of frames made of wooden beams, in order to provide safe entry inside. This can be done by filling in all gaps in the (ancient) constructed walls/supports at the entrances with fired bricks inserted tightly with clay mortar.
2) Cave rooms: Cave 4a/4b cannot be excavated or visited as fractures and rock collapse are extensive and working conditions are very hazardous. The only way to ensure minimum stability in the other caves (Caves 2, 3, 5, 6, 7), and obtain an acceptable amount of safety, is to build a series of supports in the form of masonry pillars. These pillars should be constructed with fired bricks and clay mortar built on top of blocks of bedrock that have collapsed from the ceiling. This system will effectively transmit the weight load, creating a network of support similar to a system of pillars. A system of brick pillars is preferred to scaffolding built of metal tubes, due to the necessity of filling irregularly shaped gaps in the rock and small spaces in some parts of the cave rooms.

11.1.b Artifact preservation

Pasquale Musella

Preservation focused mainly on consolidating the wooden boxes and timber, and cleaning salt incrustations from stelae and ceramics.

In particular, the boxes and timber were carefully cleaned and consolidated with ethyl silicate before removal with thin wood panels because of the fragility of the wood.

A brick wall was built between Cave 2 and Cave 5 in order to completely isolate and preserver the coils of rope in Cave 5.

11.2 Conservation, 2007-2008

Pasquale Musella

The condition of excavated ship components has been systematically checked by observation during past field seasons. Wood planks stored on site in Cave 3 are in good condition and appear to have stabilized in storage, with only minor changes on the surface such as small cracks and occasional pale areas of salt. In some cases planks stored in Cave 1 exhibit light powdery salt crystals on the surface. They are found on some surface areas of the wood and have not structurally damaged the wood.

At the end of the 2007-2008 field season five data loggers to monitor temperature and relative humidity were placed in three caves (Caves 1, 2 and 3) and one data logger was placed in one of the storage boxes containing ship timbers in the Supreme Council of Antiquities (SCA) storeroom in Qift, to monitor the environment in which materials were stored. The data loggers were obtained by Howard Wellman, who advised K. A. Bard and R. Fattovich to place them in the caves.

11.3 Conservation, 2009-2010

Howard Wellman

The broad outline of Howard Wellman's remit this field season 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.

11.3.a 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 (see 11.2 Conservation, 2007-2008; C. Zazzaro personal communication: 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.

11.3. b 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.

Timbers in storage

Twenty-nine timbers excavated in previous field 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 Maritime 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. 60° C). 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 without 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.

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 (ostracon) 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.

11.4 Conservation, 2010-2011

HOWARD WELLMAN

Howard Wellman was assisted this field season by Caroline Jacoby. Conservation work was funded by a grant from the American Research Center in Egypt (ARCE). The conservation brief for this excavation season was to assist maritime archaeologist Dr. Cheryl Ward with:

1) The preservation and storage of timbers excavated in previous seasons,
2) An attempt to lift a coil of rope from Cave 5,
3) To continue preservation of the steering oars (T72, etc.) located at the mouth of Cave 6.

11.4.a Environmental monitoring

The HOBO-brand (Onset Computer Corp.) environmental data loggers left in Caves 2, 3, and 5 in January 2010 were retrieved and downloaded. They had collected temperature and relative humidity (RH) information at ½ hour intervals for the entire year. The data collected from January to December 2010 confirm observations reported in the 2009-2010 conservation report. Temperatures in the cave follow the exterior temperature closely as the shallow rock strata transmit solar heat to the interior spaces. The bulk of the rock, especially in spaces with minimal air exchange with the exterior, helps to maintain a steady RH that stays within a range generally acceptable for the maintenance of organic artifacts.

1) At the mouth of Cave 2: temperature annual maximum 37° C, minimum 18° C; Relative Humidity (RH) annual maximum 70%, minimum 15%, daily variation approximately +- 10%.
2) Rear of Cave 3: temperature annual maximum 31° C, minimum 25° C; RH annual maximum 56%, minimum 26%, daily variation approximately +- 5%.
3) Cave 5 ("Rope Cave," sealed): temperature annual maximum 31° C, minimum 27° C; RH annual maximum 50%, minimum 45%, daily variation approximately 1%.

The three data loggers were relaunched and placed in Cave 3 with the stored timbers to monitor the different conditions in the storage area: one left on the open shelf, one sealed in an Escal bag (no oxygen scavenger), and one in a loosely clipped bag (like most of the timbers at present).

11.4.b Storage of timbers

Based on research and testing in the 2009-2010 field season, it had been determined that the best storage regime for the WG timbers would be to seal them in impermeable bags with an oxygen scavenger and humidity buffer. The bagged timbers would then be placed on shelving units inside the WG caves, where the relatively stable ambient cave climate would provide an extra level of protection.

The anoxic bagging system chosen was the RP System by Mitsubishi Gas Co. This consists of an Escal bag (polyethylene film with vacuum-deposited ceramic layer) and the proprietary RPS-K oxygen scavenger with humidity buffer. The bag provides physical protection from dust, handling, and insect infestation (silver fish were observed in the cave). The transparent bag allows visual inspection of the enclosed timbers for conservation or research purposes. The oxygen scavenger reduces the rate of organic decay by inhibiting fungal growth and insect activity. The humidity buffer reduces the annual swings in humidity levels. Reducing the humidity swings reduces fungal activity, salt crystal growth and dissolution, and the annual cycle of cellular swelling and shrinkage.

Shelves were constructed in Cave 3 by a local workman with pine lumber.

On-site, a handling protocol was developed in coordination with the archaeologists and photographer:

1) Each timber was gently cleaned with natural bristle brushes and puffer bulbs to remove dust, frass, and other foreign material.
2) Each timber was put on a luan plywood support and tied down with cotton gauze strips.
3) The timber was then put into a custom-fit Escal bag (labels were written on the inside and outside surfaces of each bag to supplement the object labels) and loosely clipped shut.
4) Timbers were given additional examination as needed by the archaeologists.
5) Each timber was photographed and videoed by the photographer.
6) Once all exams and photos were completed, the RP packets were inserted in the bags and they were sealed with a heated tacking iron. Because all of the RP packets did not arrive on site due to shipping problems, only four timbers were sealed and completed. Other timbers were shelved with the bags folded and clipped shut.
7) The bagged timber was placed on a shelf, and the location recorded.

11.4.c Future recommendations

The unsealed bags should be processed to add the scavenger and properly seal them for long-term preservation. This will take less than one week of labor.

11.4.d Treatment of rope coil

Based on field laboratory experiments in the 2009-2010 excavation season, a section of coiled rope was identified for further treatment in

Cave 5. Coil 18 (nearest the door and previously suffering damage from people moving inside the cave) was chosen. A scaled sketch and several photographs were taken to document the coil, and then loose surface material was removed by the conservator. Cyclododecane was melted on site with a small electric hot-plate and applied to the rope surface by dropper, spoon, or poured from an adapted coffee-pot. Initial tests showed that significant consolidation could be achieved by applying minimal cyclododecane to the spaces between the rope yarns. Larger volumes of consolidant poured into the coil penetrated more deeply, bonding lengths of rope within the coil together. Using approximately one kilogram of cyclododecane, it was possible to solidify and remove as one unit a "tangle" of rope sitting on top of the greater bulk of coil 18.

The remainder of the cyclododecane on hand was used to consolidate the ends and faces of the rope coils nearest the doorway to Cave 5 that have suffered erosion from visitors.

This test-lift satisfied the archaeologists and conservator that using this technique, a full coil of rope could probably be lifted safely. This, however, begs the further question of what would happen next, and whether a coil should be lifted just because it is possible. We therefore recommend that no further conservation or attempts to remove a rope coil be done until a full conservation plan has been written that considers at a minimum the following criteria:

1) Site access (working space inside the cave) by at least two conservators and protection of adjacent rope coils: this would involve building a bridge or gantry-way to allow two conservators to climb over adjacent coils and work on the coil selected.

2) Time and materials needed for temporary consolidation: at least 10 kilograms of cyclododecane and several days of conservation work, not including the construction of protective walk-ways noted above.

3) Location of conservation facility for full conservation of rope post-lifting and planning of treatment options to include at least:

a. Fumigation to kill silverfish infestation.
b. Cleaning.
c. Consolidation.
d. Mounting and support.
e. Creation of climate-controlled storage and display setting.
f. Plan for long-term monitoring and assessment.

11.4.e Future recommendations

Access to Cave 5 should be tightly controlled to prevent future damage to the extremely fragile coils of rope. The consolidants applied in 2011 should be monitored and re-applied as necessary. If authorities insist that a coil be lifted for research or display reasons, a full conservation plan as outlined above must be developed before any actions are taken.

11.4.f Protection of timbers in situ

In the 2009-2010 field season, the steering oar timbers in front of Cave 6 were partially conserved as their salt concretion shells were removed for documentation. The treatment involved consolidation with Butvar B-98 in ethanol, followed by the application of a cotton gauze facing adhered with Acryloid B-72 in acetone. The timbers were then reburied at the end of the field season.

In January 2011, the steering oars were uncovered and reexamined. The facings were still intact, but the consolidated tip of T72 was broken loose from the rest of the timber, which was still covered by its concretion. This fragment was given a hard jacket of gauze bandages impregnated with plaster of Paris with barrier layers of polyethylene film and aluminum foil, then pedestalled on burial sand and a supporting plank was slid underneath it. The fragment was then flipped over and examined. The timber is very badly fragmented due to rot and insect damage. The consolidation in 2009-2010 did not penetrate through the entire timber and the under-surface was very fragile and friable. The surface was cleaned of sand and foreign material, and a plaster of Paris base was prepared in the same fashion as the upper jacket. The timber fragment was then bagged and shelved with the other timbers.

The rest of the oar assemblage was examined. The other timbers were more solid than T72, but still fragile. It is our recommendation that these timbers cannot be lifted intact. Lifting, even with additional conservation and consolidation *in situ*, will cause the timbers to break into many smaller fragments. In consultation with Cheryl Ward, we determined that reburial with a protective shell would be the best option at this time. As described above, a hard jacket of plaster of Paris bandages was applied over barrier layers of plastic film and aluminum foil. The timbers were then reburied under 0.5 meters of sand.

Chapter 12
Synthesis

12.1 The site of Mersa/Wadi Gawasis

Kathryn A. Bard and Rodolfo Fattovich

The main purpose/use of the site of Mersa/Wadi Gawasis was as the staging point and harbor for pharaonic seafaring expeditions to regions in the southern Red Sea (Punt and Bia-Punt), to obtain exotic raw materials, especially incense, but also ebony, elephant ivory, gold, and exotic animals and animal skins. The sea route to Punt was an alternative to the river/land routes, and was much less frequently undertaken because of the complexity of the logistics required for such expeditions and the risky nature of long-distance voyages to and from the southern Red Sea.

The rise of the kingdom of Kerma in the late 3rd millennium BC and its eventual control of the Middle Nile was probably the major impetus for the organization of seafaring expeditions to Punt in the Middle Kingdom, the period to which most of the excavated material at Mersa/Wadi Gawasis dates. The Egyptians wanted to control this trade directly and bypass parts of the Middle Nile controlled by Kerma. There may also have been threats on overland routes across the Eastern Desert/Mountains from desert peoples that were belligerent or simply capable of robbing Egyptian expeditions.

Although at least one Middle Kingdom harbor is known farther north coast at Ayn Soukhna, this harbor was probably only used for short voyages across the Gulf of Suez to the Sinai, where copper and turquoise mines were exploited. For the much longer voyages to the southern Red Sea, the southern part of the Gulf of Suez would have been avoided, with the sea voyage beginning at Mersa/Wadi Gawasis, ancient *Saww*, instead of farther north. The harbor of *Saww* also was located near the shortest overland route from the Nile Valley in Upper Egypt to the Red Sea.

12.2 The ancient harbor

Kathryn A. Bard and Rodolfo Fattovich

The ancient harbor at Mersa Gawasis was an open, protected bay with a maximum area of 560,000 m^2 around 7,500 years ago and a depth of approximately 6-8 m. Large ships could pass through the 10 m (maximum) deep (and 150 m wide) channel at the mouth of the bay (see 2.3 Coastal Geology). After reaching its maximum extent as sea levels rose above their modern levels, the bay rapidly closed due to high sediment loads from the adjacent wadi during a time of significantly wetter climatic conditions. Rapid aridization between 3000 BC and 2000 BC greatly reduced sediment supply to the lagoon. Slower infilling rates combined with slowly falling sea levels to allow for the existence of a stable, shallow lagoon at the site when it was used as a harbor in the 12th Dynasty. Lagoonal waters reached the southern edge of the site near the beach that was used for expedition camps and the rock-cut caves and galleries. Ships would have moored near the southern side of the site, where they were protected from the northerly winds by the coral terrace on land.

12.3 Chronology

Kathryn A. Bard and Rodolfo Fattovich

The pottery typology and stratigraphic sequence demonstrate that the harbor was used in both the early and late 12th Dynasty (ca. 1985–1773 BC), and in the early 13th Dynasty (ca. 2055–1650 BC) (see 4.1 Egyptian ceramics, 10.1 Material culture). A few excavated potsherds, most likely dating to the late Old Kingdom/First Intermediate Period and late Second Intermediate Period/early New Kingdom, suggest that the harbor may have been used in these periods as well (Bard and Fattovich 2007: 110, 114-115).

The inscribed stelae, wooden boxes and ostraca, including the stelae that Sayed (1977, 1983) recorded in the mid-1970s, demonstrate concentrated use of the harbor throughout most of the 12th Dynasty, during the reigns of Senusret I (ca. 1956–1911 BC), Senusret II (ca. 1877–1870 BC), Senusret III (ca. 1870–1831 BC), Amenemhat III (ca. 1831–1786 BC), and Amenemhat IV (ca. 1786–1777 BC) (see 10.2 Textual evidence). An inscription from Bir Umm Al-Huwaytat, recording a seafaring expedition during the reign of Amenemhat II (ca. 1911–1877 BC) (see Sayed 1999), suggests use of the harbor during the reign of this king as well.

Of the 14 samples of charcoal, timber and shells that were submitted to the Laboratory of the Institut Français d'Archéologie Orientale, Cairo, for radiocarbon dating, five samples provided radiocarbon dates which are consistent with the use of the harbor in the first half of the 2nd millennium BC. Several other radiometric dates provide intriguing evidence of seafaring expeditions of the later 11th Dynasty or early 12th Dynasty and in the 20th Dynasty, which are not represented in the epigraphic evidence at the site (see 10.3 Radiocarbon dates).

12.4 Activity areas and site organization: new finds 2006-2011

Kathryn A. Bard and Rodolfo Fattovich

A total of eight man-made caves were excavated into the fossil coral terrace above the camp and production area by expedition workers. The caves were used mainly for storage, but there is also evidence for other activities such as food preparation and cooking, and wood-working (see 3.2.d Excavations, western terrace slope, Cave 2; 3.2.e Excavations, western terrace slope, Cave 3/WG 39; 3.2.f Excavations, western terrace slope, Cave 8). Camping activities (as well as administrative activities) took place on the coral terrace slope, outside the entrances to most of the caves.

Continuing excavations on the western terrace slope uncovered several new stelae: Stela 14 with the royal names of Senusret III, found near the entrance to Cave 6; Stela 16 of Ameny with the offering formula, dating to the reign of Amenemhat III, found to the north of the entrance to Cave 3; and Stela 28 with an inscription that includes a rare epithet of the god Osiris ("Osiris of *Wadj-wer*"), found near the "alcove shrine" (see 9.1 Stelae).

The "alcove shrine" was located directly below the circular mound on top of the terrace where the Antefoker stela was found by Sayed. It consisted of an alcove-like opening in the terrace wall, outside of which was a U-shaped structure composed of three large conglomerate blocks, with a fourth block leaning against the southernmost one (see 3.2.b Excavations, western terrace slope). A low curved wall ("cobble wall"), cut into the conglomerate layer of the terrace, extended around the shrine. Unlike most other excavated units on the western slope at Wadi Gawasis, there is no evidence of domestic activities, wood-working, or accumulated materials from expeditions; Egyptian ceramics excavated at the shrine suggest repeated cycles of offerings, as well as a concentration of sherds from at least five small jars of Palestinian origin (see 4.1.b Egyptian ceramics, 2007-2008).

The alcove shrine and exterior area of the entrance to Cave 7 (unexcavated due to ceiling collapse), where Stela 28 was found, thus provide evidence of the most unusual ritual activity excavated at the ancient harbor site. The shrine was used throughout the 12th Dynasty and offerings also were left near there, including two Minoan pots and (burnt) rods of ebony, as well as the unfinished offering stela to a maritime deity, Osiris of *Wadj-wer*, and Horus the Great. The shrine was located at a prominent point at the site, at a corner in the western coral terrace overlooking the inland lagoon/harbor. Most likely this shrine was actively in use by expedition members who camped in this area, unlike the shrines located along the seashore at Mersa Gawasis, which were probably built to commemorate different expeditions.

Also excavated outside Cave 7 was an area for salvaging ship timbers, with much wood debris and lithic artifacts. This area also was used for packing and unpacking goods and many clay sealings and wooden box fragments were found there – near the work area in front of Cave 6, where the majority of clay sealings and wooden boxes were excavated in earlier field seasons (see 3.2.b Excavations, western terrace slope).

Continuing excavations outside Cave 6 revealed a deposit of eight ship timbers, beneath which were two steering oar blades (T72 and T85) from a single steering oar, lying parallel – and probably positioned as a ramp into Cave 6. The blades are remarkable for their size, measuring ca. 3.25 m and 4.20 m in length: twice as long as the steering oar blades (T1, T2) found in the entrance to Cave 2 in 2004 (see 5.1.b Ship timbers and nautical artifacts, 2007-2008).

In the long gallery-cave Cave 2 continuing excavations revealed intensive wood-working activities, as well as an adze handle from a tool that was used to remove the damaged parts from ship timbers. A number of tenon fragments also were recorded there (see 3.2.d Excavations, western terrace slope, Cave 2).

Excavations in the contiguous Cave 3 uncovered an assemblage of seven reworked ship timbers in an earlier phase of use, including T64, a segment of a strake fastened to the keel and positioned at the waterline. In the later phase of use of Cave 3 there is evidence of the burning of ship timber parts (3.2.e Excavations, western terrace slope, Cave 3/WG 39).

Cave 3 also was used for food storage. Well preserved emmer wheat (*Triticum dicoccum*) spikelets, with the seeds completely eaten by insects, were excavated in the earlier deposit in the inner part of the cave (see 7.1.a Archaeobotanical investigations, 2006-2007). The emmer had been transported from the Nile Valley as spikelets, already coarsely threshed, and then was stored in Cave 3.

In 2009-2010 a new man-made cave (Cave 8) was discovered. This cave, which was closer to Cave 1 in dimensions, and not a long gallery-type cave, had been swept clean (probably in the late 12th Dynasty) and only contained a few Egyptian potsherds and potsherds of an unknown black ware jar with a handle that had been made on a fast wheel (see 3.2.f Excavations, western terrace slope, Cave 8).

Just outside the entrance to Cave 8, three broad, flat ship deck timbers were found covered by mud-bricks – probably originally from a roof structure that later collapsed. In this area there were many Egyptian ceramics of the early to mid-12th Dynasty, of types of pottery that would be expected at a domestic site – from small cups and dishes to cooking pots and larger storage or transport jars. Later use of this area was for administrative activities, which included evidence of clay papyrus sealings (late 12th Dynasty types), a faïence scarab/seal, and fragments of papyri, including a papyrus fragment with three lines of a hieratic text (see 9.3 Papyri and inscribed fabric, 9.5.a Sealings and seal and 9.5.b Preliminary remarks on the sealings). Other clay sealings found in this area were used to seal wooden boxes, bags and baskets. Fragments of plastered cargo boxes also were found there as was a lump of beeswax, the material used to caulk ship hulls.

Also found outside Cave 8, lying face down in colluvium that had fallen from above the cave entrance (and was probably originally associated with a feature on top of the terrace), was an inscribed sandstone stela (Stela 29), dating to Year 2 of Senusret II. The text is about an expedition to Bia-Punt, directed by the herald Henenu.

To the south of the opening of Cave 8 were two contiguous mud-brick features built on a mud-brick platform. These two features were fire-pits which contained ash, charcoal and thousands of burnt barley seeds. The features seem to have been used to process barley: to remove the chaff by parching (see 7.1.d Archaeobotanical investigations, 2010-2011).

Cave 1, to the southeast of Cave 8, was the first cave found at Wadi Gawasis, in 2004. Later excavations in WG 40 just to the south of the entrance to Cave 1, in 2010-2011, distinguished two different periods of use there, with the pottery and other artifacts associated with domestic activities of camping (see 3.2.b Excavations, western terrace slope). A pile of five mats made of halfa grass or dom palm leaves, along with cut reeds, the raw material for mat-making, was excavated farther south. The mats, which were of materials found in nearby wadis (halfa grass) and possibly along the Red Sea shore in antiquity (dom palm), were used there to create a living/sitting surface at the camp site (see 7.1.d Archaeobotanical investigations, 2010-2011).

On the southern terrace slope where Sayed had found evidence of a camp (Sayed 1978: 70-71), a constructed mud-brick platform was excavated in 2010-2011 with evidence of many potsherds of storage jars (see 3.2.b Excavations, western terrace slope). But use of this area was terminated in Middle Kingdom times when huge fragments of the coral terrace overhang broke off and destroyed part of this platform.

Large areas of the beach next to the harbor, opening to the south of the western terrace and southern slope, were excavated with evidence of two periods of use as a camp, both of which have later 12th Dynasty ceramics (see 3.2.g Excavations, southern terrace slope and harbor area). The earlier camp included an area for many large storage jars, as well as fragments of a Canaanite jar and a large cooking pot of Nile E fabric. The later camp, located farther away from the harbor edge, contained a wide variety of ceramics from the Nile Valley, as well as two body sherds of a large cooking pot of Nile E Ware. This evidence suggests that some wares (as well as Canaanite jars) in these camps were supplied from the eastern Delta.

At the base and on the lower slope of the western coral terrace slope, near the shore of the paleo-bay, three mud-brick structures, possibly ramps (slipways?) were excavated (see 3.2.i Excavations, mud-brick structures,WG 70/72/73/76). The stratigraphic evidence there suggests that the earliest use of this area in the 12th Dynasty was for baking bread, with the structures constructed only later in the 12th Dynasty. The ramps were associated with a great quantity of wood debris, suggesting that carpentry activity was practiced in this area. Constructed of mud-brick, the ramps were no more than 30 cm in height at the higher end. Possibly ships that were used at the beginning of an expedition(s) were constructed on these ramps, but the archaeological evidence is only of their dismantling and the salvaging of timbers at the end of an expedition(s).

Activities in the production area (WG 19/25/26/27), which had been excavated in earlier field seasons (see Bard and Fattovich 2007: 73-76), continued to be investigated (see 3.2.h Excavations, production area, WG 19/25/26/27/44). Although the large, chaff-tempered "platters" using local clay were fired there, the many long, cylindrical bread molds found there, once thought to have been produced at the harbor site, were probably brought from the Nile Valley and were used for bread making (see 4.1.h Bread molds and platters). Lithics also were produced there, but the evidence was mainly of debitage pieces. The majority of retouched tools were ones that could be used for scraping – probably for wood/timber salvaging.

The many charred grains that were found in the production area, mainly of barley, may represent accidents that happened during the heating of the grains, to process them to release the chaff. Cereal chaff was used as tinder for starting fires there, and a variety of woods, originally used in the ships and probably not salvageable, were burned as fuel and identified in the charcoal.

Therefore, much of the evidence at Mersa/Wadi Gawasis is from the end of the seafaring expeditions, when the products of Punt were unloaded there along the slope of the western coral terrace for transport into the Nile Valley. Ships were dismantled next to the harbor edge and their timbers were salvaged in various locations throughout the site.

12.5 Ceramics

KATHRYN A. BARD AND RODOLFO FATTOVICH

The overall chronological profile of the site is clear and uniform, dating to the 12th Dynasty with occasional indications of the early 13th Dynasty (see 10.1 Material culture). Storage was an important activity at the site and the range of storage jars was limited to a few types in Marl A3 and Marl C. A whole range of Middle Kingdom ceramics is present in areas of the site that were associated with living activities, including a range of plates, platters, bottles, jars and cups (see Appendix 1 Ceramic finds by SU). These ceramics must have been brought from the Nile Valley, and the site was supplied by different workshops allied to the state and Crown. Other ceramic material was brought from further afield, such as the Eastern Delta in the case of Nile E, and also from outside Egypt. The presence of some pieces of large, low fired platters in a friable buff clay supports the theory that some ceramic material was produced locally.

A large number of pot marks, identified in 2007-2008, were almost exclusively on jars of Marl C and related fabrics with a few from Marl A3 (see 4.1.e Pot marks). They were all made before firing.

Also found at Mersa/Wadi Gawasis are a number of wooden and pottery discs, formerly identified as gaming pieces, net floats, etc., which were probably used as jar stoppers (see 4.1.f Ceramic and wooden discs).

The wide range of ceramic material present at Wadi Gawasis demonstrates that the site experienced a wide range of uses relating to and in support of its main function as a base for foreign trade. It was necessary to bring in supplies vital to maintain the operation; it was crucial to feed the personnel, to maintain the sea going vessels, to fulfill cult activities and to be prepared for all eventualities. The ceramic material represents all these functions, especially domestic activity. The huge amounts of raw materials required to fulfill the needs generated by each expedition had to be transported to and from the site, and this was frequently achieved through the use of large jars.

Even the tubular bread molds, which are present in considerable quantity on the site, appear to be made in a technique and from a material very similar to that found in the Nile Valley, and they also may have been brought to the site.

A few Canaanite ceramics also were recorded at the harbor site, in assemblages dating to the late 12th – early 13th Dynasties. They include one handle from a jar, 24 fragments of rims and bases of at least five medium-sized bottles and a few fragments of a Middle Bronze Age Canaanite amphora (see 4.2.b Exotic ceramics, Canaanite).

Two Minoan potsherds were excavated in WG 55, just outside of the alcove shrine (4.2.c Exotic ceramics, Minoan). Although the two Minoan potsherds were found in the sames tratigraphic unit, they come from different pots dating to very different periods. One potsherd is characteristic of the Proto-palatial period, possibly as early as ca. 2000 B.C., of the White-banded Style of MMIB Kamares pottery; the other potsherd is from a shallow bowl of Fine Buff Crude Ware of the MMIIIA, ca. 1700 BC (4.2.c Exotic ceramics, Minoan).

Potsherds in a Nubian style are the majority of the exotic ceramics at Mersa/Wadi Gawasis (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics). These sherds are similar in style to the Middle Nubian ceramics and the ceramics of the Pan-Grave culture in the Lower Nubia Valley and Eastern Desert. The sherds in a Pan-Grave style may even suggest the presence of local nomads at the harbor.

12.6 Location of Punt, based on the evidence from Mersa/Wadi Gawasis

KATHRYN A. BARD AND RODOLFO FATTOVICH

Some potsherds at Mersa/Wadi Gawasis also can be ascribed to the Kerma culture of Upper Nubia (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics). In particular, several potsherds from Mersa/Wadi Gawasis that are comparable to a variant of Kerma pottery, which has been recorded in cemeteries and sites to the east of the Fourth Cataract in Sudan, are significant in terms of the possible location of Punt. These ceramics might have arrived to Mersa/Wadi Gawasis from the Sudanese coast *via* the Red Sea. The occurrence of these potsherds might suggest a location of Bia-Punt ("mine of Punt") in the gold-bearing region of Oshib, to the east of this cataract (Manzo 2012c).

Ebony imported from Punt, in the form of rods and charcoal from fire-pits, has definitely been identified at the harbor site by Rainer Gerisch (see 6.2.d Identification of wood and charcoal, 2009-2010). The overlap of the areas of distribution of ebony and gold sources in the western lowlands and northern highlands of Eritrea (Fattovich 1991c: Fig. 1; Manzo 1999: 8-9, Pl. 11-12), together with the occurrence of potsherds at Mersa/Wadi Gawasis from the same region (Gash Group ware, see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics), also might suggest that Bia-Punt included in both gold-bearing regions in present-day northern Eritrea and eastern Sudan (Bard and Fattovich 2018: 172-175).

Potsherds of the Gash Group, and potsherds arriving from the Eritrean-Djibouti coast that were excavated at Mersa/Wadi Gawasis are consistent with the archaeological evidence from the northern Horn of Africa, and support a location of Punt in this region, suggesting that Egyptian ships were navigating at least as far south as the Gulf of Zula (Bard and Fattovich 2018: 172-175).

Fourteen potsherds excavated at Mersa/Wadi Gawasis are comparable to specimens from Yemen (Bard and Fattovich 2007: 130-131, see again 6.2.d Identification of wood and charcoal, 2009-2010). The occurrence of Mal^{c}ayba ware at Mersa/Wadi Gawasis suggests that the Egyptians may also have been navigating along the coast of Yemen, and thus Punt could have included the southwestern part of the Arabian peninsula. It is also possible that myrrh and frankincense were transported from southern Arabia to the African side of the southern Red Sea, where they could be traded for Egyptian goods (Bard and Fattovich 2018).

The sources of few pieces of obsidian collected at Mersa/Wadi Gawasis have been identified: they originated in Eritrea and Yemen, but not in Ethiopia (Lucarini *et al*. 2020). This evidence points to Egyptian contact with Eritrea, probably in the area of the later harbor of Adulis, in the Gulf of Zula, which is also suggested by some ceramic finds at Mersa/Wadi Gawasis (see 4.2.a Exotic ceramics: Nubian, Eritrean and South Arabian ceramics). The lithic evidence also suggests contacts, either direct or indirect, with the southern Arabian peninsula via the Egyptian seafaring expeditions to Punt and Bia-Punt in the Middle Kingdom.

12.7 Conclusions

Kathryn A. Bard and Rodolfo Fattovich

The second five field seasons at Mersa/Wadi Gawasis (2006-2007, 2007-2008, 2009, 2009-2010, 2010-2011) have provided more evidence of the organization of the seafaring expeditions from the ancient Egyptian harbor to Punt and Bia-Punt in the Middle Kingdom, as well as specific evidence which can be used to interpret where these destinations were located in the southern Red Sea region.

The harbor was the starting point for the seafaring expeditions, when the ships made in the Nile Valley were reassembled and prepared for the long southward voyage to Punt and/or Bia-Punt. While the ships were being rebuilt, the site was used a temporary camp, which made use of both open air locations and eventually eight man-made caves excavated in the western fossil coral terrace. At the return of successful expeditions, the imported materials from Punt and Bia-Punt were unloaded at the harbor, while the ships were dismantled and timbers were salvaged for reuse.

Ritual activities took place at a special shrine (the "alcove shrine") within the camp area, where some unusual offering were found, including Minoan and Canaanite pots, and sticks of ebony. There also were special commemorative shrines built on top of the western terrace and overlooking the Red Sea. Commemorative stelae provided more specific textual information about these expeditions and their dates.

Mersa/Wadi Gawasis was a highly specialized site, with limited use mainly during the 12th Dynasty, but the evidence excavated there points to the complex logistics involved in the organization of these expeditions. Ship timbers for the large seafaring vessels were brought to Egypt from as far away as Lebanon; food, ceramics and supplies came from different locations in Egypt; and large contingents of labor had to be conscripted for transport of everything from the Nile Valley – as well as for the actual sea voyages. In order to bypass Kerma control of the Middle Nile, these seafaring expeditions successfully navigated to the southern Red Sea region, returning to Egypt with the highly desired raw materials of Punt and Bia-Punt.

References

Al-Asfour, T. A.

1982. *Changing Sea-Level along the North Coast of Kuwait Bay*, London: Kegan Paul International.

Arkell, A.J.

1954. "Four Occupation Sites at Agordat," *Kush*, 2, pp. 33-62.

Arnold, Do.

1979. "Die Keramik." Di. Arnold and Do. Arnold, *Der Tempel Qasr el-Sagha*, Mainz am Rhein: Philipp von Zabern, pp. 29-40.

1982. "Keramikbearbeitung in Dahschur 1976-1981," *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 38, pp. 25-65.

1988. "The Pottery," Arnold D. (ed.), *The South Cemeteries of Lisht I: The Pyramid of Senusret I*, New York: The Metropolitan Museum of Arts, pp. 106-146.

Arnold, Do., and Bourriau, J.

1993. *An Introduction to ancient Egyptian Pottery*, Mainz Am Rhein: Philipp von Zabern.

Arvidson, R., Becker, R., Shanabrook, A., Luo, W., Sturchio, N., Sultan, M., Lofty, Z., Mahmood, A.M., and El Alfy, Z.

1994. "Climatic, eustatic, and tectonic controls on Quaternary deposits and landforms, Red Sea coast, Egypt," *Journal of Geophysical Research* 99 (B6), pp. 12,175 – 12,190.

Arz, H. W., Lamy, F., Pätzold, J., Müller, P.J., and Prins, M.

2003. "Mediterranean Moisture Source for an Early-Holocene Humid Period in the Northern Red Sea," *Science* 300, pp. 118-121.

Arz, H.W., Lamy, F., and Pätzold, J.

2006. "A pronounced dry event recorded around 4.2 ka in brine sediments from the northern Red Sea," *Quaternary Research* 66, pp. 432-441.

Aston, D.A.

2004. *Tell El-Dab^{c}a XII. A Corpus of Late Middle Kingdom and Second Intermediate Period Pottery*, Wien: Verlag der Österreichischen Akademie der Wissenschaften.

2012. "From the Deep South to the Far North: Nubian Sherds from Khatanʿan and ʿEzbet Helmi (Tell el-Dabʿa)." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 159-179.

Ayers, N., and Moeller, N.

2012. "Nubian Pottery Traditions during the 2nd Millennium BC at Tell Edfu." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 103-115.

Bader, B.

2001. *Tell El-Dab^{c}a XIII. Typologie und Chronologie der Mergel C-Ton Keramik. Materialien zum Binnenhandel des Mittleren Reiches und der Zweiten Zwischenzeit*, Wien: Verlag der Österreichischen Akademie der Wissenschaften.

Bard, K.A,. and Fattovich, R.

2007. *Harbor of the Pharaohs to the Land of Punt. Archaeological Investigations at Mersa/Wadi Gawasis, Egypt, 2001-2005*, Naples: Università degli Studi di Napoli "L'Orientale".

2008. *Mersa/Wadi Gawasis 2007-2008*, Naples: http://www.unior.it/userfiles/workarea_231/file/Progetti/WadiGawasis/Final%20Report%20WG%202007-2008.pdf

2010. *Mersa/Wadi Gawasis 2009-2010*, Naples: http://www.unior.it/userfiles/workarea_231/file/Progetti/WadiGawasis/Final%20Report%20WG%202009-2010.pdf

2018. *Seafaring Expeditions to Punt in the middle Kingdom. Excavations at Mersa/Wadi Gawasis, Egypt*, Leiden – Boston: Brill (*Culture & History of the Ancient Near East* 96).

Bard, K.A., Fattovich, R., and Ward, C.

2011. *Mersa/Wadi Gawasis 2010-2011*, Naples: http://www.unior.it/userfiles/workarea_231/file/Progetti/WadiGawasis/Final%20Report%20WG%202010-2011.pdf

Berger, A.L.

1978. "Long-term variations of daily insolation and Quaternary climate change," *Journal of the Atmospheric Sciences* 35, pp. 2362-2367.

Bietak, M.

1966. *Ausgrabungen in Sayala-Nubien 1961-1965. Denkmaler der C-Gruppe und der Pan-gräber-Kultur*, Wien: Hermann Böhlaus (*Akademie der Wissenschaften in Wien, Phil.-Hist. Klasse, Denkschrift* 92).

1968. *Studien zur Chronologie der Nubischen C-Gruppe Kultur*, Wien: Hermann Böhlaus Nachfolge (*Akademie der Wissenschaften in Wien, Phil.-Hist. Klasse, Denkschrift* 97).

Blanchette, R.A., Haight, J.E., Koestler, R.J., Hatchfield, P.B., and Arnold, D.

1994. "Assessment of Deterioration in Archaeological Wood from Ancient Egypt," *Journal of the American Institute for Conservation* 33, pp. 55-70.

Blue, L.

2007. "Locating the Harbour: Myos Hormos / Quseir al-Qadim: A Roman and Islamic Port on the Red Sea Coast of Egypt," *International Journal of Nautical Archaeology* 36 (2), pp. 265-281.

Borojevic, K., and Childs, S.T.

2018. "Bread Baking Experiments." K.A. Bard and R. Fattovich, 2018. *Seafaring Expeditions to Punt in the middle Kingdom. Excavations at Mersa/Wadi Gawasis, Egypt*, Leiden – Boston: Brill (*Culture & History of the Ancient Near East* 96); pp. 117-125.

Borojevic, K., and Mountain, R.

2011. "The Ropes of Pharaohs: The Source of Cordage from the 'Rope Cave' at Mersa/Wadi Gawasis," *Journal of the American Research Center in Egypt* 47, pp. 131-141.

Borojevic, K., Steiner, W.E., Gerisch, R., Zazzaro, C., and Ward, C.

2010. "Pests in an ancient Egyptian harbour," *Journal of Archaeological Science* 30, pp. 1-10.

Boulos, L.

1999. *Flora of Egypt: Volume One (Azollaceae – Oxalidaceae)*. Cairo: Al Hadara Publishing.

Boulos, L., and Hobbs, J.

1986. "Three arboreal species new to the Eastern Desert of Egypt," *Candollea* 41, pp. 183-191.

Bourriau, J.

1981. *Umm el Ga'ab. Pottery from the Nile Valley before the Arab Conquest*, Cambridge: Cambridge University Press.

1991. "Relations between Egypt and Kerma during the Middle and New Kingdom." W.V. Davies (ed.), *Egypt and Africa. Nubia from Prehistory to Islam*, London: British Museum Press, pp. 129-144.

2004. "Egyptian Pottery Found in Kerma Ancien, Kerma Moyen and Kerma Classique Graves at Kerma." T. Kendall (ed.), *Nubian Studies 1998. Proceedings of the IX Conference of the International Society for Nubian Studies,* Boston: Northeastern University, pp. 3-13.

2012. "Nubian Pottery from Memphis, Kom Rabia." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 149-158.

Braddock, P.

2003. "The Pottery." D. Welsby (ed.), *Survey above the Fourth Cataract*, London: The Sudan Archaeological Research Society, pp. 51-72.

Braithwaite, C.J.R.

1987. "Geology and paleogeography of the Red Sea region." A. J. Edwards and S. M. Head (eds.), *Key Environments: Red Sea*, Oxford: Pergamon, pp. 22-44.

Buffa, V.

2007. *Ma^c^layba et l'Âge du Bronze du Yémen*, Wiesbaden: Reichert Verlag (*Archaeologische Berichte aus dem Yemen* 12).

Cappers, R.T.J.

2006. *Roman Foodprints at Berenike: Archaeobotanical Evidence of Subsistence and Trade in the Eastern Desert of Egypt*, Los Angeles: Cotsen Institute of Archaeology, Los Angeles University (*Berenike Reports* 6).

Carannante, A., Fattovich, R., and Pepe, C.

2014. "Marine Resource Exploitation at Mersa/Wadi Gawasis (Red Sea, Egypt). The Harbour of the Pharaohs to the Land of Punt." K. Szabó, C. Dupont, V. Dimitrijević, L. Gómez Gastélum and N. Serrand (eds.), *Archaeomalacology: Shells in the Archaeological Record*, Oxford: Archaeopress (*BAR International Series* 2666), pp. 121-134.

Cichocki, O.

2000. "Methods and Aims in Dendrochronology. Dating Wooden Objects from the Eastern Mediterranean in the Second Millennium

B.C. (Absolute Chronology IV)." M. Bietak (ed.), *The Synchronization of Civilizations in the Eastern Mediterranean in the Second Millennium B.C.* Vienna: Österreichischen Akademie der Wissenschaften (*Denkschriften der Österreichischen Akademie der Wissenschaften* 19), pp. 62-67.

2004. "The Wooden Plank from al-Hourriyeh Cave." F. Beyano, Ch. Mattar and H. Abdul-Nour (eds.), "Mgharet al-Hourriyé (Karm Saddé, Caza de Zgharta)," *Bulletin d´Archéologie et d´Architecture Libanaises* 6 [2002], pp. 135 –178.

2006. "Libanesische Zedern als Datierungswerkzeug in der ägyptischen Archäologie." E. Czerny, I. Hein, H. Hunger, D. Melman, and A. Schwab (eds.), *Timelines. Studies in Honour of Manfred Bietak*. Louvain: Peeters (*Orientalia Lovaniensia Analecta* 149), Bd. 3, pp. 293-299.

Cichocki, O., Bichler, M., Firneis, G., Kutschera, W., Müller, W., and Stadler, P.

2004. "The Synchronization of Civilizations in the Eastern Mediterranean in the Second Millennium BC - Natural Science Dating Attempts." E. C. Buck and A. R. Millard (eds.), *Tools for Constructing Chronologies: Crossing Disciplinary Boundaries*. London: Springer, pp. 83-110.

Cichocki, O.

(in press). "Cèdres libanais comme instrument de datation en Egypte," Proceedings of the 3 ICAANE. Paris : Eisenbrauns.

Close, A.E.

1980. "Methods of Analysis of Lithic Artefacts." F. Wendorf, R. Schild and A.E. Close (eds.), *Loaves and Fishes: The Prehistory of Wadi Kubbaniya*, Dallas: Southern Methodist University Press, pp. 49-54.

1989. "Analysis of Flaked Stone Artefacts at Wadi Kubbaniya: the Low-Technology Approach." F. Wendorf, R. Schild and A.E. Close (eds.), *The Prehistory of Wadi Kubbaniya, Volume 3. Late Palaeolithic Archaeology*, Dallas: Southern Methodist University Press, pp. 293-300.

Conchon, O., Plaziat, J.-C., Baltzer, F., Choukri, A., Freytet, P., Orszag-Sperber, F., and Reyss, J.-L.

2000. "Environmental Changes on the Egyptian Coast of the Red Sea and Gulf of Suez Since Oxygen Isotope Stage 9." G. Victor Rajamanickam, M. J. Tooley (eds.), *Proceedings of the International Quaternary Seminar on INQUA Shoreline Indian Ocean Sub-Commission*. Delhi: New Academic Publisher [2001], pp. 236-248.

Damnati, B.

2000. "Holocene lake records in the Northern Hemisphere of Africa," *Journal of African Earth Sciences* 31 (2), pp. 253-262.

Daniels, D.

2004. *Ground Penetrating Radar, Second Edition.* London: IEE.

Dash, G.

2008. "How Deep Can We See? The Depth Penetrating Characteristics of Ground Penetrating Radar," http://dashfoundation.com/downloads/archaeology/working-papers/How_Deep_Can_We_See_(rev_of_9-30-08).pdf .

David, A.R.

1986. *The Pyramid Builders of Ancient Egypt*, London and Boston: Routledge and Kegan Paul.

Davies, N. de G.

1920. *The Tomb of Antefoker, Vizier of Sesostris I, and His Wife Senet (no. 60)*, London: G. Allen & Unwin (*The Theban Tombs Series* 2).

de Menocal, P., Ortiz, J., Guilderson, T., Adkins, J., Sarnthein, M., Baker, L., and Yarusinsky, M.

2000. "Abrupt onset and termination of the African Humid Period: rapid climate responses to gradual insolation forcing," *Quaternary Science Reviews* 19, pp. 347-361.

de Souza, A.

2019. *New Horizons: The Pan-Grave ceramic tradition in context*, London: Golden House Publications (*Middle Kingdom Studies* 9).

Edwards, F.

1987. "Climate and oceanography." A. J. Edwards and S. H Head (eds.), *Key Environments: Red Sea*, Oxford: Pergamon, pp. 45-69.

Emberling, G., and Williams, B.

2010. "The Kingdom of Kush in the 4th Cataract: Archaeological Salvage of the Oriental Institute Nubian Expedition 2007 Season. Part I. Preliminary Report on the Sites of Hosh el-Guruf and El-Widay", *Gdańsk Archaeological Museum and Heritage Protection Fund African Reports* 7, pp. 7-38.

FAO

2006. *Mangrove description - Egypt*. Mangrove management. Vegetation description by country. Flora. http://www.fao.org/forestry/mangrove/vegetation/en/egy/.

Fattovich, R.

1991. "The problem of Punt in the Light of recent field work in the Eastern Sudan." S. Schoske (ed.), *Akten des Vierten Internationalen Ägyptologen Kongresses - München 1985*, Hamburg: Helmut Buske, pp. 257-272.

1993. "Punt: the Archaeological Perspective." *Atti del VI Congresso Internazionale di Egittologia*, II, Torino: Società Italiana del Gas, pp. 399-405.

1995. "L'archeologia del Mar Rosso: problemi e prospettive. Note in margine ad una recente pubblicazione di due siti costieri della Somalia settentrionale," *Annali dell'Istituto Universitario Orientale di Napoli* 55, pp. 159-176.

1996a. "The Afro-Arabian Circuit: Interregional Contacts between the Horn of Africa and Southern Arabia in the 3rd-2nd millennia

B.C." L. Krzyzaniak *et al.* (eds.), *Interregional Contacts in the Later Prehistory of Northeastern Africa*, Poznań: Poznań Archaeological Museum (*Studies in African Archaeology* 5), pp. 395-402.

1996b. "Punt: the archaeological perspective," *Beitrage zur Sudanforschung* 6, pp. 15-29.

1997a. "The contacts between Southern Arabia and the Horn of Africa in late prehistoric and early historical times: a view from Africa." A. Avanzini (ed.), *Profumi d'Arabia*, Roma: L'Erma di Bretschneider, pp. 273-186.

1997b. "The Near East and Eastern Africa: Their Interaction." J.O. Vogel (ed.), *Encyclopedia of Precolonial Africa*, Walunt Creek: Altamira Press, pp. 479-484.

1997c. "Northeastern States." J.O. Vogel (ed.), *Encyclopedia of Precolonial Africa*, Walunt Creek: Altamira Press, pp. 484-489.

1999. "The Development of Urbanism in the Northern Horn of Africa in Ancient and Medieval Times." P. Sinclair (ed.), *The Development of Urbanism in Africa from a Global Perspective*, Uppsala: http://www.arkeologi.uu.se.

Fattovich, R., and Bard, K.A.

2006. *Joint Archaeological Expedition at Mersa/Wadi Gawasis (Red Sea, Egypt) of the University of Naples "L'Orientale" (Naples, Italy), Istituto Italiano per l'Africa e l'Oriente (Rome, Italy), and Boston University (Boston, USA) - 2005-2006 Field Season*, Naples: http://www.unior.it/userfiles/workarea_231/file/ Progetti/WadiGawasis/Final%20Report%20WG%202005-2006_ part1.pdf.

Fattovich, R., Manzo, A., and Zazzaro, C.

2009. *Mersa/Wadi Gawasis 2009*, Naples: http://www.unior.it/userfiles/workarea_231/file/Progetti/WadiGawasis/Final%20Report%20WG%202009.pdf

Fischer, H.G.

1985. *Egyptian Titles of the Middle Kingdom. A Supplement to Wm. Ward's Index*. New York: The Metropolitan Museum of Arts.

Forstner-Müller, I.

2012. "Nubian Pottery in Aswan." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 59-82.

Forstner-Müller, I., and Rose, P.

2012. "Nubian Pottery at Avaris in the Second Intermediate Period and the New Kingdom: Some Remarks." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 181-212.

Friedman, R.

2007. "C-Group Cemetery at Locality HK 27 C," *Sudan & Nubia* 11, pp. 57-62.

Frost, H.

1979. "Egyptian Stone Anchors: Some Recent Discoveries," *Mariner's Mirror* 65, pp. 137-161.

1985. "Ancient Egyptian Anchors: A Focus on the Facts," *Mariner's Mirror* 71, p. 348.

1996. "Ports, Cairns and Anchors. A Pharaonic Outlet on the Red Sea," *Topoi* 6 (2), pp. 869-890.

Gallorini, C.

1998. "A Reconstruction of Petrie's Excavation at the Middle Kingdom Settlement of Kahun," S. Quirke (ed.), *Lahun Studies*, Reigate: SIA, pp. 42-59.

2018. "Review of Sally Wallace-Jones, *Egyptian and Imported Pottery from the Red Sea Port of Mersa Gawsis* [sic]*, Egypt*, with contributions from A. Manzo, M. Ownby and K. Kopetzky, Archaeopress Egyptology 20, Archaeopress Publishing, Oxford, 2018," *Birmingham Egyptology Journal* 6, pp. 1-5.

Gardiner, A.

1957. *Egytian Grammar*, Oxford: Griffith Institute (third edition revised).

Gatto, M.C., Gallorini, C., and Roma, S.

2012. "Pan-Grave Pottery from Nag el-Qarmilla and Sheikh Mohamed Cemeteries in Gharb Aswan." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 83-102.

Gatto, M.C., and Giuliani, S.

2006-2007. "Nubians in Upper Egypt: Results of the Survey in the Aswan-Kom Ombo Region (2005-2006)." B. Gratien (ed.), *Mélanges offerts à Francis Geus*, Lille, Université Charles-de-Gaulle Lille III (*Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 26), pp. 121-130.

Geb, M.

2000. "Factors favouring precipitation in North Africa: seen from the viewpoint of present day climatology," *Global and Planetary Change* 26, pp. 85-96.

Gerisch, R.

2004. *Holzkohleuntersuchungen an pharaonischem und byzantinischem Material aus Amarna und Umgebung: ein Beitrag zur Identifizierung von Hölzern unter Berücksichtigung des Gebrauches von Holz als Brennmaterial und seiner Rolle bei der Rekonstruktion der lokalen Vegetation*, Mainz: Philipp von Zabern (*Münchner Ägyptologische Studien* 53).

2017. *Anthrakologische Studien über die Gehölze des altägyptischen und -nubischen Niltals und der angrenzenden Wüsten: Arteninventare und Naturraumpotential*, Berlin: Freie Universität Berlin (Dissertation).

Giuliani, S.

2001. "Pottery from the Nubian Cemeteries," *Sudan & Nubia* 5, pp. 40-45.

Gratien, B.

1985. "Le village fortifié du Groupe C à Ouadi es-Séboua Est, typologie de la céramique," *Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 7, pp. 39-56.

2006-2007. "Au sujet des Nubiens au Moyen Empire et à la Deuxième Période Intermédiaire dans les fortresses égyptiennes de la deuxième cataracte." B. Gratien (ed.), *Mélanges offerts à Francis Geus*, Lille: Université Charles-de-Gaulle Lille III (*Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 26), pp. 151-161.

Gutherz, X., Joussaume, R. Amblard, S., and Mohammed, G. (in collaboration with R. Bonnefille, H. Duday, G. Gouraud, S. Thiebault, I. Thiam El Hadji, and W. Van Neer)

1996. "Le site d'Asa Koma (République de Djibouti) et les premiers producteurs dans la corne de l'Afrique", *Journal des africanistes* 66, pp. 255-297.

Harrell, J.A.

1996. "Geology." S.E. Sidebotham and W.Z. Wendrich (eds.), *Preliminary Report of the 1995 Excavations at Berenike (Egyptian Red Sea Coast) and the Survey of the Eastern Desert*, Leiden: CNWS, pp. 99-105.

1996. "Geology." S.E. Sidebotham and W.Z. Wendrich (eds.), *Preliminary Report of the 1996 Excavations at Berenike (Egyptian Red Sea Coast) and the Survey of the Eastern Desert*, Leiden: CNWS, pp. 121-131.

Harris, E.C.

1979. *Principles of Archaeological Stratigraphy*, London: Academic Press.

Hein, C.J., FitzGerald, D.J., Milne, G.A., Bard, K.A., and Fattovich, R.

2011. "Evolution of a Pharaonic Harbor on the Red Sea: Implications for Coastal Responseto Changes in Sea Level and Climate," Geology, July 2011, pp. 687-690.

Hikade, T.

2002. "Die lithischen Industrien des Alten Reiches auf Elephantine," *Mitteilungen des Deutschen Archäologischen Instituts Abteilung Kairo* 58, pp. 305-322.

Hoang, C. T., and Taviani, M.

1991. "Stratigraphic and Tectonic Implications of Uranium-Series Dated Coral Reefs from Uplifted Red Sea Islands," *Quaternary Research* 35, pp. 264-273.

Hoelzmann, P., Kruse, H.-J., and Rottinger, F.

2000. "Precipitation estimates for the eastern Saharan palaeomonsoon based on a water balance model of the West Nubian Palaeolake Basin," *Global and Planetary Change* 26, pp. 105-120.

Holmes, D.

1989. *The* Predynastic *Lithic Industries of Upper* Egypt*: A Comparative Study of the* Lithic *Traditions of Badari, Naqada, and Hierakonpolis*, Oxford: Archaeopress (*BAR International Series* 469).

Issar, A.S.

2003. *Climate Changes during the Holocene and their Impact on Hydrological Systems*, Cambridge: Cambridge University Press.

Jacquet-Gordon, H.

1981. "A Tentative Typology of Egyptian Bread Molds." D. Arnold (ed.), *Studien zur altägyptischen Keramik*, Mainz am Rhein: Verlag Philipp von Zabern, pp. 11-24.

Johnson, H.

1977. "Private Name Seals of the Middle Kingdom." M. Gibson and R. D. Biggs (eds.), *Seals and Sealings in the Ancient Near East*. Malibu: Undena Publications, pp. 141-145.

Jones, J.

2002. "The Textiles at Abydos: New Evidence," *Mitteilungen des Deutschen Archäologischen Instituts Kairo* 58, pp. 323-340.

Joussaume, R.

1995. *Tiya – L'Ethiopie des mégalithes*, Chauvigny: Association des Publications Chauvinoises.

Kassas, M., and Zahran, M.A.

1965. "Studies on the ecology of the Red Sea coastal land, II. The district from El-Galala El-Qibliya to Hurghada," *Bulletin de la Société Géographique d'Égypte* 38, pp. 155-193.

1967. "On the ecology of the Red Sea littoral salt marsh, Egypt," *Ecological Monographs* 37 (4), pp. 297-315.

Kelley, A.L.

1976. *The pottery of ancient Egypt: Dynasty I to Roman times*, Toronto: Royal Ontario Museum.

Killen, G.P.

1994. *Ancient Egyptian Furniture*, Volume II. Oxford: Oxbow.

Kobusiewicz, M.

2007. "Stone-knapping Tradition in Old Kingdom Dakhleh." K. Kroeper, M. Chłodnicki, and M. Kobusiewicz (eds.), *Archaeology of the Early Northeastern Africa. In Memory of Lech Krzyżaniak*, Poznań: Poznań Archaeological Museum (*Studies in African Archaeology* 9), pp. 449-461.

Kołosowska, E., el-Tayeb, M., and Paner, E.

2003. "Old Kush in the Fourth Cataract Region," *Sudan & Nubia* 7, pp. 21-25.

Kołosowska, E., and el-Tayeb, M.

2006-2007. "Old Kush II Burials in the Fourth Cataract Region." B. Gratien (ed.), *Mélanges offerts à Francis Geus*, Lille, Université Charles-de-Gaulle Lille III (*Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 26), pp. 205-218.

Lambeck, K., Purcell, A., Johnston, P., Nakada, M., and Yokoyama, Y.

2003. "Water-load Definition in the Glacio-hydro-isostatic Sea-level Equation," *Quaternary Science Reviews* 22, pp. 309-318.

Lindquist, S.J.

1998. *The Red Sea Basin Province: Sudr-Nubia and Maqna Petroleum Systems*, U.S. Geological Survey World Energy Project, October, 1998. USGS Open-File Report OF99-50-A.

Lucarini, G.

2014. "The excavated artefacts from Sectors B/4, D/2, E/1 at Hidden Valley (2003 and 2005 field seasons)." B.E. Barich, G. Lucarini, M.A. Hamdan and F.A. Hassan (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis, Western Desert, Egypt*, Firenze: All'Insegna del Giglio, pp. 251-264.

Lucarini, G., Barca, D., and Manzo, A.

2020. "The provenance of obsidian artefacts from the Middle Kingdom harbour of Mersa/Wadi Gawasis, Red Sea, Egypt, and its implications for Red Sea trade routes in the 2nd millennium BC," *Quaternary International* 555, pp. 85-95.

Mahfouz, E.

2008a. "Amenemhat III au Ouadi Gaouasis," *Bulletin de l'Institut français d'Archéologie Orientale* 108, pp. 253-279.

2008b. "A-t-il existé une voie de communication entre le Ouadi Gaouasis et les sites miniers du Sud Sinaï?," *Abgadiyat* 3, pp. 48-55.

2010a. "L'Expédition de Sésostris III au pays de Pount." W. Godlewski and A. Łajtar (eds.), *Between the Cataracts. Proceedings of the 11th Conference of Nubian Studies. Warsaw, 27 August-2 September 2006, vol. 2.2*, Warsaw: Polish Centre for Mediterranean Archaeology (*Polish Archaeology in the Mediterranean Supplement Series* 2.2/2), pp. 431-438.

2010b. "Amenemhat IV au ouadi Gaouasis," *Bulletin de l'Institut français d'Archéologie Orientale* 110, pp. 165-175.

2011. "Osiris de Ouadj-Our, une nouvelle attestation provenant du ouadi Gaouasis au bord de la mer Rouge," *Bulletin de l'Institut français d'Archéologie Orientale* 180, pp. 7-14

2012. "New Epigraphic Material from Wadi Gwasis." P. Tallet and E. Mhfouz (eds.), *The Red Sea in Pharaonic Times. Recent Discoveries along the Red Sea Coast. Proceedings of the Colloquium held in Cairo /Ayn Soukhna 11th-12th January 2009*, Cairo: Institut Français d'Archéologie Orientale (*Bibliothèque d'Etude* 155), pp. 117-132.

2015. "Sésostris III existait officiellement au Ouadi Gaouasis." F. Haikal (ed.), *Mélanges offerts à Ola el-Aguizy*, Cairo: Institut Français d'Archéologie Orientale (*Bibliothèque d'Etudes* 164), pp. 269-276.

Manassa, C.

2012 a. "Nubians in the Third Upper Egyptian Nome: A View from Moalla." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 117-127.

2012 b. "Middle Nubian Ceramics from Umm Mawagir, Kharga Oasis." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*, Wien: Österreichisches Archäologisches Institut, pp. 129-148.

Manzo, A.

1997. "Les tessons «exotiques » du Groupe du Gash: un essai d'examen statistique." *Actes de la VIIIe Conférence Internationale des* Etudes Nubiennes, *vol. II*, Lille, Université Charles-de-Gaulle Lille III (*Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 17/2), pp. 77-87.

1999. *Echanges et contacts le long du Nil et de la Mer Rouge dans l'époque protohistorique (IIIe et IIe millénaires avant J.-C.)*, Oxford: Archaeopress (*BAR International Series* 782).

2010 a. "Exotic Ceramic Materials from Mersa Gawasis, Red Sea." W. Godlewski and A. Łajtar (eds.), *Between the Cataracts. Proceedings of the 11th Conference of Nubian Studies. Warsaw, 27 August-2 September 2006, vol. 2.2*, Warsaw: Polish Centre for Mediterranean Archaeology (*Polish Archaeology in the Mediterranean Supplement Series* 2.2/2), pp. 439-453.

2010 b. "Adulis Before Aksum? Possible 2nd and 1st millennium BC Evidence from the Site of the Ancient Port," *Annali dell'Istituto Orientale di Napoli* 70, pp. 29-42.

2012 a. "Nubians and the Others on the Red Sea. An Update on the Exotic Ceramic Materials from the Middle Kingdom Harbour of Mersa/Wadi Gawasis, Red Sea, Egypt." D.A. Agius, J.P. Cooper, A. Trakadas and C. Zazzaro (eds.), *Navigated Spaces, Connected Places Proceedings of Red Sea Project V Held at the University of Exeter 16-19 September 2010*, Oxford: Archaeopress (*British Archaeological Reports International Series* 2346, *British Foundation for the Study of Arabia Monographs* No. 12), pp. 47-58.

2012 b. "Typological, Chronological and Functional Remarks on the Ceramic Materials of Nubian Type from the Middle Kingdom Harbour of Mersa/Wadi Gawasis, Red Sea, Egypt." I. Forstner-Müller and P. Rose (eds.), *Nubian Pottery from Egyptian Cultural Contexts of the Middle and Early New Kingdom. Austrian Archaeological Institut, Cairo, December 1-12 2010*. Wien: Österreichisches Archäologisches Institut, pp. 213-232.

2012 c. "From the sea to the deserts and back: New research in Eastern Sudan," *British Museum Studies in Ancient Egypt and Sudan* 18, pp. 75-106.

2017. "Bi3w Pwnt in the archaeological record. Preliminary results and perspective of research." I. Micheli (ed.), *Cultural and Linguistic Transition explored Proceedings of the ATrA closing workshop Trieste, May 25-26, 2016*, Trieste: EUT Edizioni Università di Trieste (*ATrA* 3), pp. 87-108.

2018a. "The Chronology of the Transition between the Gash Group and the Jebel Mokram Group of Eastern Sudan (2nd Millenium BC)." M. Honegger (ed.), *Nubian Archaeology in the XXIst Century. Proceedings of the Thirteenth International Conference for Nubian Studies (Neuchâtel, 1st – 6th September 2014),* Leuven-Paris-Walpole: Peeters Editions (*Orientalia Lovaniensia Analecta* 273), pp. 263-273.

2018b. "Appendix Three: Nubian and southern Red Sea ceramics." S. Wallace-Jones, *Egyptian and Imported Pottery from the Red Sea port of Mersa Gawsis, Egypt*, Oxford: Archaeopress (*Archaeopress Egyptology* 20), pp. 128-135.

Manzo, A., and Pirelli, R.

2006. "The sealings from Marsa Gawasis (*S3w*): preliminary considerations on the administration of the port." E. El-Saeed, E. Mahfouz and A.M. Megahed (eds.), *The Festschrift Volume. A Collection of Studies presented to Professor Abdel Monem Abdel Haleem Sayed*. Alexandria: University of Alexandria, pp. 40-101.

Martin, G.T.

1971. *Egyptian Administrative and Private-name Seals principally of the Middle Kingdom and Second Intermediate Period*. Oxford: Griffith Institute Ashmolean Museum

Masri, R.

1995. *The Cedars of Lebanon: Significance, Awareness and Management of the Cedrus libani in Lebanon*. Lecture, International Relief Fund, November 1995 (http://almashriq.hiof.no/lebanon/300/360/363/363.7/RaniasSeminar.html.

Milne, G. A., Long, A. J., and Bassett, S.E.

2005. "Modelling Holocene Relative Sea-level Observations from the Caribbean and South America," *Quaternary Science Reviews* 24, pp. 1183-1202.

Mitrovica, J. X., and Milne, G.A.

2002. "On the Origin of Late Holocene Sea-level Highstands within Equatorial Ocean Basins," *Quaternary Science Reviews* 21, pp. 2179-2190.

Munsell Soil Color Charts

1990. *Munsell Soil Color Charts* , Newburgh, N.Y.: Munsell Color (revised edition).

Murray, M.A.

2000a. "Cereal production and processing." P. Nicholson and I. Shaw (eds.), *Ancient Egyptian Materials and Technology*, Cambridge: Cambridge University Press, pp. 505-535,

2000b. "Fruits, vegetables, pulses and condiments." P. Nicholson and I. Shaw (eds.), *Ancient Egyptian Materials and Technology*, Cambridge: Cambridge University Press, pp. 609–655.

Nibbi, A.

1976. "Remarks on the Stelae from the Wadi Gasus," *Journal of Egyptian Archaeology* 62, pp. 45-56.

1981. "Some Remarks on the Two Monuments from Mersa Gawasis," *Annales du Service del Antiquités de l'Égypte* 64, pp. 69-74.

Nicholson, P.T.

1989. "Experimental Determination of the Purpose of a "Box Oven." In B. Kemp (ed.), *Amarna Reports V*, London: Egypt Exploration Society, pp. 241-252.

Nicholson, S.E.

2000. "The nature of rainfall variability over Africa on time scales of decades to millennia," *Global and Planetary Change* 26, pp. 137-158.

O'Brien, M.P.

1931. "Estuary tidal prisms related to entrance areas," *Civil Engineering* 1, pp. 738-739.

Obsomer, C.

1993. "*di.f prt-ḫrw* et la filiation *ms*(*t*)*.n / ir*(*t*)*.n* comme critères de datation dans les textes du Moyen Empire," C. Cannuyer and J.-M. Kruchten (eds.), *Individu, société et spiritualité dans l'Égypte pharaonique et copte, Mélange égyptologique offerts au Professeur Aristide Théodoridès*, Bruxelles, pp. 163-200.

Peltier, W.R.

2002. "On Eustatic Sea Level History: Last Glacial Maximum to Holocene," *Quaternary Science Reviews* 21, pp. 377-396.

Perlingieri, C., and Childs, S.T.

2006. "The Production Area at Mersa Gawasis. Evidence for Multiple Craft Activities." E. El-Saeed, E. Mahfouz and A.M. Megahed (eds.), *The Festschrift Volume. A Collection of Studies presented to Professor Abdel Monem Abdel Haleem Sayed*. Alexandria: University of Alexandria, pp. 101-138.

PERSGA

2004. *Status of Mangroves in the Red Sea and Gulf of Aden, Draft 09-05-2004*, Jeddah: PERSGA May 2004 (PERSGA Technical Series No. 11) [http://www.persga.org / Files / Publications / Technical/TS/TS11_Status_of Mangroves_in_RSGA.pdf].

Petrie, W.M.F.

1890. *Kahun, Gurob and Hawara. Chapters by F. Ll. Griffith and P. E. Newberry*, London: Kegan Paul and Co.

1898. *Dendereh. Chapters by F. Ll. Griffith, J.H. Gladstone and T. Oldfield*, London: Kegan Paul and Co.

Plaziat, J.-C., Baltzer, F., Choukri, A., Conchon, O., Freytet, P., Orszag-Sperber, F., Purser, B., Raguideau, A., and Reyss, J.-L.

1995. "Quaternary Changes in the Egyptian Shoreline of the Northwestern Red Sea and Gulf of Suez," *Quaternary International* 29/30, pp. 11-22.

Poisblaud, B.

2002. "Le site de Dankalelo (Ghoubbet al Kharab, République de Djibouti)," *Annales d'Ethiopie* 18, pp. 199-214.

2004-2005. "Recherche sur la préhistoire récente en République de Djibouti. Le site d'Asgoumhati," *Afrique Archéologie et Arts* 3, pp. 117-122.

Privati, B.

1999. "La céramique de la nécropole orientale de Kerma (Soudan): essai de classification," *Cahier de Recherche de l'Institut de Papyrologie et d'Egyptologie de Lille* 20, pp. 41-69.

2004. "Le matériel céramique." C. Bonnet (ed.), *Le temple principal de la ville de Kerma et son quartier religieux*, Paris: Errance, pp. 162-189.

Pugh, D.T.

1996. *Tides, Surges and Mean Sea-level*, Chichester: John Wiley.

Quibell J.E.

1898. *El Kab*, London: Quaritch (*Egyptian Research Account* 3).

Reimer, P.J, Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Ramsey, C.B., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M., and Van der Plicht, J.

2013. "IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP," *Radiocarbon* 55 (4), pp. 1869-1887.

Reisner, G.A.

1923. *Excavations at Kerma. Parts IV-V*, Cambridge Mass.: Peabody Museum of Harvard University.

Rice, P.

1987. *Pottery Analysis: A Sourcebook*, Chicago and London: The University of Chicago Press.

Rose, P.J.

1987. "Report on the 1986 Amarna pottery survey." B. Kemp (ed.), *Amarna Reports IV*, London: Egypt Exploration Society, pp. 115-131.

Rye, O.S.

1981. *Pottery Technology: Principles and Reconstruction*, Washington, DC: Taraxacum Inc. (*Manuals on Archaeology* 4).

Sadr, K.

1987. "The Territorial Expanse of the Pan-Grave Culture," *Archéologie du Nil Moyen* 2, pp. 265-291.

1990. "The Medjay in Southern Atbai," *Archéologie du Nil Moyen* 4, pp. 63-86.

Sadr K., Castiglioni, A., and Castiglioni, A.

1993. *Interim Report on the Eastern Desert Research Centre's (CeRDO) Archaeological Activities 1989/93*, Varese: CeRDO.

Saleh, M.A.

2006. "Assessment of mangrove vegetation on Abu Minqar Island of the Red Sea," *Journal of Arid Environments* 68 (2), pp. 331-336.

2007. "Mangrove vegetation on Abu Minqar island of the Red Sea," *International Journal on Remote Sensing* 28, pp. 5191-5194.

Säve-Söderbergh, T. (ed.)

1989. *Middle Nubian Sites*, *The Scandinavian Joint Expedition to Sudanese Nubia*, 4, Partille: Astrom.

Sayed, A.M.

1977. "Discovery of the Site of the 12th Dynasty Port at Wadi Gawasis on the Red Sea Shore," *Revue d'Égyptologie* 29, pp. 140-178.

1978. *The Discovery of the Twelfth Dynasty Port in the Region of of the Wadi Gawasis on the Red Sea Coast* (in Arabic). Alexandria: University of Alexandria.

1979a. "Discovery of the Site of the 12th Dynasty Port at Wadi Gawasis on the Red Sea Shore." W.F. Reinecke (ed.), *Acts of the First International Conference of Egyptology*, Berlin: Akademie Verlag.

1979b. "New Light on the Recently Discovered Port on the Red Sea Shore." *Second International Congress of Egyptology*, Grenoble, abstract.

1980. "Observations on the Recent Discoveries at Wadi Gawasis," *Journal of Egyptian Archaeology* 66, pp. 154-157.

1983. "New Light on the Recently Discovered Port on the Red Sea Shore," *Chronique d'Égypte* 58, pp. 23-37.

1999. "Wadi Gasus." K.A. Bard (ed.), *Encyclopedia of the Archaeology of Ancient Egypt*, London: Routledge, pp. 866-868.

Schmidt, P.R., Curtis, M., and Teka, Z.

2008. "The Ancient Ona Communities of the First Millennium BCE: Urban Precursors and Indipendent Development on the Asmara Plateau." P.R. Schmidt, M. Curtis and Z. Teka (eds.), *The Archaeology of Ancient Eritrea*, Trenton and Asmara: Red Sea Press, pp. 109-161.

Schweinfurth, G.

1885. *Alte Baureste und hieroglyphische Inschriften im Uadi Gasus, Abhandlungen der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, Berlin: Verlag der Königlich Preussischen Akademie der Wissenschaften.

Seidlmayer, S.J.

1991. "Beispiele nubischer Keramik aus Kontexten des hohen Alten Reiches aus Elephantine." D. Mendel and U. Claudi (eds.), *Ägypten im afro-orientalischen Kontext. Aufsätze Archäologie, Geschichte und Sprache eines unbegrenzten Raumes. Gedenkschrift Peter Behrens*, Köln: Universität zu Köln, pp. 337-350.

Shaw, I.

2000. *The Oxford History of Anceint Egypt*, Oxford: Oxford University Press.

2009. "Non-textual marks and the twelfth Dynasty dynamics of centre and periphery: A case-study of potmarks at the Gebel el-Asr gneiss quarries". P. Andrassy, J. Budka and F. Kammerzell (eds.), *Non-textual Marking Systems, Writing and Pseudo Script from Prehistory to Present Times,* Göttingen (*Lingua Aegyptia –Studia Monographica* No. 8), pp. 69-82.

Shortland, A.J., and Ramsey, C.B.

2013. *Radiocarbon and the Chronologies of Ancient Egypt*, Oxford and Oakville: Oxbow Books.

Siddall, M., Rohling, E.J., Almogi-Labin, A., Hemleben, Ch., Meischner, D., Schmelzer, I., and Smeed, D.A.

2003. "Sea-level Fluctuations during the Last Glacial Cycle", *Nature* 423, pp. 853– 858.

Sidebotham, S.E., Thomas, R.I., and Harrell, J.A.

2010. "The El-Kab and Nuri-Hamdab/Fourth Cataract Survey. January 2006." W. Godlewski and A. Łatjar (eds.), *Between the Cataracts. Proceedings of the 11th Conference of Nubian Studies. Warsaw, 27 August-2 September 2006, vol. 2.1*, Warsaw: Polish Centre for Mediterranean Archaeology (*Polish Archaeology in the Mediterranean Supplement Series* 2.2/1), pp. 77-110.

Śliwa, J.

1992. "Die Siedlung des Mittleren Reich bei Qasr el-Sagha," *Mitteilungen des Deutschen Archälogischen Instituts Abteilung Kairo* 48, pp. 177-191.

Smith, S.T.

1992. "Askut, Sudan," *Bulletin de Liaison du Groupe International d'Etude de la Céramique Egyptienne* 16, pp. 27-34.

2012. "Pottery from Askut and the Nubian Forts." In R. Schiestl and A. Seiler (eds), *Handbook of the Pottery of the Egyptian Middle Kingdom, Volume 2,* Vienna: OAW, pp. 347-405.

Sultan, M., Becker, R., Arvidson, R.E., Shore, P., Stern, R.J., El Alfy, Z., and Attia, R.I.

1993. "New Constraints on Red Sea Rifting from Correlations of Arabian and Nubian Neoproterozoic Outcrops," *Tectonics* 12, pp. 1303– 1319.

Taylor, J.C.M., and Illing, L.V.

1969. "Holocene Intertidal Calcium Carbonate-Cementation, Qatar, Persian Gulf," *Sedimentology* 12, pp. 69-107.

Tengberg, M.

2002. "Vegetation History and Wood Exploitation in the Oman Peninsula from the Bronze Age to the Classical Period." S. Thiébault (ed.), *Charcoal Analysis. Methodological Approaches, Palaeoecological Results and Wood Uses*. Oxford: Archaeopress (*BAR International Series* 1063), pp. 151-157.

Tregenza, L.A.

1958. *Egyptian Years*, London: Oxford University Press.

Valamoti, S.M.

2002. "Food remains from Bronze Age Archondiko and Mesimeriani Toumba in northern Greece?," *Vegetation History and Archaeobotany* 11, pp. 17–22.

Valamoti, S.M., Samuel, D., Bayram, M., and Marinova, E.

2008. "Prehistoric cereal foods from Greece and Bulgaria: investigation of starch microstructure in experimental and archaeological charred remains," *Vegetation History and Archaeobotany* 17 (Suppl. 1), pp. 265-276.

Van der Veen, M.

2006. "Formation processes of desiccated and carbonized plant remains – the identification of routine practice," *Journal of Archaeological Science* 20, pp. 1–23.

Van Vliet, G.J.C.M.

1976. "Wood anatomy of the Rhizophoraceae." P. Baas, A.J. Bolton, and D.M. Catling (eds), *Wood Structure in Biological and Technologial Research*. The Hague: Leiden University Press (*Leiden Botanical Series* 3), pp. 20-75.

Veldmeijer, A.J., and Zazzaro, C.

2007. "The Rope Cave at Mersa Gawasis: a Preliminary Report," *Antiguo Oriente* 5, pp. 243-247.

2008. "The ʿRope Cave' at Mersa/Wadi Gawasis," *Journal of the American Research Center in Egypt* 44, pp. 9-39.

Vila, A.

1987. *Le cimitière kermaïque d'Ukma Ouest*, Paris: CNRS.

Vogt, B., and Buffa, V.

2005. "Cultural Interactions with the Horn of Africa – A View from Early Arabia." W. Rauning and S. Wenig (eds.), *Afrikas Horn. Akten der Ersten Internationalen Littmann-Konferenz 2. bis 5. Mai 2002 in München*, Wiesbaden: Harrassowitz (*Meroitica* 22), pp. 437-456.

Wachsmann, S.

1997. *Seagoing Ships and Seamanship in the Bronze Age Levant*, College Station: Texas A&M University Press.

Wallace-Jones, S.

2018. *Egyptian and Imported Pottery from the Red Sea port of Mersa Gawsis, Egypt*, Oxford: Archaeopress (*Archaeopress Egyptology* 20).

Ward, C.

2000. *Sacred and secular: ancient Egyptian ships and boats*; Boston, MA: Archaeological Institute of America.

2009. "Evidence for Ancient Egyptian Seafaring." R. Bockius (ed.), *Between the Seas: Transfer and Exchange in Nautical Technology. Proceedings of the Eleventh International Symposium on Boat and Ship Archaeology*, *Mainz 2006*, Mainz: Verlag des Römisch-Germanischen Zentralmuseums, pp. 9-16.

Ward, C., and Zazzaro, C.

2010. "Evidence for Pharaonic Seagoing Ships at Mersa/Wadi Gawasis, Egypt," *The International Journal of Nautical Archaeology* 39.1, pp. 27-43.

Ward, W.A.

1982. *Index of Egyptian Administrative and Religious Titles of the Middle Kingdom*. Beirut: American University.

1987. "Scarab Typology and Archaeological Context," *American Journal of Archaeology* 91, pp. 507-532.

Wegner, J.

2007. *The Mortuary Temple of Senwosret III at Abydos,* New Haven and Philadelphia: Publications of the Pennsylvania-Yale Institute of Fine Arts Expedition to Abydos.

Welsby Sjöström, I.

2001 a. "The Pottery from the Survey." D. Welsby (ed.), *Life on the Desert Edge. Seven Thousand Years of Settlement in the Northern Dongola Reach, Sudan*, London: The Sudan Archaeological Research Society, pp. 230-348.

2001 b. "The Pottery from the Kerma Moyen graves at P37." D. Welsby (ed.), *Life on the Desert Edge. Seven Thousand Years of Settlement in the Northern Dongola Reach, Sudan*, London: The Sudan Archaeological Research Society, pp. 349-353.

Wendrich, W.

2000. "Basketry." P. Nicholson and I. Shaw (eds.), *Ancient Egyptian Materials and Technology*, Cambridge: Cambridge University Press, pp. 254-267.

Williams, B.B.

1977. "Aspects of Sealing and Glyptic in Ancient Egypt before the New Kingdom." M. Gibson and R. D. Biggs (eds.), *Seals and Sealings in the Ancient Near East*. Malibu: Undena Publications, pp. 136-138.

Wolf, P.

2004. "The SARS Anglo-German Expedition at the Fourth Cataract of the Nile: the 2003/04 Season," *Sudan & Nubia*, 8, pp. 17-26.

Zahran, M.A., and Willis, A.J.

2009. *The Vegetation of Egypt, Second Edition. Plant and Vegetation 2*, Dordrecht: Springer Science+Business Media.

Zazzaro, C.

2009. "Nautical evidence from the pharaonic site of Marsa/Wadi Gawasis. Report on two parts of a steering oar/rudder." R. Bockius (ed.), *Between the Seas: Transfer and Exchange in Nautical Technology. Proceedings of the Eleventh International Symposium on Boat and Ship Archaeology*, *Mainz 2006*, Mainz: Verlag des Römisch-Germanischen Zentralmuseums, pp. 3-8.

APPENDICES

Appendix 1
Ceramic finds by SU

Location	Fabric: Diagnostics/bodies	Vessel type and comments
Box 14 content	1 hemispherical bowl Nile B1 1 Small jar Marl AV3	Wallace-Jones 2018: Figure118:1 Wallace-Jones 2018: Figure 136 5:6
T9 A1 geological test pit	1 small bowl rim Marl AV3 Marl C	Wallace-Jones 2018: Figure 130:5 6 body sherds from large jars
T9 A2 geological test pit	1 small closed form Marl AV3 Marl C Marl C2	Fine fabric 3 body sherds no type possible 6 body sherds from a large vessel 2 body sherds from a large vessel
T9 A3 geological test pit	Marl C	9 body sherds from large jars
T9 A4 geological test pit	1 large rounded jar base Marl C	Handmade, internal diameter around 40cm
T10 A1 geological test pit	1 cooker rim Nile E Nile D Nile E Marl AV3 Breadmould	Wallace-Jones 2018: Figure 120:9 smoked 1 body sherd from a hemispherical bowl, limestone fragments are distinct 1 body sherd heavily smoked 6 body sherds from large jars 8 body sherds uncoated
T10 A2 geological test pit	1 hemispherical cup Nile B1 3 large plates Nile C 1 large pot stand Nile C 1 shallow cup Marl AV3 1 large, flat, jar base Marl C Nile A Nile B2 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 118:3 very fine fabric almost Wallace-Jones 2018: Figures 128:6,128:7, 128:10 Wallace-Jones 2018: Figure 125:3 Wallace-Jones 2018: Figure 130:14 hard, very fine fabric Handmade 1 small body sherd from a cup 6 body sherds from large jars 3 body sherds from large jars 1 body sherd from a large jar 8 body sherds from large jars 3 body sherds uncoated
T12 A1 geological test pit	Nile B1 Marl C	1 body sherd from a hemispherical cup 17 body sherds from large jars
T13 A2 geological test pit	Nile B1 Nile B2 Marl AV3 Marl C Breadmould	1 body sherd from a hemispherical cup 1 body sherd from a large jar 2 body sherds one from a medium jar one from a small plate 5 body sherds from large jars 3 body sherds unlined
Cave 4b surface	1 jar Marl C	Wallace-Jones 2018: Figure 142:6 (5)
On/beside T33	Nile B2 Marl AV3	body sherds no quantities available
WG2	Nile B2 Marl C	41 body sherds 28 body sherds
WG2 transect 3 a2	1 jar Marl AV3 Marl C	No further data 3 large body sherds
WG2 transect 4 a3	1 bottle Marl AV3 1 Small shallow bowl Marl AV3 Marl C	Wallace-Jones 2018: Figure 135: 4-5 Wallace-Jones 2018: Figure 130:1 8 large body sherds

WG2 transect 5 a2	Nile clay type undefined Marl AV3 Marl C	3 body sherds 2 body sherds 4 body sherds
WG2 transect 6 pit 1	1 jar Marl C Marl AV3 Marl C	Wallace-Jones 2018: Figure142:6 (4) 3 body sherds 7 body sherds
WG2 transect 6 pit 3	1 jar Marl C Marl C	No further data 4 body sherds
WG2 transect 7 pit 3	1 Flat base Marl AV3	Wallace-Jones 2018: Figure 137:7
WG2 transect 8 pit 2	2 jars Marl C Marl C	Wallace-Jones 2018: 142: 6 (4) 11 large body sherds
WG2 transect 8 pit 3	1 small open bowl base Nile B1 Flat base Marl C	No type Handmade
WG03 SU1	1 small jar fabric unidentified 1 small bowl fabric unidentified 4 jars Marl C Nile undefined Marl AV3 Marl C	Too small to type Wallace-Jones 2018: Figure 147:3 uncertain origin and fabric Wallace-Jones 2018: Figures 142:6 (2), 142:6 (3), two like 146:2 (4) 162 Body sherds 11 Body sherds 41 Body sherds
WG03 SU1-3	4 jars Marl C Nile clay type undefined Marl C	Wallace-Jones 2018: Figure 142:6 (5) 3 body sherds one fine with burnish 4 body sherds
WG03 SU0	6 jars Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure142:6 (3) 101 body sherds 6 body sherds 88 body sherds
WG03 SU1	1 jar Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 142:6 (3) 46 body sherds 5 body sherds 40 body sherds
WG03 SU2	Marl C 3 bowls Marl AV3 5 jars Marl C Nile clay type undefined Marl AV3 Marl C	2 body sherds Wallace-Jones 2018: Figures 130:10, 130:14, 130:15 Wallace-Jones 2018: Figure 142:6 (4) 217 body sherds 21 body sherds 131 body sherds medium and large jars
WG03 SU5	1 jar Marl C Marl AV3 Marl C 2 jars fabric unidentified 1 small jar fabric unidentified 1 small open bowl Marl AV3 2 Jars Marl C 1 hemispherical cup rim Nile B2	Too small to type 2 body sherds 5 Body sherds *cnw* vessels Small incisions below rim Wallace-Jones 2018: Figure 130: 9-11 Wallace-Jones 2018: 142:6 (4) Wallace-Jones 2018: Figure 119: 13 red slip and burnished out
WG03 feature 1	2 jars	No further data

	2 small open bowls one Marl AV3 1 Nile B1 shallow vessel	Wallace-Jones 2018: Figure 130: 1-4 Figure 117
WG03 feature 2	1 jar Marl C Nile clay type undefined Marl AV3 Marl C	Wavy vertical bands on exterior 30 body sherds 5 body sherds 32 body sherds
WG03 feature 5	Nile clay type undefined Marl AV3 Marl C	4 body sherds 1 body sherds 4 body sherds
WG05 SU1	1 small jar Marl AV3 2 small bowls Marl AV3 Marl AV3 Marl C	Type uncertain Wallace-Jones 2018: Figure 130: 1-4 8 body sherds 47 body sherds
WG06 SU5	1 small open bowl Nile B? 3 small open bowls Marl AV3 3 small jars Marl AV3 Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 118: 13 Wallace-Jones 2018: Figures 130: 1 130:3 130:4 Wallace-Jones 2018: Figures all like 136: 5 28 body sherds 5 body sherds 80 body sherds
WG06 SU10	1 small jar fabric unidentified Nile clay type undefined Marl AV3 Marl C	Too small to type 2 body sherds 16 body sherds 31 body sherds
WG10 SU0	2 jars Marl C Nile clay type undefined Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figure 141: 2 (2) 15 body sherds 4 body sherds 1 body sherds 94 body sherds
WG10 SU1	Nile B clay type undefined Marl AV3 Marl C	426 body sherds 73 body sherds 771 body sherds
WG11 SU1	Nile B undefined Marl AV3 Marl C	2 body sherds 1 body sherds 7 body sherds
WG12 SU1	Nile clay type undefined Marl AV3 Marl C	12 body sherds 1 body sherd 6 body sherds
WG12 SU3	Nile clay type undefined Marl AV3 Marl C	39 body sherds 1 body sherd 3 body sherds
WG12 SU4	Nile clay type undefined Marl AV3 Marl C	69 body sherds 5 body sherds 3 body sherds
WG15 SU0	Marl C 1 jar Marl C	2 body sherds with two pot-marks one rhomboid shaped one two straight lines crossed by a curve Wallace-Jones 2018: Figure 142:6 (1)
WG15 SU1	1 Nile B2 plate 1 bottle Marl AV3	Wallace-Jones 2018: Figure 117 clay undefined Too small to type

	1 jar Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 142:6 (4) 34 body sherds 1 body sherd 9 body sherds
WG15 SU2	No pottery except one possible Nubian sherd	
WG15 SU5	1 jar 1 corrugated bottle rim Marl C 1 jar Marl C Nile clay type undefined Marl AV3 Marl C	No further data Wallace-Jones 2018: Figure 144:7 Wallace-Jones 2018: Figure 142:6 (3) 16 body sherds 1 body sherd 14 body sherds
WG15 MONEIM	1 Nile B2 plate 3 Nile clay plates 2 Nile B2 bottles 1 Nile jar clay undefined 1 Marl AV3 lid 1 Marl AV3 open bowl 1 Marl AV3 carinated bowl 1 Marl C jar 1 Marl C jar Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 121:3 Wallace-Jones 2018: Figures all like 122:6 Wallace-Jones 2018: Figures both like 127:4 Too small to type Wallace-Jones 2018: Figure 133:3 Figure 130: 9-14 Figure 132: 4-6 Figure 143:1 Figure 142:5 1 body sherd 4 body sherds 15 body sherds
WG16 Tr1 Surface	Nile clay type undefined Marl AV3 Marl C	1 body sherd 1 body sherd 4 body sherds
WG16 SU0	Nile clay type undefined Marl AV3 Marl C	15 body sherds 5 body sherds 35 body sherds one pot-mark of four short lines forming a rough square
WG16 SU1 WG16 SU1 cont.	4 small bowls Nile undefined 2 jars Nile undefined 2 plates Marl AV3 5 jars Marl C 1Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 121:5, 121:6, 122:3, 122:4 Wallace-Jones 2018: Figures127: 1, 127:4 Wallace-Jones 2018: Figure122 Wallace-Jones 2018: Figures 142:1 and 142:6 (2) 130 body sherds 17 body sherds 29 body sherds
WG16 SU2	2 jars Nile clay type undefined 8 jars Nile B2 3 small Marl AV3 bowls 1 deep bowl Marl AV3 1 cooker Marl C Nile clay type undefined Marl AV3 Marl C	*emw* vessels Wallace-Jones 2018: Figures 127: 3, 127:4, 127:5, two like 127:6, 127:7, others too worn to type Wallace-Jones 2018: Figure 130:11, two like Figure 130:13 Wallace-Jones 2018: Figure 130:16 Wallace-Jones 2018: Figure138:12 67 body sherds 12 body sherds

		61 body sherds
WG16 SU3	3 small jars Marl C	Wallace-Jones 2018: Figures138:8, 138:11, 138:14
	1 medium jar Marl C	Wallace-Jones 2018: Figure 139:9
	Nile clay type undefined	2 body sherds
	Marl AV3	7 body sherds
	Marl C	20 body sherds
WG16 Tr1 SU0	1 plate Nile B	No further data
	1 small bowl Marl AV3	No further data
	1 bottle Marl AV3	No further data
	1 jar Marl C	No further data
	Nile clay type undefined	39 body sherds
	Marl AV3	2 body sherds
	Marl C	23 body sherds
WG16 Tr1 SU1	2 jars fabric unidentified	No further data
	1 small bowl Nile B1	Wallace-Jones 2018: Figure 118:3
	1 Nile basin B2	Wallace-Jones 2018: Figure 129:1
	1 basin Nile C	Wallace-Jones 2018: Figure 129:1
	1 plate Marl AV3	Wallace-Jones 2018: Figure 129:2
	1 small jar Marl AV3	Wallace-Jones 2018: Figure 135:14
	3 small jars Marl AV3	Wallace-Jones 2018: Figures 135:16, 135:18, 136:3
	5 bottles Marl AV3	Wallace-Jones 2018: Figures 136:10, 136:11, 136:16, 136:17, 136:18
	1 bag shaped jar Marl C	Wallace-Jones 2018: Figure 138:9
	2 small jars Marl C compact	Too small to type
	1 cooker Marl C compact	Wallace-Jones 2018: Figure 138:12
	1 jar Marl C compact	Wallace-Jones 2018: Figure 141:2 (4)
	2 small jars Marl D?	Too small to type
	Nile clay type undefined	16 body sherds
	Nile B2	11 body sherds
	Marl AV3	21 body sherds
	Marl C	34 body sherds
WG16 Tr1 SU2	Nile clay type undefined	25 body sherds
	Marl AV3	8 body sherds
	Marl C	17 body sherds
WG16 Tr1 SU3	2 jars unknown fabric	No type possible
	1 Nile clay type undefined	*cnw* vessel
	4 open bowl rims no fabric	Wallace-Jones 2018: Figures 122:3 three like 122:4
	Nile clay type undefined	21 body sherds
	Marl AV3	11 body sherds
	Marl C	23 body sherds
WG16 Tr1 SU4	1open bowl no fabric	Too small to type
	1 small plate no fabric	Wallace-Jones 2018: Figure 122:1
	1 large plate Nile C	Wallace-Jones 2018: Figure 128:8 rope marks on outer
	2 bowls Marl AV3	Wallace-Jones 2018: Figures 131:5, 131:8
	2 bottles Marl AV3	Wallace-Jones 2018: Figure 135:11
	2 jars Marl C	Wallace-Jones 2018: Figures 142:2, 142:3
	Nile clay type undefined	42 body sherds

	Marl AV3 Marl C	20 body sherds 39 body sherds
WG16 Tr1 SU5	3 open bowls no fabric 4 small bowls Marl AV3 4 jars Marl AV3 Nile clay type undefined Marl AV3 Marl C	No type possible Wallace-Jones 2018: Figure130 Wallace-Jones 2018: Figures three like 135:5, 135:6 26 body sherds 9 body sherds 23 body sherds
WG16 Tr1 SU6	4 hemispherical cups shallow Nile B1 2 medium bowls Nile B2 1 jar Nile B2 1 small jar Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:1, two like 118:3, 118:15 Wallace-Jones 2018: Figures 122:3, 122:6 Too small to type Wallace-Jones 2018: Figure 139:3 32 body sherds 13 body sherds 11 body sherds
WG16 Tr1 SU7	2 small bowls fabric not identified 1 plate Nile B2 1 open bowl Nile B2 1 small bowl Marl AV3 1 bottle Marl AV3 Nile clay type undefined Marl AV3 Marl C	Too small to type Wallace-Jones 2018: Figure 122:1 Wallace-Jones 2018: Figure 123:2 Wallace-Jones 2018: Figure 130:14 Wallace-Jones 2018: Figure 134:6 62 body sherds 13 body sherds 15 body sherds
WG16 Tr1 SU8	6 hemispherical cups Nile B1 1 open bowl Nile B2 1 jar Nile B2 2 small jars Marl AV3 Nile clay type undefined Marl AV2 Marl AV3 Marl C	Wallace-Jones 2018: Figures three like 118:1, two like118:6, 118:8 Wallace-Jones 2018: Figure 122:6 Wallace-Jones 2018: Figure 127:2 Wallace-Jones 2018: Figures 135:1, 135:9 1 body sherd 47 body sherds 16 body sherds 6 body sherds
WG16 Tr1 SU9	4 plates Nile B2 3 hemispherical cups Nile B1 1 bottle Marl AV3 Nile clay type undefined Marl AV3 Marl C	Too small to type Wallace-Jones 2018: Figure118:1, 118:2, 118:3 Too small to type 92 body sherds 13 body sherds 16 body sherds
WG16 Tr1 SU11	3 hemispherical cups Nile B1 2 plates Nile B2 1 jar Nile B2 2 jars Marl C	Wallace-Jones 2018: Figure 118:8 Wallace-Jones 2018: Figure 121:10 Wallace-Jones 2018: Figure 127:5 Wallace-Jones 2018: Figure 139: 3,6
WG16 Tr1 SU13	1 small open bowl Nile B2 1 open bowl Nile B2 1 Nile jar B2 Nile clay type undefined Marl AV3	Too small to type Too small to type Too small to type 42 body sherds 2 body sherds

	Marl C	12 body sherds
WG16 Tr1 SU45	3 small hemispherical cups Nile B1 1 bottle Nile B2 1 large plate Nile C 1 small plate Marl AV3 1 plate Marl AV3 1 medium jar Marl AV3 4 jars Marl AV3 1 bottle Marl AV3 1 bowl Marl C compact 1 cooker Marl C compact 6 jars Marl C compact Nile clay type undefined Nile B1 Marl AV2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figures 118:1, 118:2, 119:10 Wallace-Jones 2018: Figure 127:4 Wallace-Jones 2018: Figure 128 Wallace-Jones 2018: Figure 130:1 Wallace-Jones 2018: Figure 130:2 Wallace-Jones 2018: Figure 134:4 Wallace-Jones 2018: Figures 135:10, 135:16, 135:18, 136:1 Wallace-Jones 2018: Figure 135:17 Wallace-Jones 2018: Figure 138:3 Wallace-Jones 2018: Figure 138:12 Too small to type but in the range of Wallace-Jones 2018: Figure 140 13 body sherds 1 body sherd 15 body sherds 29 body sherds 2 body sherds 8 body sherds
WG16 Tr1 SU48	1small hemispherical cup Nile B1 3 small bowls Marl AV3 3 jars Marl C Nile B2 Marl Av2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:7 Wallace-Jones 2018: Figure 131:11 Wallace-Jones 2018: Figure 142:6 (5) 142:6 (7) 142:6 (8) 8 body sherds 2 body sherds 8 body sherds 59 body sherds 10 body sherds
WG16 Tr1 SU63	Nile B2 Marl AV2 Marl AV3 Marl C Marl C compact	7 body sherds 2 body sherds 2 body sherds 16 body sherds 10 body sherds
WG16 Tr1 SU73	1 hemispherical cup Nile B1 1 Marl C compact jar Nile clay type undefined Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:2 Too small to type 31 body sherds 4 body sherds 3 body sherds 20 body sherds 2 body sherds
WG16 Tr1 SU75 WG16 Tr1 SU75 cont.	1 hemispherical cup Nile B1 3 jars Marl C compact Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:3 Too small to type 4 body sherds 7 body sherds 3 body sherds
WG16 Tr1 SU75-77 Interface	1 open plate Nile B1 1 plate Nile B2 2 medium jars Nile B2	Wallace-Jones 2018: Figure 117:3 Wallace-Jones 2018: Figure 121:8 Wallace-Jones 2018: Figures 127:4, 127:16

	1 small Marl AV3 bottle 1 Marl AV3 jar 3 Marl C jars 3 Marl C compact jars 1 triangular scraper Marl AV3 Marl C compact	Wallace-Jones 2018: Figures 135:8 Wallace-Jones 2018: Figure 135:3 Wallace-Jones 2018: Figures 139:1, 139:4, 147:6 kettle mouthed Wallace-Jones 2018: Figures 139:12, 140:4, 140:5 - 3 body sherds
WG16 Tr1 SU77-81	1 jar Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 135:7-9 6 body sherds 2 body sherds 2 body sherds
WG16 Tr2 sand	1 hemispherical cup Nile B1 1 plate Nile C 1 jar Marl C 1Nile B1 Nile C Marl AV3 Marl C Breadmould	Too small to type Wallace-Jones 2018: Figure 128:7 Too small to type 1 body sherd 1 body sherd 1 body sherd 1 body sherd 2 body sherds one low fired with remains of fine slip coating
WG16 Tr2 surface	1 jar Marl C Nile clay type undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 142:6 (4) 1 body sherd 2 body sherds 1 body sherd
WG16 Tr2 SU1 WG16 Tr2 SU1 cont.	1 deep hemispherical bowl B1 2 bowls Nile B2 1 small, deep, open bowl Nile B2/C 2 small bowls Marl AV3 2 plates Marl AV3 2 bottles Marl AV31 1 small jar Marl AV3 2 medium jars Marl AV3 1 small bowl Marl C 6 jars Marl C 7 jars Marl C 1 jar Marl C compact Nile clay type undefined Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C compact Marl C sandy Breadmould	Wallace-Jones 2018: Figure 118:9 Wallace-Jones 2018: Figure 121 Wallace-Jones 2018: Figure129:1 Wallace-Jones 2018: Figures 130:12, 130:14 Wallace-Jones 2018: Figure 130:1, 130:4 Wallace-Jones 2018: Figure 131:5, 135:10 Wallace-Jones 2018: Figure 135:6 Wallace-Jones 2018: Figures 135:7, 135:9 Wallace-Jones 2018: Figure 138:1 Wallace-Jones 2018: Figures 139:4, 139:9 others too small to type Wallace-Jones 2018: Figures in the range of types 142:6 (1) Too small to type 34 body sherds 5 body sherds 35 body sherds 7 body sherds 11 body sherds 73 body sherds 27 body sherds 8 body sherds 4 body sherds, 4 different vessels, all

		unlined
WG16 Tr2 SU19	Nile B1 Nile B2 Nile C Marl A2 Marl AV3 Marl C Marl C compact Marl C sandy Breadmould	1 body sherd 1 body sherd 12 body sherds 2 body sherds with fine red burnish could be red lustrous ware or a local imitation 24 body sherds 14 body sherds 10 body sherds 20 body sherds 5 body sherds unlined
WG16 Tr2 SU45	2 hemispherical cups Nile B1 2 bottle Nile B2 3 large plates Nile C 1 large, open Nile C bowl 4 small Marl AV3 plates 2 small, deep, open bowls Marl AV3 1 small bottle Marl AV3 3 jars Marl AV3 1 large jar Marl AV3 1 small jar Marl C 3 jars Marl C 3 jars Marl C compact 3 jars Marl C2 6 breadmoulds 1 scraper Nile B1 1 unidentified? Marl AV2 Nile undefined Nile B1 Nile C Nile D Marl AV3	Wallace-Jones 2018: Figure 118:3 Wallace-Jones 2018: Figure 134:4 Wallace-Jones 2018: Figures 128:4 128: 6, 128:8 Wallace-Jones 2018: Figure 129:1 Wallace-Jones 2018: Figures 130:2, 130:3, two like 130:4 Wallace-Jones 2018: Figures 130:17, 131:1 Wallace-Jones 2018: Figure 135:5 Too worn to type Wallace-Jones 2018: Figure136:4 Too small to type Wallace-Jones 2018: Figure 142:6 (3) Too small to type Wallace-Jones 2018: Figure 142:6 (1) 6 different vessels all unlined Triangular with rounded top Incised and red burnished? red lustrous. 2 body sherds 1 body sherds 10 body sherds 5 body sherds 10 body sherds
WG16 Tr2 SU48	1 hemispherical cup Nile B1 3 plates Nile B2 1 very small bowl Marl AV3 4 small bowls Marl AV3 1 bottle Marl AV3 4 plates Marl C 2 bottles with corrugated rim Marl C 2 medium jars Marl C 1 jar Marl C 1 medium jar Marl C compact Nile B1	Wallace-Jones 2018: Figure 118:6 Wallace-Jones 2018: Figures all like 121:10 Wallace-Jones 2018: Figure 130:11 Wallace-Jones 2018: Figures 130:9, 130: 12, 130:13, 130:14 Wallace-Jones 2018: Figure 13:7 Wallace-Jones 2018: Figures 138:1, 3 like Figure 138:4 (ration plate type) Wallace-Jones 2018: Figure 144:10, 144:12 Wallace-Jones 2018: Figure 139:12 Wallace-Jones 2018: Figure 139:19 Wallace-Jones 2018: Figure 139:7 1 body sherd

WG16 Tr2 SU48 cont.	Nile B2 Nile C Marl AV3 Marl C Marl C compact Marl C2 Breadmould	8 body sherds 4 body sherds 10 body sherds 6 body sherds 21 body sherds 11 body sherds 1 almost complete slip lined
WG16 Tr2 SU60	2 open bowls Nile B2 1 jar Marl C2 Nile clay type undefined Marl AV3 Marl C Marl C compact Marl C sandy Breadmould	Wallace-Jones 2018: Figures 122:3, 122:4 Wallace-Jones 2018: Figure 142:6 (1) 4 body sherds 7 body sherds 1 body sherd 15 body sherds 24 body sherds 1 almost complete, slip lined
WG16 Tr2 SU61	1 hemispherical cup Nile B1 1 plate Nile B2 1 basin Nile C 3 small open bowls Marl AV3 4 bottles Marl AV3 Marl AV3 bottle 3 medium jars Marl AV3 1 jar Marl AV3 2 jars Marl C 2 jars Marl C2 3 jars Marl C compact 2 jars Marl C compact 3 scrapers, Marl AV3 Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C sandy	Wallace-Jones 2018: Figure 118:3 Wallace-Jones 2018: Figure 128:4 Wallace-Jones 2018: Figure 129:3 Wallace-Jones 2018: Figure 130:12, 130:13, 130:14 Wallace-Jones 2018: Figure 127:14 (although this is Nile B2) Wallace-Jones 2018: Figure 134 Too small to type Wallace-Jones 2018: Figure 136:1 Wallace-Jones 2018: Figure 140:2, 40:5 Too small to type Too small to type Too small to type two triangular with rounded top, one rectangular with wavy edges 3 body sherds 1 body sherd 4 body sherds 17 body sherds 20 body sherds 62 body sherds
WG16 Tr2 SU48-60 Interface	2 hemispherical cups Nile B1 1 small, deep bowl Nile B1 1 plate Nile B2 1 plate Nile C 2 deep, open bowls Marl AV3 3 open bowls Marl AV3 2 medium jars Marl C 1 jar Marl C Nile clay type undefined Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:1, 118:8 Wallace-Jones 2018: Figure 118:15 with red rim Too small to type Wallace-Jones 2018: Figure 128:5 Wallace-Jones 2018: Figure 131:5, 131:6 Wallace-Jones 2018: Figure 130:12, 130:13, 130:14 Wallace-Jones 2018: Figure 139:9 Wallace-Jones 2018: Figure 140:3 24 body sherds 24 body sherds 4 body sherds 25 body sherds

	Breadmould	At least 7 different vessels 3 slip lined
WG16 Tr2 SU66	2 hemispherical cups Nile B1 2 plates Nile C 1 small bowl Marl AV3 1 bottle Marl AV3 2 jars Marl C 4 jars Marl C compact Nile B1 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 118:1, 118:3 Wallace-Jones 2018: Figure 128:10, 128:11 Wallace-Jones 2018: Figure 130:14 Too small to type Wallace-Jones 2018: Figure 142:6 (1) Wallace-Jones 2018: Figure 141:2 (2) 1 body sherd 20 body sherds 8 body sherds 25 body sherds 1 body sherd, uncoated low fired
WG16 Tr2 SU72	Nile C Marl AV3 Marl C Marl C compact	3 body sherds 2 body sherds 7 body sherds 1 body sherd with black graffito of a dog
WG16 Tr2 SU73	1 small fine hemispherical cup 1 medium bowl Nile B2 1 Nile B2 plate 1 medium jar Marl C compact 2 jars Marl C compact 1 jar fabric? Marl D Nile B1 Nile clay type undefined Nile B1 Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:7 Wallace-Jones 2018: Figure 122:3 Wallace-Jones 2018: Figure 121:7 Wallace-Jones 2018: Figure 139:9 Too small to type Wallace-Jones 2018: Figure142:6 (6) 4 body sherds 15 body sherds 7 body sherds 4 body sherds 16 body sherds 11 body sherds 4 body sherds
WG16 Tr2 SU74	1 bowl Nile C 1 jar Marl C Nile B1 Nile B2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 128:6 Too small to type 3 body sherds 6 body sherds 8 body sherds 1 body sherd 16 body sherds
WG17 SU0	1 plate Nile clay undefined Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 121:5 2 body sherds 2 body sherds 10 body sherds
WG17 SU1	3 hemispherical cups Nile B1 3 small bowls Marl AV3 2 medium jars Marl C 3 Marl C jars 1 *cnw* vessel Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:3, 118:7, 118:8 Wallace-Jones 2018: Figures two like 131:2, 131:7, Too small to type Wallace-Jones 2018: Figure 141:2 (1), 141:2 (2), 141:2 (5) Fabric unknown 52 body sherds 11body sherds 96 body sherds

WG17 SU2	5 hemispherical cups Nile B1 1 small plate Marl C 3 large jars Marl C Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:1, 118:3, 118:4, 118:6, 118:8 Wallace-Jones 2018: Figure 138:4 (ration plate type) Wallace-Jones 2018: Figure 140 25 body sherds 4 body sherds 18 body sherds
WG17 SU4	3 hemispherical cups Nile B1 2 plates Nile B2 1 plate Nile C 1 jar Nile clay undefined 1 jar fabric undefined Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:1, 118:3, 118:6 Wallace-Jones 2018: Figures 121:1, 121:6 Wallace-Jones 2018: Figure 128:10 Too small to type Fabric described as *Ballas* by excavator 7 body sherds 3 body sherds 19 body sherds
WG17 SU7	3 hemispherical cups Nile B1 1 hemispherical cup Nile B1 2 Nile clay jars fabric undefined 2 jars Marl AV3 5 plates Marl C 2 jars Marl C 2 jars Marl C Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:3, 118:5, 118:6 Wallace-Jones 2018: Figure 118:8 Too small to type Too small to type Wallace-Jones 2018: Figure 138:4 (ration plate type) Wallace-Jones 2018: Figures 139:5, 139:7 Wallace-Jones 2018: Figures 140:5, 140:6 57 body sherds 14 body sherds 64 body sherds
WG18 SU1	3 hemispherical cups Nile B1 4 plates Nile B2 2 jars NileB2 2 small jars Marl C 1 jar with corrugated rim Marl C 5 jars Marl C Nile clay undefined Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figures all like 118:1 Wallace-Jones 2018: Figures in the range of 121:10 but very worn Wallace-Jones 2018: Figures 127: 13, 127:15 Wallace-Jones 2018: Figures 138:9, 138:11 Wallace-Jones 2018: Figure 145:5 Wallace-Jones 2018: Figures two like 142:6 (4), 141:2 (2) 141:2 (4), 147:5 123 body sherds 21 body sherds 195 body sherds 6 body sherds 3 slip lined
WG18 SU2	2 hemispherical cups Nile B1 1 plate Nile B2 2 small jars NileB2 1 bottle Nile B2 1 medium jar Marl C Nile clay undefined	Wallace-Jones 2018: Figures both like 118:1 Wallace-Jones 2018: Figure 123:3 Too worn to type Too small to type Wallace-Jones 2018: Figure 142:6 (3) 14 body sherds

	Marl AV3 Marl C	2 body sherds 21 body sherds
WG18 SU4	2 hemispherical cups Nile B1 1 plate Nile B2 2 small jars NileB2 7 Marl C jars Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:1 Too small to type Too small to type Wallace-Jones 2018: Figures: four like 138:12, two like 139:7 147:5 30 body sherds 11 body sherds 38 body sherds
WG18 SU6	3 hemispherical cups Nile B1 1 plate Nile B2 1 jar Nile B2 1 jar with corrugated neck Marl C Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figures al like 118:2 Wallace-Jones 2018: Figure 123:3 Wallace-Jones 2018: Figure 127:5 Wallace-Jones 2018: Figure144:12 14 body sherds 9 body sherds 14 body sherds
WG18 SU7	1 hemispherical cup Nile B1 1 plate Nile B2 1 small jar NileB2 1 Nile B2 bottle 1 small jar Marl C 1 jar Marl C Nile clay undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 121:3 Wallace-Jones 2018: Figure 139:9 Wallace-Jones 2018: Figure 127:3 Too small to type Wallace-Jones 2018: Figure 141:2 (5) 3 body sherds 4 body sherds 2 body sherds one traces of hieroglyphs in black (illegible) and one with one pot-mark of three incised parallel vertical lines
WG18 SU8	14 hemispherical bowls Nile B1 1 deep hemispherical bowl 9 plates Nile B2/C2 4 jars Nile B2 1 large open bowl 3 *enw* vessels Nile B2 2 restricted bowls Marl AV3 3 bottles Marl AV3 6 jars Marl AV3 1 large jar Marl AV3 3 jars Marl C 2 jars with corrugated rims Marl C 35 jars Marl C	Wallace-Jones 2018: Figures 118:1 is the best match; many sherds are very small and hard to type Wallace-Jones 2018, Figure 118:9 Wallace-Jones 2018: Figures 128:4, 128:5, 128:9, five like 128:10, 128:11 Wallace-Jones 2018: Figures 127: 3, three like 127:4 Wallace-Jones 2018: Figure 129:1 Too small to type Wallace-Jones 2018: Figures like 131:6, 132:2 two like Wallace-Jones 2018: Figures 134:3, 134:4, 134:5, Wallace-Jones 2018: Figures 135:9, 135:10, two like Figure 135:15 two like Figure 135:16 Wallace-Jones 2018: Figure 136:4 Too small to type Wallace-Jones 2018: Figures 145:2 and 145:5 two like Wallace-Jones 2018: Figure

		140:5, thirty-two like Figure 142:6 (2) one with comma pot-mark (see Figure 145:10), Figure 143:4
	Nile clay undefined	145 body sherds one with comma pot-marks, one with rope impressions
	Marl AV3	54 body sherds
	Marl C	90 body sherds one with traces of illegible hieroglyphs, one with incised pot-mark of a boat, one with incised pot-mark, short horizontal groove see 146:10
WG18 SU9	3 hemispherical cups Nile B1	Wallace-Jones 2018: Figures 118:1, 118:2, 118:8
	1 plate Nile B2	Wallace-Jones 2018: Figure 121:3
	2 small jars fabric unidentified	Too small to type
	Nile clay undefined	7 body sherds
	Marl AV3	5 body sherds
	Marl C	3 body sherds
WG18 SU10	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:1
	2 jars Marl C	Too small to type
	Nile clay undefined	6 body sherds
	Marl AV3	4 body sherds
	Marl C	8 body sherds
WG18 SU11	3 hemispherical cups Nile B1	Wallace-Jones 2018: Figure 118:3
	1 plate Nile B2	Wallace-Jones 2018: Figure 121
	Nile C	410 body sherds from large and very large jars
	Marl AV3	8 body sherds
	Marl C	5 body sherds
WG18 SU12	3 hemispherical cups Nile B1Nile clay undefined	all like Wallace-Jones 2018: Figure 118:1 12 body sherds
	Marl AV3	6 body sherds
	Marl C	13 body sherds
WG18 SU13	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:1
	1 bottle Marl AV3	Too small to type
	1 jar Marl C	Wallace-Jones 2018: Figure 139:9
	Nile clay undefined	7 body sherds
	Marl AV3	9 body sherds
	Marl C	4 body sherds
WG18 SU14	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:1
	4 jars Marl C	Wallace-Jones 2018: Figures 139:9, 143:4, and two like Wallace-Jones 2018: Figure 139:12
	1 jar Marl C compact	Wallace-Jones 2018: Figure 142:6 (3)
	Nile clay undefined	7 body sherds
	Marl AV3	8 body sherds
	Marl C	18 body sherds from large jars, one with a pot-mark of three short lines resembles Wallace-Jones 2018: 146:5 but with three lines 23 body sherds from large jars
WG 19 SU0	2 hemispherical cups	Wallace-Jones 2018: Figures 118:8 and

		119:2
	1 plate Nile B2	Too small to type
	2 plates Nile C	Too small to type
	4 jars Marl AV3	Too small to type
	4 jars Marl C	Wallace-Jones 2018: Figures 140:1-2
	2 jars Marl C	Too small to type
	Nile clay type undefined	2 body sherds
	Nile B1	4 body sherds
	Nile B2	11 body sherds
	Nile C	27 body sherds
	Marl AV2	2 body sherds
	Marl AV3	22 body sherds from medium and large jars
	Marl C	43 body sherds from large jars
	Marl C compact	1 half-moon scraper, 1 triangular scraper with round top, 2 rectangular scrapers with wavy edges
	Breadmould	1 body sherd unlined
WG 19 SU1	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:13
	1 lipped bowl Nile B2	Wallace-Jones 2018: Figure 123:4 red in/out slightly smoked stained
	1 small, deep bowl Marl AV3	Wallace-Jones 2018: Figure 131:1
	1 medium bowl	Wallace-Jones 2018: Figure 131:4
	1 bottle Marl AV3	Too small to type
	3 jars Marl AV3	Too small to type
	1 jar Marl AV3	Wallace-Jones 2018: Figure 136:2
	1 jar with corrugated rim Marl C	Wallace-Jones 2018: Figure 145:3
	1 jar Marl C; 3 jars Marl C compact	Wallace-Jones 2018: Figure 141:2 (1), 141:2, (4) 141:2 (5)
	Nile B1	2 body sherds
	Nile B2	2 body sherds
	Nile C	10 body sherds
	Marl AV2	1 body sherd
	Marl AV3	25 body sherds
	Marl C compact	103 body sherds
WG 19 SU11	3 hemispherical cups Nile B1	Wallace-Jones 2018: Figure 118:1
	1 ledged rim from a small, deep cup Nile B1	Wallace-Jones 2018: Figure 119:15 red and burnished in/out
	1 plate Nile B2	Wallace-Jones 2018: Figure 123:7
	1 large bowl Nile B2	Too small to type
	2 plates Nile C	Wallace-Jones 2018: Figure 127
	1 bottle Nile B2	Too small to type
	1 jar Marl AV2?	Too small to type
	1 small cup Marl AV3	Wallace-Jones 2018: Figure 136:5-6
	1 carinated bowl Marl AV3	Wallace-Jones 2018: Figure 133:5
	1 ring footed bowl Marl AV3	Wallace-Jones 2018: Figure 134:4-5
	1 bottle Marl AV3	Too small to type
	3 jars Marl AV3	Wallace-Jones 2018: Figure 134:10
	1 bag shaped jar Marl AV3	Too small to type
	1 basin Marl C	Too small to type
	1 oval bodied jar Marl C	Wallace-Jones 2018: Figure 139:11

	compact	
	4 medium jars Marl C compact	Wallace-Jones 2018: Figures 139:11, 139:12, 140:2, 141:2 (1)
	5 jars Marl C compact	Wallace-Jones 2018: Figures 141:2 (5), two like 141:5,
	2 jars Marl C2	Wallace-Jones 2018: Figures 142:6 (1), 142:6 (3)
	Nile B1	17 body sherds
	Nile B2	8 body sherds
	Nile C	17 body sherds
	Marl AV3	22 body sherds from medium jars, 27 from large jars, three scrapers one rectangular with wavy edges, 2 triangular with rounded top
	Marl C	77 body sherds
	Marl C compact	7 body sherds
	Marl C2	1 body sherd
WG 19 SU13	4 hemispherical bowls Nile B1	Wallace-Jones 2018: Figures 118:6, 118:8 119:7, 119:8
	1 plate Nile B2	Too small to type
	2 bowls B2 Nile	both like Wallace-Jones 2018: Figure124:3
	3 bottles Nile B2	all like Wallace-Jones 2018: Figure 127:3
	3 plates Nile C	Wallace-Jones 2018: Figures 128:6, 128:7, 128:8
	3 small bowl Marl AV3	Wallace-Jones 2018: Figures 130:10 131:1
	2 bottles Marl AV3	Wallace-Jones 2018: Figure 138:2
	1 jar medium Marl AV3	Too small to type
	2 jars Marl C	Wallace-Jones 2018: Figures 142:2, 142:6 (6)
	4 jars Marl C compact	Wallace-Jones 2018: Figures 134:2
	2 medium jars Marl C compact	Too small to type
	4 jars Marl C compact	Wallace-Jones 2018: Figures 141:1, 141:2 (2), 141:2 (5), one too worn to type
	Nile B1	6 body sherds
	Nile B2	80 body sherds
	Nile C	14 body sherds
	Marl AV3	61 body sherds plus one scraper blade shaped
	Marl C	70 body sherds
	Mar C compact	83 body sherds
WG 19 SU38	1 hemispherical cup Nile B1	Too small to type
	1 restricted bowl Nile D?	Too small to type
	1 small plate Marl AV3	Wallace-Jones 2018: Figure 130:2
	1 small bowl Marl AV3	Wallace-Jones 2018: Figure 130:8
	2 Marl AV3 bottles	Wallace-Jones 2018: Figure 134:4
	1 medium jar Marl AV3	Too small to type
	1 jar Marl C	Wallace-Jones 2018: Figure 139:2
	2 large jars Marl AV3	Wallace-Jones 2018: Figures 140:1, 140:6
	1 jar Marl D?	Too small to type
	1 scraper rectangular with	

	rounded top and wavy edge	
	Nile B1	2 body sherds
	Nile B2	1 body sherd
	Nile C	2 body sherds
	Nile D	8 body sherds
	Marl AV3	1 body sherd
	Marl C	56 body sherds
	Marl C compact	15 body sherds
	Breadmould	13 body sherds 8 unlined
WG 19 SU43	1 small bowl Marl AV3	Wallace-Jones 2018: Figure 131:2
	1 jar Marl C compact	Wallace-Jones 2018: Figure 135:5
	1 small jar Marl AV3	Too small to type
	Nile B2	1 body sherd
	Nile C	19 body sherds
	Marl AV3	27 body sherds
	Marl C	4 body sherds
	Marl C compact	66 body sherds
WG19 SU46	3 hemispherical bowls Nile B1	Wallace-Jones 2018: Figure 118
	2 plates Nile B2	Wallace-Jones 2018: Figure 121
	1 bowl Marl AV3	Wallace-Jones 2018: Figure 135
	1 bottle Marl AV3	Too small to type
	1 scraper, Marl AV3	blade shaped
	Nile B1	4 body sherds
	Nile B2	2 body sherds
	Nile C	40 body sherds
	Marl AV3	28 body sherds
	Marl C	54 body sherds
WG19 SU47	1 small open bowl Nile B2	Wallace-Jones 2018: Figure 121:5
	4 bowls Nile B2	Wallace-Jones 2018: Figures 121:6, two like 122:2, 122:5
	4 Nile C plates	Wallace-Jones 2018: Figures 128:8, 128:10, two like 128:11
	2 bowls Marl AV3	Wallace-Jones 2018: Figure 130:12, 130:14
	1 bottle Marl AV3	Wallace-Jones 2018: Figure 127:13
	3 jars Marl AV3	Too small to type
	1 bowl Marl C	Wallace-Jones 2018: Figure138:1
	1 large jar Marl AV3	Wallace-Jones 2018: Figure136:3
	1 jar Marl C	Wallace-Jones 2018: Figure 140:1
	4 jars Marl C compact	Too small to type but rolled rims
	5 jars Marl C compact	Two like Wallace-Jones 2018: 141:3, 142:6 (1) 142:6 (3), 142:6 (4)
	Emc vessel Nile?	Fabric uncertain
	Nile B1	5 body sherds
	Nile B2	61 body sherds
	Nile C	47 body sherds
	Marl AV2	1 body sherd
	Marl AV3	87 body sherds
	Marl C	9 body sherds
	Marl C compact	99 body sherds
WG 19 SU50	1 open bowl Nile B2/C	Wallace-Jones 2018: Figure 128:4
	2 jars Marl AV3	Too small to type

	2 jars Marl C compact 2 jars Marl C compact 2 complete breadmoulds Nile B2 Marl AV2? Marl AV3 Marl C Breadmould	Too small to type Wallace-Jones 2018: Figures 143:4 and 146:2 no pot mark Wallace-Jones 2018: Figure 120:10 sandy fabric unlined 6 body sherds 11 body sherds 55 body sherds 253 body sherds 2 body sherds unlined
WG 19 SU60	2 hemispherical bowls Nile B1 2 plates Nile B2 2 bottles Nile B2 1 small bowl Marl AV3 2 medium jars Marl AV3 1 plate Marl C (sandy) 1 jar Marl C 2 jars Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C	Wallace-Jones 2018: Figures 118:1, 118:6 Wallace-Jones 2018: Figure 121 too worn to type further Wallace-Jones 2018: Figures 127:14, 127:15 Wallace-Jones 2018: Figure 130:10 Too small to type Wallace-Jones 2018: Figure 138:4 Too small to type Wallace-Jones 2018: Figures 142:5 and 142:6 (4) 2 body sherds 3 body sherds 21 body sherds 17 body sherds 51 body sherds
WG19 SU63	1 jar Marl C compact	Wallace-Jones 2018: Figure 142:5
WG 19 SU66	No diagnostics Nile C Marl AV3 Marl C Marl C compact	 1 body sherd 2 body sherds 1 body sherd 1 body sherd
WG20 SU0	1 bottle Nile B2 1 jar Marl C Nile undefined Nile B2 Marl AV3 Marl C	Too small to type Too small to type 153 body sherds 30 body sherds 11 body sherds 255 body sherds
WG20 SU1	No diagnostics Nile undefined Marl AV3 Marl C	 1 body sherd 1 body sherd 1 body sherd
WG21	No diagnostics Nile undefined Marl AV3	6 body sherds 1 body sherd 4 body sherds
WG22 SU0	1 jar Marl C Nile undefined Marl AV3 Marl C 4 jars mar AV3	17 body sherds 7 body sherds 15 body sherds 18 body sherds Wallace-Jones 2018: Figure 144:9, 144:11, 144:14 one too worn to type

WG23 SU0 in front	1 jar Marl C Marl C	Wallace-Jones 2018: Figure 139:11 5 body sherds
WG23 SU1 Entrance	No diagnostics Marl C	 3 body sherds
WG 23 SU1 inside	1 jar Marl C	Figure 139:12
WG 23 SU1 outside	1 open bowl Nile B2 1 plate Marl AV3 2 bowls Marl AV3 1 circle lid? Marl AV3 2 jars Marl C Nile undefined Marl AV3 Marl C	Wallace-Jones 2018: Figure 122:3 Wallace-Jones 2018: Figure 131:3 Wallace-Jones 2018: Figure 130:14 Wallace-Jones 2018: Figure 133:4 Too small to type 16 body sherds 5 body sherds 26 body sherds
WG24 Cave 2 Cleaning	2 hemispherical bowls Nile B1 1 plate Nile B2 1 bottle Nile B2 6 jars Marl C compact 1 jar Marl C compact Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 117:1, 118:8 Wallace-Jones 2018: Figure 121:1 Too damaged to type Wallace-Jones 2018: Figures three like 138:13, 138:15 two like 138:15 Too small to type 3 body sherds 5 body sherds 2 body sherds 4 body sherds 9 body sherds 13 body sherds
WG24 Cave 2 Surface rm 2	1 hemispherical cup Nile B1 1 small jar Nile B1 1 jar Marl C 1 breadmould partially complete Nile B1 Nile B2 Marl C	Wallace-Jones 2018: Figure 118:4 Wallace-Jones 2018: Figure 120:4 Wallace-Jones 2018: Figure 120:10 unlined 4 body sherds 3 body sherds 1 body sherd with ink graffito a short vertical line and a circle similar to 145:14
WG24 Cave 2 Outside cave NW side	Nile C Marl AV3 Marl C Marl C compact	1 body sherd 1 body sherd 1 body sherd 2 body sherds
WG24 Cave 2 SU0	Nile B1 Nile B2 Nile C Marl C Marl C compact Marl D?	5 body sherds 1 body sherd 5 body sherds 1 body sherd 8 body sherds 5 body sherds
WG24 Cave 2 SU0 entrance	1 plate Nile B1 2 cookers Nile B1 2 plates Nile C 1 jar Marl AV3 1 jar Marl C 2 jars Marl C compact	Wallace-Jones 2018: Figure 117:1 Wallace-Jones 2018: Figures 119:4 and 119:13 Wallace-Jones 2018: Figure128:6, 128:7 Too damaged to type Wallace-Jones 2018: Figure 144:9 Too small to type

	Nile B1 Nile B2 Nile C	2 body sherds 1 body sherd 4 body sherds
WG24 Cave 2 SU1 rm1	2 hemispherical bowls one deep 1 open bowl Nile B1 1 jar Marl C compact 1 deep bowl Marl AV3 2 breadmoulds 1 bottle fabric unidentified Nile B1 Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:1 and 8 Wallace-Jones 2018: Figure 117:3 Too small to type Wallace-Jones 2018: Figure 131:2 No type possible unlined - could be red lustrous ware 2 body sherds 4 body sherds 7 body sherds
WG24 Cave 2 SU25	1 jar Marl C compact Nile B1 Marl C compact	Wallace-Jones 2018: Figure 139:3 4 body sherds 6 body sherds
WG24 Cave 2 SU34 rm1	1 hemispherical bowl Nile B1 1 small cooker Nile B1 1 jar Marl C 2 jars Marl C compact 1 jar Marl D? Nile B1 Nile B2 Marl AV3? Marl C Marl C compact 1 bright orange and burnished fabric?	Wallace-Jones 2018: Figure 118:4 Wallace-Jones 2018: Figure 119:4 Too small to type Wallace-Jones 2018: Figures 140:1, 140:5 Too small to type 2 body sherds 3 body sherds 1 body sherd coarse enough to be Marl AV4 6 body sherds 1 body sherd Could be red lustrous ware or a local imitation
WG24 Cave 2 SU37 entrance rm1 Inside near fish	1 globular jar Marl AV3 1 jar Marl AV3 2 jars Marl C compact Nile undefined Marl AV3 Marl C	Too small to type Too small to type Figure 143:10 2 body sherds 3 body sherds 9 body sherds
WG24 Cave 2 SU44	1 jar Marl C Marl C compact	Unidentified 2 body sherds
WG24 Cave 2 SU47 rm 1	Marl C compact	2 body sherds
WG24 Cave 2 SU53 rm 1	4 hemispherical bowls Nile B1 1 medium jar Marl AV3 2 jars Marl C compact Nile B1 Nile B2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:2 Unidentified Unidentified 2 body sherds 1 body sherd 2 body sherds 3 body sherds 2 body sherds
WG24 Cave 2 SU57	2 hemispherical bowls Nile B1 2 plates Nile B2/ C	Wallace-Jones 2018: Figures 118 too worn for further typing both like Wallace-Jones 2018: Figure

		123:2 with rope marks
	1 plate Nile B2	Wallace-Jones 2018: Figure121:4
	1 plate Nile C	Wallace-Jones 2018: Figure 128:6
	1 small jar Marl AV3	Wallace-Jones 2018: Figure136:1
	1 jar Marl C compact	Wallace-Jones 2018: Figure 142:5
	Nile B1	11 body sherds one with black band? imitating Nubian style
	Nile B2	2 body sherds
	Marl AV3	3 body sherds
	Marl C compact	12 body sherds
WG24 Cave 2 SU58	Nile B1	1 body sherd
	Nile B2	1 body sherd
	Marl C	1 body sherd
WG24 Cave 2 SU64	4 hemispherical bowls Nile B1	all like Wallace-Jones 2018: Figure 118:1
	1 small bowl Nile B1	Wallace-Jones 2018: Figure 117:7
	1 small jar Nile B1	Too small to type
	1 small globular bottle Nile B1	with red and black decoration in bands
	1 plate Nile B2	Wallace-Jones 2018: Figure121:3
	1 beer jar Nile B2	Wallace-Jones 2018: Figure 127:15
	1 bottle Nile C	Unidentified
	4 Marl AV3 jars	Wallace-Jones 2018: Figures 135:5, 135:7, 135:10, 135: 13
	1 jar Marl C	Wallace-Jones 2018: Figure 142:6 (2)
	5 jars Marl C compact	Too worn to type
	Nile B1	11 body sherds
	Nile B2	20 body sherds
	Nile C	1 body sherd with rope impressions
	Marl AV3	8 body sherds
	Marl C compact	19 body sherds
	Breadmould	2 body sherds unlined
WG24 Cave 2 SU76 rm1	2 hemispherical bowls Nile B1	Wallace-Jones 2018: Figures 118:5, 118:6
	3 plates Nile B2	all like Wallace-Jones 2018: Figure 121:7
	2 plates Nile C	both like Wallace-Jones 2018: Figure 128:10
	3 medium jars Marl AV3	Wallace-Jones 2018: Figures134:10, 135:3, 135:8
	1 *cnw* vessel Marl C	-
	3 jars Marl C	Too small to type
	Nile B1	46 body sherds 2 with black bands
	Nile B2	17 body sherds
	Nile C	40 body sherds
	Marl AV3	7 body sherds
	Marl C compact	16 body sherds
	Breadmould	3 body sherds unlined
WG24 Cave 2 SU76-44	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 118:4
	1 plate Nile B2	Wallace-Jones 2018: Figure 121:10
	1 plate Nile C	Wallace-Jones 2018: Figure 128:7
	2 plates Marl C	Wallace-Jones 2018: Figure 138:4
	1 jar Marl C	Wallace-Jones 2018: Figure 142:3
	Nile B1	25 body sherds
	Nile B2	4 body sherds

	Nile C Marl AV3 Marl C compact Marl C2	6 body sherds 1 body sherd 3 body sherds 5 body sherds
WG24 Cave 2 SU78-44	Nile B1 Marl AV3	1 body sherd 5 body sherds
WG24 Cave 2 SU80	1 jar Marl C compact Marl C compact	Unidentified 1 body sherd
WG25 SU0	No diagnostics Nile B1 Nile B2 Nile C Nile D Marl AV3 Marl C Marl C compact	 2 body sherds 4 body sherds 4 body sherds 11 body sherds 7 body sherds 15 body sherds 3 body sherds
WG25 SU30	1 small hemispherical bowl Marl AV3 1 jar Marl AV3 2 bottles Marl AV3 1 jar Marl C compact Nile B1 Nile B2 Marl AV3 Marl C compact	Wallace-Jones 2018: Figure 131:1 Wallace-Jones 2018: Figure 136:2 Wallace-Jones 2018: Figures 135:5, 135:9 Unidentified 2 body sherds 6 body sherds 8 body sherds 33 body sherds
WG25 SU87	4 hemispherical bowls Nile B1 1 bowl fabric undefined 1 bottle Marl AV3 2 bottles Marl C 2 jars with corrugated necks Marl C No body sherds	Wallace-Jones 2018: Figures 118:1, 118:3, 118:5, 118:8 Wallace-Jones 2018: Figure 129:1 Wallace-Jones 2018: Figure135:16 Wallace-Jones 2018: Figures 139:1, 139:9 Wallace-Jones 2018: Figure144:12, 144:16
WG25 SU90	1 lid Nile B2 1 flat base Nile B2 No body sherds	Wallace-Jones 2018: Figure 126:5 Wallace-Jones 2018: Figure 128:1 red and burnished out
WG25 SU91	2 jars with corrugated necks Marl C No body sherds	Wallace-Jones 2018: Figures 144: 10, 144:12
WG25/26SU0	1 Nile bottle B2 1 plate Nile C 1 jar Nile D 1 Marl AV3 bowl 2 Marl AV3 jars 1 jar Marl C 1 jar Marl C 1 complete breadmould Nile C Marl AV3	Wallace-Jones 2018: Figure 127:4 Wallace-Jones 2018: Figure128:10 Too small to type Wallace-Jones 2018: Figure131:2 very fine Too worn to type Wallace-Jones 2018: Figure 139:12 Wallace-Jones 2018: Figure 142:6 (4) Slip lined 14 body sherds 16 body sherds
WG26 SU1	1 hemispherical bow Nile B1	Wallace-Jones 2018: Figure 118:1

	1 flat base Nile B1	Red wash out
	1 plate Nile C	Wallace-Jones 2018: Figure128:8
	1 bottle Nile B2	Wallace-Jones 2018: Figure127:3
	1spout Marl AV3	Unidentified
	1 bottle Marl AV3	Wallace-Jones 2018: Figure 135:10
	One scraper Marl AV3	blade shaped
	4 jars Marl C	Too small to type
	1 large flat jar base Marl C	Handmade and scraped
	Nile C	18 body sherds
	Marl AV3	7 body sherds
	Marl C compact	43 body sherds
WG26 SU13	1 hemispherical bow Nile B1	Wallace-Jones 2018: Figure 118:3
	1 Small Marl AV2 jar base	Wallace-Jones 2018: Figure 137:7 but not Marl AV3
	1 small jar Marl C compact	Too small to type
	No body sherds	
WG26 SU30	3 plates Nile C	Wallace-Jones 2018: Figure 128:9
	1 jar Marl AV3	Wallace-Jones 2018: Figure135:9
	2 medium jars Marl C	Wallace-Jones 2018: Figure142:3
	1 large jar Marl C	Wallace-Jones 2018: Figure141:2 (1)
	2 jars Marl C compact	Unidentified
	Nile B1	5 body sherds
	Nile B2	8 body sherds
	Marl AV3	4 body sherds
	Marl C	5 body sherds
	Breadmould	1 body sherd unlined
WG26 SU71	1 plate Nile B1	Wallace-Jones 2018: Figure 119:2
	1 bottle Nile B2	Wallace-Jones 2018: Figure 121:17
	1 hemispherical cup Marl AV3	Wallace-Jones 2018: Figure 131:2
	1 bottle Marl AV3	Wallace-Jones 2018: Figure 134:4
	2 medium Marl C compact jars	Wallace-Jones 2018: Figures 144:7, 144:9
	1cooker Marl C compact	Wallace-Jones 2018: Figure138:12
	Nile B1	2 body sherds
	Nile B2	36 body sherds
	Marl AV3	16 body sherds
	Marl C	1 body sherd
	Marl C compact	44 body sherds
WG26 SU72	1 open bowl Nile B1	Wallace-Jones 2018: Figure 117:7
	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 118:3
	2 bowls Nile B2	Wallace-Jones 2018: Figures 123:4, 124:7
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:4
	2 plates Nile C	Wallace-Jones 2018: Figure 128:5
	1 Nile C platter	Wallace-Jones 2018: Figure 128:11
	1 bottle Marl AV3	Too small to type
	2 jars Marl AV3	Unidentified
	1 jar Marl C	Too small to type
	3 jars Marl C compact	Unidentified
	2 jars Marl C compact	Wallace-Jones 2018: Figures141:2 (4), 142:9
	Nile B2	9 body sherds
	Nile C	16 body sherds

	Marl AV3 Marl C Marl C compact	15 body sherds 7 body sherds 49 body sherds
WG26 SU79	1 platter Nile C 1 bottle Marl AV3 1 jar Marl AV3 1 jar Marl C 5 medium jars Marl C compact 5 Marl C compact jars 1 complete breadmould Nile B2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure128:11 Wallace-Jones 2018: Figure134:4 Too small to type Wallace-Jones 2018: Figure141:2 (8) Wallace-Jones 2018: Figures 139:9, 139:9, 139:12 others too worn to type Wallace-Jones 2018: Figures 140:4, 140:6, 141:12, 141:2 (2), 141:2 (4) Wallace-Jones 2018: Figure 120:10 unlined 15 body sherds 35 body sherds 97 body sherds 56 body sherds
WG26 SU81	1 jar Marl C compact 2 medium jars Marl C compact Nile B1 Marl AV3 Marl C Marl c compact	Unidentified Wallace-Jones 2018: Figures141:2, (3), 142:2 (5) 14 body sherds 7 body sherds 2 body sherds 18 body sherds
WG26 SU84	2 medium jars Marl AV3 1 open bowl Marl C 4 jars Marl C compact Marl AV3 Marl C	Wallace-Jones 2018: Figure134:4 Wallace-Jones 2018: Figure 138:1 Wallace-Jones 2018: Figures: 139:2, 141:2 (2), two like 141:2 (7) 3 body sherds 1 body sherd
WG26 SU90	2 bottles Marl AV3 1 shoulder from a jar Marl AV3 1 open plate Marl C 4 Marl C compact jars No body sherds	Wallace-Jones 2018: Figures both like135:2 Wallace-Jones 2018: Wallace-Jones 2018: Wallace-Jones 2018: Figure 85 incised decoration of horizontal bands and concentric curves Wallace-Jones 2018: Figure 138:4 Wallace-Jones 2018: Figures139:2, 139:3 two too small to type
WG27 SU0	2 plates Nile B2 2 large plates Nile B2 1 hemispherical cup Marl AV3 1 jar Marl AV4? 1 jar with corrugated neck Marl C 1 medium jar Marl C 2 jars Marl C 1 medium jar with corrugated neck Marl C compact Nile B1	Wallace-Jones 2018: Figure both like121:3 Wallace-Jones 2018: Figures 122:1, 123:2 Wallace-Jones 2018: Figure 130:17 Unidentified Wallace-Jones 2018: Figure 145:2 Unidentified Wallace-Jones 2018: Figure 142:6 (1) 144:12 Wallace-Jones 2018: Figure 145:3 4 body sherds

	Nile B2 Nile C Marl AV3 Marl AV4? Marl C Marl C compact	2 body sherds 9 body sherds 2 body sherds 1 body sherd 19 body sherds 41 body sherds
WG27 SU1	Nile B1 Marl AV3 Marl C Marl C compact	1 body sherd 1 body sherd 5 body sherds 1 body sherd
WG27 SU3	Marl C Marl C compact	6 body sherds 4 body sherds
WG27 SU7	2 jars Marl C compact	Wallace-Jones 2018: Figures 139: 8, 139: 9
WG27 SU43	2 hemispherical bowls Nile B1 1 plate Nile B2 2 plates Nile C 1 large, open platter Nile C? 3 hemispherical cups Marl AV3 1 plate Marl AV3 1 bottle Marl AV3 1 jar Marl AV3 1 jar Marl AV3 1 jar Marl C compact 1 jar Marl C compact Nile B1 Nile C Marl AV3 Marl C Marl C compact	both like Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure121:3 Wallace-Jones 2018: Figure 128:11 Wallace-Jones 2018: Figure 126:6 Wallace-Jones 2018: Figures all like 130:17 Wallace-Jones 2018: Figure 130:1 Wallace-Jones 2018: Figure 135:2 Wallace-Jones 2018: Figure 135:16 Wallace-Jones 2018: Figure 136:3 Wallace-Jones 2018: Figure 139:9 Wallace-Jones 2018: Figure 142:2 1 body sherd 23 body sherds 27 body sherds 49 body sherds 23 body sherds
WG27 SU46	2 hemispherical bowls Nile B1 2 *enw* vessels Nile B1 3 plates Nile B2 2 plates Nile C 1 platter Nile B2/C? 1 bottle Nile B2 1 jar Nile B2 2 bowls Marl AV3 2 small plates Marl AV3 3 bottles Marl AV3 2 medium jars Marl AV3 2 jars with corrugated neck Marl C 4 jars Marl C 2 jars Marl C compact	Wallace-Jones 2018: Figures 118:1 118:2 Wallace-Jones 2018: Figure 121:10 Wallace-Jones 2018: Figures 128:6 and 128:7 Wallace-Jones 2018: Figure 126:6 Wallace-Jones 2018: Figure 127:15 Unidentified Wallace-Jones 2018: Figures 130:14, 130:17 both like Wallace-Jones 2018: Figure 130:1 Wallace-Jones 2018: Figure 134:4, and two like Wallace-Jones 2018: Figure 135:10 Unidentified both like Wallace-Jones 2018: Figure 145:6 Wallace-Jones 2018: Figures 139:12, 142:6 (1), 142:6 (3), 142:6 (4) Unidentified

	1 jar with corrugated neck Marl C compact	Wallace-Jones 2018: Figure 145:5
	4 jars Marl C compact	Wallace-Jones 2018: Figure 141:2 (2), 141:2 (5), 141:2 (6), 141:2 (7)
	Nile B1	5 body sherds
	Nile B2	39 body sherds
	Nile C	48 body sherds
	Marl AV3	34 body sherds
	Marl C	23 body sherds
	Marl C compact	120 body sherds
WG27 SU49	Nile B1	2 body sherds
	Nile B2	6 body sherds
	Marl AV3	9 body sherds
	Marl C	2 body sherds
	Marl C compact	14 body sherds
WG27 SU60	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 118:13
	1 medium jar Marl AV3	Wallace-Jones 2018: Figure 136:2
	1 large jar Marl AV3	Wallace-Jones 2018: Figure136:3
	1 jar with corrugated neck Marl C	Wallace-Jones 2018: Figure 145:
	1 jar Marl C compact	Wallace-Jones 2018: Figure 145:6
	Nile B1	2 body sherds one rounded base with red slip and burnish out
	Nile B2	16 body sherds
	Nile C	2 body sherds
	Marl AV3	86 body sherds one rounded base burnished out
	Marl C	53 body sherds
WG27 SU79	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:1
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:11
	1 jar Marl C compact	Too small to type
	Nile B1	1 body sherds
	Nile B2	5 body sherds
	Marl AV3	5 body sherds
	Marl C compact	12 body sherds
	Breadmoulds	7 body sherds all unlined
WG29 SU1	1 plate Nile B2	Wallace-Jones 2018: Figure 121:3
	1 *ene* vessel Marl C	
	Nile B1	1 body sherd
	Marl AV3	1 body sherd
	Marl C	6 body sherds
WG29 SU3	3 jars Marl C compact	Wallace-Jones 2018: Figure 139:12
	Marl C	121 body sherds
WG30 surface	Nile B1	1 body sherd red slip and burnish out
	Marl AV3	3 body sherds, one rounded scraped base, one body
WG30 SU1	5 jars Marl C	Wallace-Jones 2018: Figure two like 138:11 138:14 two too worn to be identified
	1 cooker Marl C compact	Wallace-Jones 2018: Figure 138:12
	1 jar Marl C compact	Wallace-Jones 2018: Figure 139:10

	Nile B2 Nile C Marl AV2 Marl AV3 Marl C Marl C compact	1 body sherd 2 body sherds possibly red lustrous? 8 body sherds 7 body sherds 36 body sherds one incised with commas on shoulder
WG30 SU5	1 bottle Nile undefined 1 jar Marl C Nile undefined Marl C	Unidentified Wallace-Jones 2018: Figure 141:2 (2) with incisions 3 commas 7 body sherds 7 body sherds
WG30 SU36	Marl AV3 Marl C	74 body sherds one with burnish out 6 body sherds
WG30 SU45	2 platters/oven bases? Nile undefined/local fabric 2 jars Marl C compact Marl C Marl C compact	Wallace-Jones 2018: Figure 126:6 Too small to type 2 body sherds 4 body sherds
WG30 SU48	1 jar Marl C 1 complete breadmould Nile B1 Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figure 139:7 Unlined 2 body sherds 10 body sherds 7 body sherds 40 body sherds
WG30 SU50	1 bowl Nile B2 7 plates Nile C 1 bottle Nile C 3 small bowls Marl AV3 1 small, globular bottle Marl AV3 2 jars Marl C 4 jars Marl C compact 6 jars Marl C compact 2 jars fabric undefined 5 stoppers Marl C compact 2 scrapers Marl c compact Nile undefined Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 122:3 Wallace-Jones 2018: Figures128:7, 128:8 one with very deep turning marks Unidentified Wallace-Jones 2018: Figure 131:3 two like Wallace-Jones 2018: Figure 131:14, one with repair hole, one with rope marks Unidentified Wallace-Jones 2018: Figure 142:6 (1), 142:6 (3) two like Wallace-Jones 2018: Figure 140:6, 142:6 (1), 146:2 (4) two like Wallace-Jones 2018: Figure 142:6 (4) others too small to type No further information No further information Triangular with rounded top 4 body sherds 1 body sherd 1 body sherd 15 body sherds 13 body sherds 26 body sherds 32 body sherds
WG30 SU54	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 118:3

	2 Nile B2/C bottles 1 Marl AV3 bowl Nile B1 Nile B2 Marl AV3	Wallace-Jones 2018: Figures 127:14, 127:15 with rope impressions Too small to type 5 body sherds 6 body sherds one with rope impressions 6 body sherds
WG30 SU65	1 hemispherical bowl Nile B1 1 plate Nile C 1 jar Marl C compact 1 jar stopper Marl C Nile B1 Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:2 Wallace-Jones 2018: Figure 128:11 Wallace-Jones 2018: Figure140:1 No further information 1 body sherd 1 body sherd 4 body sherds 13 body sherds 3 body sherds
WG30 SU68	1 hemispherical bowl Nile B1 1 open bowl Nile B2 2 plates Nile B2 1 plate Nile C 1 small bowl Marl AV3 1 jar Marl AV3 2 jars Marl C compact 1 jar Marl C compact 1 *cmw* vessel Nile B1 Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 118:2 Wallace-Jones 2018: Figure 122:6 Wallace-Jones 2018: Figures 128: 1, 128:8 Wallace-Jones 2018: Figure 128 Wallace-Jones 2018: Figure 130:14 Unidentified Unidentified Wallace-Jones 2018: Figure 140:6 6 body sherds 6 body sherds 4 body sherds 4 body sherds 1 body sherd 8 body sherds
WG30 SU69	1 jar Marl AV3 1 jar Marl C compact 1 scraper Marl C compact Nile undefined Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 135:9 Wallace-Jones 2018: Figure 139:6 7 body sherds 8 body sherds 16 body sherds 1 body sherd
WG30 SU70	1 bowl Nile B1 1 scraper Nile B2 Nile B1 Nile B2 Marl AV3	Wallace-Jones 2018: Figure117:5 rectangular with wavy edges 3 body sherds 5 body sherds 2 body sherds
WG30 T32 Timber hole	Marl AV4?	1 body sherd
WG31 SU1	1 open bowl Nile A/B1 1 *cmw* vessel Nile B1 3 hemispherical bowls Nile B1 1 plate Nile B2 2 plates Nile C	Wallace-Jones 2018: Figure 131:4 fabric and walls very fine Wallace-Jones 2018: Figure two like 118:1, 118: 8 Wallace-Jones 2018: Figure 122:1 Wallace-Jones 2018: Figures 128:3, 128:8

	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:13
	1 jar Nile B2	Wallace-Jones 2018: Figure 127:1
	1 small jar Marl AV2	Wallace-Jones 2018: Figure 137:9
	2 small open bowls Marl AV3	both like Wallace-Jones 2018: Figure 131:3
	1 medium jar Marl AV3	Wallace-Jones 2018: Figure 136:1
	4 medium jars Marl C	Wallace-Jones 2018: Figures 138:15, 138:16, two like Wallace-Jones 2018: Figure 139:9 two like Wallace-Jones 2018: Figure 146:2 (2), (4)
	4 large jars Marl C	Unidentified
	1 large jar base Marl C	Handmade clearly finger smoothed
	1 jar Marl C compact	Unidentified very burnt
	1 jar Marl undefined	-
	2 complete Breadmoulds	Wallace-Jones 2018: Figure 120:10 both unlined
	1 scraper Marl C compact	Fan shaped
	Nile B1	11 body sherds
	Nile B2	21 body sherds
	Nile C	13 body sherds
	Marl AV2	7 body sherds
	Marl AV3	9 body sherds
	Marl C	58 body sherds
	Marl C compact	19 body sherds
WG31 SU2	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 118:2
	1 *ene* vessel Nile B1	
	1 plate Nile B2	Wallace-Jones 2018: Figure122:1
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:14
	3 small bowls Marl AV3	Wallace-Jones 2018: Figures 130:10, 130:12, 130:15
	1 atypical sherd with internal ledge Marl AV2	Wallace-Jones 2018: Figure 137:10 decorated with horizontal painted black bands does not appear MK
	1 bottle Marl AV3	Wallace-Jones 2018: Figure 135:9
	1 jar Marl AV3	Wallace-Jones 2018: Figure134:4
	1 medium Marl C jar	Wallace-Jones 2018: Figure 138:15
	1 jar Marl C compact	Too small to type
	2 stoppers	Small jar size
	Nile B1	1 body sherd
	Nile C	9 body sherds
	Marl AV2	2 body sherds
	Marl AV3	10 body sherds
	Marl C compact	35 body sherds
WG32 Surface	1 bottle Nile B1	Wallace-Jones 2018: Figures 120:2
	2 jars Marl C	Wallace-Jones 2018: Figures139:6, 139:9
	Nile B1	1 body sherd
	Marl AV3	1 body sherd
	Marl C	2 body sherds
	Marl C compact	2 body sherds
WG32 SU1	1 bottle Nile B1	Wallace-Jones 2018: Figure 120:4
	1 plate Nile B2	Wallace-Jones 2018: Figure122:1

	1 jar Nile C	Unidentified
	1plate Marl AV3	Wallace-Jones 2018: Figure 130:4
	1 jar neck Marl AV2	Wallace-Jones 2018: Figure 137:9
	2 bowls Marl AV3	Wallace-Jones 2018: Figures 130:4, 130:6
	1 small, flat jar base Marl AV3	Wallace-Jones 2018: Figure 137:7
	3 small jars Marl AV3	Unidentified
	5 jars Marl C	Wallace-Jones 2018: Figure 139:6-8
	2 jars Marl C	Wallace-Jones 2018: Figures 142:6 (1), 142:6 (2)
	1 bottle Marl C compact	Wallace-Jones 2018: Figure 139:9
	1 jar Marl C compact	Wallace-Jones 2018: Figure 141:3
	Nile B1	2 body sherds
	Nile B2	5 body sherds from large jars, one red out
	Nile C	3 body sherds
	Marl AV2	6 body sherds
	Marl AV3	37 body sherds
	Marl AV4	1 from a large jar
	Marl C	10 body sherds
	Marl C compact	36 body sherds
	Marl C1	9 body sherds from at least two vessels
WG32 SU9-10	1 jar Marl C	Wallace-Jones 2018: Figure 141:1
	Nile undefined	3 body sherds one with rope marks out
	Marl AV3	5 body sherds
	Marl C	3 body sherds
WG32 SU10	6 hemispherical cups Nile B1	Wallace-Jones 2018: Figures Four like 118:1, two like118:2
	1 deep hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:17 red in
	1 small jar Nile B1	Wallace-Jones 2018: Figure 120:6
	1 plate Nile B2	Wallace-Jones 2018: Figure 124:3 red in
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:3 red out
	1 plate Nile C	Wallace-Jones 2018: Figure 128:10
	1 small jar shoulder Marl AV2	Wallace-Jones 2018: Figure 137:9 burnished out
	3 plates Marl AV3	Wallace-Jones 2018: Figures 130:3, 130:4, 130:9
	1 water jar Marl AV3	Wallace-Jones 2018: Figure 134:10
	4 medium jars Marl C	Two small to type
	2 large jars Marl C	Wallace-Jones 2018: Figures 139:9 and 138:9
	Nile B1	body sherds from at least 3 cups
	Nile B2	19 body sherds 5 red out
	Nile C	2 body sherds, one bottle neck red out
	Marl AV3	13 body sherds
	Marl C	17 body sherds
	Marl C compact	6 body sherds
	Marl C1	11 body sherds all from large jars
	Breadmould	1 almost complete vessel unlined
WG32 SU15	1 medium jar Marl AV3	Unidentified
	Nile B2	1 body sherd
	Marl AV3	2 body sherds

WG32 SU16	2 hemispherical cups Nile B1	Wallace-Jones 2018: Figures 117: and 118:1
	1 plate Nile C	Wallace-Jones 2018: Figure 128:10
	1 bowl Marl AV3	Wallace-Jones 2018: Figure 130:4
	2 medium jars Marl AV3	Unidentified
	1 jar Marl C	Unidentified
	1 medium jar Marl C compact	Wallace-Jones 2018: Figure 139:9-9
	2 jars Marl C compact	Unidentified
	Nile B1	3 body sherds
	Marl AV3	21 body sherds
	Marl C	4 body sherds
	Marl C compact	4 body sherds
	Breadmould	1 lower half of one vessel slip lined
WG32 SU18	1 bowl Marl AV3	Wallace-Jones 2018: Figure 131:3
	1 medium jar Marl AV3	Wallace-Jones 2018: Figure 135:8-9
	1 jar Marl C	Unidentified
	2 jars Marl C	Wallace-Jones 2018: Figures 142:3 and 146:6
	2 jars Marl C compact	Wallace-Jones 2018: Figure 139:9, 141:1
	Nile B1	5 body sherds
	Nile B2	7 body sherds one with rope marks out
	Marl AV3	21 body sherds
	Marl C	13 body sherds
	Marl C compact	18 body sherds
WG32 SU25	6 hemispherical cups Nile B1	Wallace-Jones 2018: Figures, 118:1, 118:2 red in/out, 118:7 red and burnished in/out, 119:2 and two like 119:11
	2 plates Nile B1	Wallace-Jones 2018: Figure 117:2
	1 bowl Nile B1	Wallace-Jones 2018: Figure117:6
	3 plates Nile B2	Wallace-Jones 2018: Figures 122:1, two like 121:10 one red in
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:14
	1 jar base Nile B2	Wallace-Jones 2018: Figure 128:1 red out
	3 shallow cups Marl AV3	Wallace-Jones 2018: Figures 130: and two like 130:14
	2 plates Marl AV3	Wallace-Jones 2018: Figure 130:2
	1 ring base from a closed form Marl AV3	Wallace-Jones 2018: Figures 68, 69, 70, 133:6 turned ring applied to the base of the jar
	2 bottles with corrugated rim Marl C	Wallace-Jones 2018: Figures 144:11, 144:12
	5 jars Marl C	three like Wallace-Jones 2018: Figure 142:6 (4), 140:1, 143:5
	Nile undefined	16 body sherds
	Nile B1	19 body sherds, some red out, two red in/out
	Nile B2	12 body sherds, one red in, two red out, one red/burnish out
	Nile E	2 body sherds, cooker heavily smoked stained
	Marl AV2	1 body sherd

	Marl AV3 Marl C Marl C compact Marl C1 Breadmould	24 body sherds, one burnished in, one with pot-mark, 3 from small fine open forms 29 body sherds 22 body sherds from at least two large vessels, 33 body sherds including one large, flat, handmade base and one bowl base 1 partially complete vessel slip lined
WG32 SU33	4 shallow cups Marl AV3 1 plate Marl AV3 1 complete bowl Marl AV3 1 carinated bowl Marl AV3 1 jar Marl C compact 1 jar Marl C1 1 jar Marl C1 Nile B1 Nile C Marl AV3 Marl C compact Marl C1 Breadmould	Wallace-Jones 2018: Figure 130:14 at least two vessels Wallace-Jones 2018: Figure 130:2 Wallace-Jones 2018: Figure 131:3 scraped base Wallace-Jones 2018: Figure 132:4 fine clay, handmade base Wallace-Jones 2018: Figure 139:9 Wallace-Jones 2018: Figure 142:3 Wallace-Jones 2018: Figure 142:6 (4) 3 body sherds 8 body sherds from at least three large closed forms some with red out 6 body sherds high fired fine fabric at least 2 vessels 5 body sherds 8 body sherds 6 body sherds at least three vessels unlined
WG32 SU34	1 jar rim with internal ledge Marl AV3 Nile B2 Marl AV3 Marl C Marl C1	Wallace-Jones 2018: Figure 143:7 but in Marl AV3 2 body sherds including 1 bottle neck 3 body sherds 6 body sherds 1 body sherd
WG32 SU39	Nile B1 Nile B2 Marl C compact Marl C1	2 body sherds from two different cups 4 body sherds, closed forms red out 6 body sherds 1 body sherd from large closed form
WG32 SU40	Nile B2 Marl C1	2 body sherds, large closed forms 1 body sherd
WG32 SU46 cave entrance	2 plates Marl AV3 1 complete bowl Marl AV3 1 deep bowl Marl AV3 1 bowl with wavy rim Marl AV3 Nile B1 Nile B2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure 130:4 ration plate type Wallace-Jones 2018: Figure 130:7 Wallace-Jones 2018: Figure 44b scraped and turned Wallace-Jones 2018: Figure 132:10 with incised decoration 5 body sherds from at least 2 cups 4 body sherds from a large closed form 5 body sherds medium closed forms 6 body sherds 4 body sherds

	Marl C1 Breadmoulds Large platter fragment, fabric may be local?	12 body sherds 2 different vessels one slip lined, one unlined 8 body sherds
WG33 SU1	1 water jar Marl AV3 2 cups Marl C 2 medium jars Marl C 1 large jar Marl C 2 jars Marl C compact Nile B2 Nile C Marl AV3 Marl C Marl C compact Breadmoulds Rims, bases and bodies of small open mouth jars foreign probably Syro-Palestinian	Wallace-Jones 2018: Figure 134:4 Wallace-Jones 2018: Figure 143:4 Wallace-Jones 2018: Figure 142:5 Wallace-Jones 2018: Figure 140:2 Wallace-Jones 2018: Figures 142:1, 142:6 (5) 12 body sherds at least three vessels 8 body sherds 9 body sherds including one shallow bowl one large jar and one medium jar 17 body sherds all from large jars 43 body sherds all from large jars 7 different vessels some lined some unlined 24 sherds from at least 5 vessels Shapes resemble Wallace-Jones 2018: Figure 147:4
WG33 SU2	2 hemispherical cups Nile B1 1 water jar Nile B2 2 medium jars Marl AV3 1 jar Marl AV3 2 medium jars Marl C 1 large jar Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C compact Marl C1	Wallace-Jones 2018: Figure 118:7 Wallace-Jones 2018: Figure 127:1 one body sherd and one rounded scraped base from the same vessel Wallace-Jones 2018: Figure 136:3 Wallace-Jones 2018: Figures 139:7, 142:5 Wallace-Jones 2018: Figure 142:6 (4) 18 body sherds hemispherical cups 43 body sherds all from large jars 2 body sherds 17 body sherds from small bowls and medium jars 20 body sherds all from large jars 4 body sherds 34 body sherds
WG33 SU3	1 restricted bowl rim Marl C 1 small everted jar rim Marl C 4 jars two with corrugated rims Marl C 1 flat jar base Marl C1 Nile B1 Nile B2 Marl AV3 Marl C Marl C compact Marl C1 Marl C2	Wallace-Jones 2018: Figure 138:3 Wallace-Jones 2018: Figure 138:8 Wallace-Jones 2018: Figures 141:1, 142:6 (4) two like 144: 1 Handmade 2 body sherds from cups 20 body sherds including 5 long bottle necks and 2 large plates with rope marks 5 body sherds from medium vessels and one large jar with comma pot-mark 16 body sherds all from large jars 8 body sherds 10 body sherds all from large jars 2 body sherds
WG33 SU4	1 body sherd from a carinated	Wallace-Jones 2018: Figures 87, 132:9

	bowl Marl AV3	with applied clay scrolls and incised decoration
WG33 SU9	1 medium jar Marl C 1 jar with corrugated neck Marl C Marl AV3 Marl C	Wallace-Jones 2018: Figure 142:5 Wallace-Jones 2018: Figure 144:9 2 body sherds 2 body sherds
WG33 SU15	1 jar Marl C No body sherds	Unidentified
WG34SU1	No diagnostics Marl C compact	 1 body sherd
WG34 SU2	1 cooker rim Nile B2 1 medium jar Marl AV3 2 jars Marl AV3 1 jar with corrugated neck Marl C 2 medium jars Marl C compact Nile B2 Marl AV2 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figure122:5 red in/out smoke stained Wallace-Jones 2018: Figure 134:2 Wallace-Jones 2018: Figure 136:2 Wallace-Jones 2018: Figure 144:11 Unidentified 8 body sherds 1 body sherd 7 body sherds 22 body sherds 10 body sherds
WG34 SU4	2 small bowls Marl AV3 1 small jar Marl C compact Nile B1 Marl AV3 Marl C Marl C compact	Wallace-Jones 2018: Figures 1301:1 and 130:141 Wallace-Jones 2018: Figure 139:3 12 body sherds from hemispherical cups 8 body sherds from medium jars and two from a deep bowl 13 body sherds from large jars 16 body sherds
WG38 SU1	1 hemispherical cup Nile B1 1 shallow bowl Marl AV3 1 jar Marl C 1 tiny rim in Marl AV3? Nile B1 Nile C Marl AV3 Marl AV4? Marl C	Wallace-Jones 2018: Figure 118:2 Wallace-Jones 2018: Figure 130:6 Wallace-Jones 2018: Figure 142:6 (1) Wallace-Jones 2018: Figure 135:19 probably a miniature 2 body sherds 5 body sherds 7 body sherds 1 body sherd 6cm thick with red core 1 body sherd
WG38 SU2	1 jar no defined fabric 4 jars no defined fabric 2 jars with corrugated necks Marl C Marl AV3 Marl C	Unidentified Wallace-Jones 2018: Figure 142:6 (2) Wallace-Jones 2018: Figures 144:10, 144:12 14 body sherds 1 body sherd 52 body sherds
WG38 SU4	1 small bottle Nile B2 1 small water jar Marl AV3	Wallace-Jones 2018: Figure 127:9 red in/out Wallace-Jones 2018: Figure 135:5

	2 small fine jars Marl C 1 small flat jar base Marl C Nile B1 Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figures 138:13,138:14, much smaller and finer than usual for Marl C, may be miniatures Handmade traces of burnish out 16 body sherds from hemispherical cups 31 body sherds from large jars and open forms some with smoke blackening 6 sherds from a very large jar 52 body sherds from large jars
WG39 Surface	3 hemispherical cups Nile B1 Nile B1 Nile B2 Marl AV3 Marl C	both like Wallace-Jones 2018: Figure 118:2 5 body sherds 38 body sherds 1 body sherd 9 body sherds
WG39 SU1	3 hemispherical cups Nile B1 1 open bowl Nile B2 1 small bowl Marl AV3 Nile B1 Nile B2 Nile C Marl AV3 Marl C compact Marl C1	two like Wallace-Jones 2018: Figure 118:1, 118:2 Wallace-Jones 2018: Figure 122:4 Wallace-Jones 2018: Figure 130:11 36 body sherds 4 body sherds 5 body sherds 1 body sherd 6 body sherds 3 body sherds
WG39 SU7	2 hemispherical bowls Nile B1 1 open bowl Nile B1 Nile B1 Nile C Marl AV2 Marl AV3 Marl C compact	both like Wallace-Jones 2018: Figure 118:2 Wallace-Jones 2018: Figure 119:2 red rim band 7 body sherds 1 body sherds 1 body sherd 1 body sherd 3 body sherds
WG39 SU19	Large flat base Marl C	Handmade with exterior scraping
WG 40 South Extension	1 rounded jar with ring base Marl AV2	Wallace-Jones 2018: Figure 137:8 finely made with thin walls finely burnished out ring foot is wheel made and applied to scraped base. This is a very high quality vessel
WG 40 Feature 2	1 large platter Nile C No body sherds	Wallace-Jones 2018: Figure 128:10
WG 40 Feature 4	1 hemispherical bowl Nile B1 1 large basin Nile C 1 bottle Marl AV3 Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:3 Wallace-Jones 2018: Figure 129:32 Wallace-Jones 2018: Figure 135:2 2 body sherds 2 body sherds 2 body sherds
WG40 SU3	4 hemispherical cups Nile B1 1 large platter Nile C No body sherds	two like Wallace-Jones 2018: Figure 117:8 and two like Wallace-Jones 2018: 118:4 Wallace-Jones 2018: Figure 128:10

WG40 SU5	1 hemispherical bowl Nile B1 1 large platter Nile C 2 small bowls Marl AV3 1 bottle Marl AV3 1 medium jar Marl AV3 2 basins Marl C 1 jar Marl C Nile C Marl AV3 Marl C	Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 128:11 Wallace-Jones 2018: Figure 130:14 Wallace-Jones 2018: Figure 135:2 Unidentified Wallace-Jones 2018: Figure 138:2 Wallace-Jones 2018: Figure 143:5 6 body sherds 8 body sherds 13 body sherds
WG43 SU1/SU2 interface	1 shallow hemispherical cup Nile B1 Marl AV3 Marl C compact Marl C1	Wallace-Jones 2018: Figure 118:1 1 body sherd from a small open form 1 body sherd from a small fine vessel form uncertain 10 body sherds from large jars 6 body sherds from large jars
WG45 SU1	1 jar Marl C compact Nile B2 Marl A2 Marl AV3 Marl C compact Marl C1 Breadmould	Wallace-Jones 2018: Figure 142:6 (3) 3 body sherds 1 body sherd from a small open form 3 body sherds 23 body sherds 25 body sherds 1 body sherd unlined
WG45 SU2	1 small hemispherical cup rim 1 small bowl Marl AV3 Nile B1 Nile C Marl AV3 Marl C Marl C compact Breadmould	Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 130:11 5 body sherds from hemispherical cups 5 body sherds of very thick body from a large, open plate 4 body sherds from a large jar 55 body sherds from several closed vessels 22 body sherds from large jars 4 pieces from 4 different vessels unlined
WG46 SU1/2 interface	Nile B2 Marl AV3 Marl C Marl C compact Marl C1 Marl C2	4 body sherds from large closed forms 15 body sherds two from the same medium jar and 1 fine cup 2 body sherds from large jars 32 body sherds from large jars one with pot-mark see figure 145:12 22 body sherds from large jars 2 body sherds from large jars
WG46 SU1	1 hemispherical cup Marl AV3 1 rounded base Marl AV3 1 water jar Marl AV3 1 large jar Marl AV3 2 bag shaped jars with corrugated neck Marl C 6 jars Marl C 1 medium jar Marl C compact	Wallace-Jones 2018: Figure 130:14 Wallace-Jones 2018: Figure 137:4 handmade and scraped Wallace-Jones 2018: Figure 135:5 very fine fabric Wallace-Jones 2018: Figure 136:4 Wallace-Jones 2018: Figure 145:1, 145:2 Wallace-Jones 2018: Figures 2 like 139:12, 140:1, 140:2 and 142:6 (5) Wallace-Jones 2018: Figure 139:3

	1 jar Marl C1 1 jar Marl C2 1 hemispherical cup Marl C 1 counter Marl C Nile B1 Nile B2 Marl AV3 Marl C compact Marl C Marl C1 Marl C2 Breadmould	Wallace-Jones 2018: Figure 143:5 Wallace-Jones 2018: Figure 141:1 Wallace-Jones 2018: Figure 118:6 but in Marl C not Nile Circular recut with chipped edges 2 body sherds from two hemispherical cups 24 body sherds from a bottle a medium globular jar and large jars, one red out 30 body sherds ten from very large jars, twelve from large jars and one from a carinated bowl five from small, fine cups turned then scraped to shape 90 body sherds from several large and medium jars one badly spalled inside 76 body sherds from several large and medium jars one highly vitrified 84 body sherds from same vessel lots of unmixed Marl in the groundmass 34 body sherds from large jars partially complete vessels 6 body sherds from 4 different vessels 5 uncoated one slip lined
WG46 SU2	1 large plate Nile B2 7 jars Marl C Nile B2 Marl AV3 Marl C Marl C compact Marl C1	Wallace-Jones 2018: Figure 121:10 Wallace-Jones 2018: Figures 142:5 two different vessels and 143:3 three different vessels 1 body sherd from a large jar, red out 3 body sherds two from a large jar one from a medium jar 66 body sherds from at least two large jars 56 body sherds all from large jars 93 body sherds all from large jars
WG47 SU1	1 small plate Marl AV3 1 medium jar with corrugated neck Marl C 1 medium jar Marl C compact 1 large jar Marl C 5 large jars Marl C 1 large flat jar base Marl C Nile B1 Nile B2 Nile C Marl AV3	Wallace-Jones 2018: Figure 130:2 Wallace-Jones 2018: Figure 144:12 Wallace-Jones 2018: Figure 142:5 Wallace-Jones 2018: Figure 140:1 Wallace-Jones 2018: Figures one too abraded to identify, one very large bag shaped, 140:1, 141:2 (1), and 142:6 (3) with thick white firing surface 2 body sherds from two different cups handmade 3 body sherds, red and burnish in/out 15 body sherds from large closed forms including three from the same large bottle with red out 1 large body sherd from a very large jar 24 body sherds from different vessels including one medium and one large jar also several small cups, medium jar has

		burnishing out
	Marl C compact	109 body sherds several jars
	Marl C1	106 body sherds from several large closed forms
	Marl C2	8 body sherds from at least two large jars
	Breadmould	5 body sherds from 5 different vessels two slip lined
WG47 SU2	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 119:7 red and burnished in/out
	1 small plate Nile B1	Wallace-Jones 2018: Figure 117:1
	2 plates Nile B2	Wallace-Jones 2018: Figures 121:10, 122:1 red out
	6 bottles Nile B2	three like Wallace-Jones 2018: Figures 127:3, 127:10, two like Wallace-Jones 2018: 127:16 all red out,
	1 cooker rim Nile E	Wallace-Jones 2018: Figure 120:9 heavily smoked
	1 small plate Marl AV3	Wallace-Jones 2018: Figure 130:2
	4 small hemispherical cups Marl AV3	Wallace-Jones 2018: Figures 131:1, 131:2, 131:4, one rounded base turned and scraped outside
	small water jars Marl AV3	Wallace-Jones 2018: Figure 135:5
	1 small round base Marl AV3	Wallace-Jones 2018: Figure 130:17 exterior scraped to shape
	3 large jars Marl AV3	Wallace-Jones 2018: Figures 136:3, two like 136:4
	1 medium jar Marl C	Wallace-Jones 2018: Figure 142:5
	6 jars with corrugated necks Marl C	Wallace-Jones 2018: Figures 144:8, 144:10, 144:12, 144:16, two like Wallace-Jones 2018: Figure 145:1
	1 small jar Marl C	Wallace-Jones 2018: Figure 144:2 an unusually small vessel with cup shaped rim
	6 jars Marl C	Wallace-Jones 2018: Figures 140:1, 140:5, 143:2, 143:3, 143:4, one 143:2 with nfr pot-mark post firing,
	3 jars Marl C1	Wallace-Jones 2018: Figures 143:2, 143:4 one flat handmade base
	Nile B1	7 body sherds from at least 3 hemispherical cups, one heavily scraped rounded base
	Nile B2	21 body sherds from large bag shaped and globular jars 2 from finer bottles red in/out
	Marl AV3	26 body sherds three from different small cups, seven from at least three large jars
	Marl C	449 body sherds from a quantity of different vessels one round base and some bag shaped profiles
	Marl C compact	88 body sherds from large and medium jars
	Marl C1	24 body sherds from jars
	Marl C2	1 body sherd
WG47 SU1/SU2 interface	1 deep bowl Marl C	Wallace-Jones 2018: Figure 138:1
	Nile B2	9 body sherds from large jars

	Marl C1	2 body sherds from large jars
WG49 SU1	1 platter Nile C	Wallace-Jones 2018: Figure 128:10
	1 large bag shaped jar Marl AV3	Wallace-Jones 2018: Figure 136:3
	1 jar Marl C	Wallace-Jones 2018: Figure 140:1 with rolled rim
	Marl AV3	1 body sherd from a large jar
	Marl C compact	15 body sherds
	Marl C1	5 body sherds
	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:1
	1 carinated cup Nile B1	Wallace-Jones 2018: Figure 118:12 very fine and sandy, red burnish in
	1 large cooker Nile B2	Wallace-Jones 2018: Figure 123:7 red out
	1 medium jar Nile B2	Wallace-Jones 2018: Figure 127:5
	1 medium jar base rounded with a pointed base	Wallace-Jones 2018: Figure similar to 129:4 but smaller with internal spiral
	1 fine plate Marl AV3	Wallace-Jones 2018: Figure 130:2
	1 flared neck Marl AV3	Wallace-Jones 2018: Figure 135:18
	1 small, fine, jar possibly in the shape of a pomegranate Marl AV2	Wallace-Jones 2018:Figure 137:11 thin walls, hard fabric with illegible traces of hieratic ink on shoulder
	1 jar Marl AV3	Wallace-Jones 2018: Figure 136:3
	7 cookers Marl C	all like Wallace-Jones 2018: Figures 138:12 smoked stained
	6 jars with corrugated necks Marl C	Wallace-Jones 2018: Figures 144:6, 144:12, 145:1, 145:2, 145:3, 145:6
	32 jars Marl C	Figures four like 140:1, six like 142:6 (4), twenty-two like Figures 143:2, 143:3, 143:4, many different vessels are represented some too worn to type
	1 flat jar base	Handmade with scraped outer
	5 jars Marl C compact	Wallace-Jones 2018: Figures 142:4, four like Wallace-Jones 2018: 143:2
	1 scraper Marl C	Fan shaped
	Nile B1	12 body sherds from several hemispherical cups including one rounded and scraped base
	Nile B2	87 body sherds form medium and large jars
	Nile C	45 body sherds from large jars
	Nile E cooker	Wallace-Jones 2018: Figure 120:9 heavily smoke stained
	Marl AV2	4 body sherds two from large open forms two from one small closed vessel, very fine fabric self-slipped and burnished out
	Marl AV3	23 body sherds from several different large jars, eight from one large open plate
	Marl C	136 body sherds and one flat, handmade base, from six different medium and large jars and 1 from a fine shallow cup
	Marl C compact	103 body sherds from large jars, some bag shaped a few with deliberate exterior

	 Marl C1 Marl C2	burnish 125 body sherds from large jars 19 body sherds from large jars
WG49 SU3	1 hemispherical cup Nile B1 1 large lid with ledge on exterior Nile C 1 small deep bowl Marl C 1 storage jar shoulder Marl C compact 1 large bag shaped jar with corrugated rim Nile B1 Nile B2 Marl C compact Marl C1	Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 129:2 Wallace-Jones 2018: Figure 49 with pot-mark semicircle with cross inside Wallace-Jones 2018: Figure 144:16 1 body sherd from a hemispherical cup 10 body sherds from at least two medium closed forms and one large closed form all red out 41 body sherds from large jars 28 body sherds from large jars
WG50 SU1	Nile B2 Marl AV3 Marl C compact Marl C1	Wallace-Jones 2018: 1 body sherd from a large jar 2 body sherds from two different vessels 2 body sherds from two different large jars 7 body sherds from several different jars
WG50 interface SU1/SU2	1 hemispherical cup Marl AV3 Nile B2 Marl AV3 Marl AV4 Marl C Marl C compact	Wallace-Jones 2018: Figure 130:11 shallow, very fine fabric 1 body sherd from a large jar 1 body sherd too small to type 3 body sherds from 2 vessels, one open form, one small jar 6 body sherds from large jars at least three vessels 10 body sherds
WG50 SU2	1 small jar/cup base Nile D 2 small hemispherical cups Marl AV3 4 bag shaped jars Marl C 3 jars Marl C Nile B2 Marl AV3 Marl C Marl C compact Marl C1 Marl C2 1 body sherd with handle from an amphora Syro-Palestinian	Rounded and globular red out with smoking Wallace-Jones 2018: Figures 130:10 and 130:11 very fine fabric Wallace-Jones 2018: Figures 143:2, three 143:4 at least three different vessels with cup shaped rims Wallace-Jones 2018: Figures 141:1 rolled rim, two like 143:2 1 sherd from a medium closed form 1 body sherd from a large jar 25 body sherds all from large jars 86 body sherds all from large jars 121 body sherds all from large jars 25 body sherds all from large jars Wallace-Jones 2018: Figure Syro-Palestinian Appendix 7
WG51 SU1	2 almost complete profile hemispherical cups Nile B1 2 plates Nile B2	Wallace-Jones 2018: Figure 119:2 Wallace-Jones 2018: Figure 121:10 one red

		in/out
	2 medium jars Nile B2	Wallace-Jones 2018: Figures 127:5, 127:9 red in/out
	1 large jar neck Nile B2	Wallace-Jones 2018: Figure 127:3 red out
	6 hemispherical cups but in Marl AV3	Wallace-Jones 2018: Figures 130:10 with notched rim, two like Wallace-Jones 2018: Figures 130:14, three like Wallace-Jones 2018: Figure 131:2 at least four different vessels
	1 medium water jar Marl AV3	Wallace-Jones 2018: Figure 134:4 highly fired fine fabric
	3 jars with corrugated necks Marl C compact	Wallace-Jones 2018: Figures 144:12 two like 145:3 one with white firing surface
	1 jar Marl C	Wallace-Jones 2018: Figure 140:5
	1 jar Marl C compact	Wallace-Jones 2018: Figure 141:3
	1 large, flat base Marl C	From the above Marl C jar, handmade
	4 jars Marl C1	Wallace-Jones 2018: Figures 142:6 (2), 142:6 (4) 142:6 (5) Figure 143:3 with pre-firing pot-mark, two short parallel horizontal lines on shoulder
	1 blade shaped scraper Marl AV3	Worn to a fine point
	Nile B1	17 body sherds from hemispherical cups one red in/out and one small plate with red and burnish in/out, one with black? burnish out
	Nile B2	21 body sherds from medium and at least three large closed forms and one large plate
	Nile E	3 body sherds, smoke stained one body sherd burnished in from an open form?
	Marl AV3	38 body sherds from open and closed forms including shallow cups and large and medium jars
	Marl C	14 body sherds from large closed forms
	Marl C compact	85 body sherds from medium and large jars including one bag shaped
	Marl C1	164 body sherds from closed forms mostly large, but two from the same small vessel
	Marl C2	13 body sherds from large closed forms
	Breadmould	6 vessels almost complete two slip lined
WG52 SU1	Nile B2	1 body sherd from a very large closed form
	Marl AV3	1 body sherd from a small, fine jar
	Marl C compact	3 body sherds
	Marl C1	2 body sherds from large jars
	Marl C2	2 body sherds from the same large jar
WG52 SU3	1 small plate Nile B1	Wallace-Jones 2018: Figure 117:4
	2 small, lipped bowls Nile B2	Wallace-Jones 2018: Figures 124:5, 124:6 both red and burnished in/out
	1 rounded cup base Nile B1	Handmade and scraped
	1 jar Nile B2	Wallace-Jones 2018: Figure 127:1

	2 large plates Nile C	Wallace-Jones 2018: Figure 128:9
	1 flat jar base Marl AV3	Wallace-Jones 2018: Figure 137:7
	Nile B1	1 body sherd from a hemispherical cup
	Nile B2	9 body sherds 3 from same small, globular jar and others from large jars including one red out
	Nile C	3 body sherds
	Marl AV3	5 body sherds from at least two vessels including one cup
	Marl C	7 body sherds from large jars
	Marl C compact	8 body sherds at least two large vessels
	1 breadmould	Wallace-Jones 2018: Figure 120:10 partially complete unlined
	1 platter fabric?	Could be locally made
WG53 surface infill	2 hemispherical cups Nile B1	both like Wallace-Jones 2018: Figure 119:7 very fine fabric and walls
	1 hemispherical cup Marl AV3	Wallace-Jones 2018: Figure 130:12 extremely fine and thin walls
	Nile B1	1 body sherd from a small shallow hemispherical cup with red and burnish out
	Nile B1	1 body sherd from a small, closed vessel outer red and fine high burnishing
	Nile B2	4 body sherds from at least 2 large jars, one neck with red out
	Nile E	1 body sherd rather square shaped as if moulded
	Marl AV3	3 body sherds from small open forms
	Marl C	3 body sherds from large jars
WG53 SU1	Marl C	6 body sherds from three large jars
WG53 SU2	2 jar rims Marl C	Wallace-Jones 2018: Figures 141:3 and 143:1
	Marl AV3	4 body sherds three from the same large jar one from a small fine cup
	Marl C	3 body sherds from two different large jars
	Marl C compact	23 body sherds from large jars
	Marl C1	22 body sherds from large jars
WG53 SU10	1 hemispherical cup Nile B1	Wallace-Jones 2018: Figure 118:6
	1 small carinated cup Nile B1	Wallace-Jones 2018: Figure 118:12, red out and on inner rim
	1 ring base Nile B1	Wallace-Jones 2018: Figure 119:16 signs of turning and also finger modelling where base was applied
	1 small plate rim Nile B2	Wallace-Jones 2018: Figure 121:1 red in/out
	1 bottle rim Nile B2	Wallace-Jones 2018: Figure 127:16 red out
	2 small, flaring plate rims Marl AV3	Wallace-Jones 2018: Figures 130:2 and 130:5
	1 bag shaped jar Marl C	Wallace-Jones 2018: Figure 143:3
	1 jar Marl C	Wallace-Jones 2018: Figure 142:6 (1)
	Nile B1	7 body sherds from shallow hemispherical

		cups
	Nile B2	13 body sherds from several medium and large jars some red out
	Marl AV3	6 body sherds including one turned shoulder
	Marl C	9 body sherds from several large jars
	Marl C compact	13 body sherds from several large jars
	Marl C1	14 body sherds from large jars
	Marl C undefined	1 body sherd of Marl C but with large, dark grey rock particles scattered thickly throughout the groundmass, very had and highly fired
	Breadmould	4 sherds, 3 different vessels, one slip lined
WG53 SU23	Nile B1	1 body sherd from a small, fine, shallow cup
	Marl AV3	1 body sherd from a small, fine, shallow cup
	Marl C	1 body sherd from a large closed form
WG53 SU25	4 hemispherical cups Nile B1	all like Wallace-Jones 2018: Figure 118:6 one red in/three uncoated
	1 carinated cup rim Nile B1	Wallace-Jones 2018: Figure 118:12 very fine fabric almost Nile A
	1 bottle rim Nile B2	Wallace-Jones 2018: Figure 127:3 red in/out
	3 fine bowls Marl AV3	two like Wallace-Jones 2018: Figures 130:13, 130:14
	1 water jar Marl AV3	Wallace-Jones 2018: Figure 135:5
	1 large jar rim Marl AV3	Wallace-Jones 2018: Figure 136:3
	1 large flat jar base Marl AV3	Handmade with clear finger marks
	1 small handle Marl AV3	hand pulled
	1 very large jar Marl C	Wallace-Jones 2018: Figure 140:1
	1 very large flat jar base Marl C	From the above vessel, handmade, scraped
	1 piece of platter local clay?	Too small to type
	Nile B1	5 body sherds one from a hemispherical cup red in/out, others uncoated from cups
	Nile B2	16 body sherds one from a bottle neck, two from large jars
	Marl AV3	36 body sherds mix of large closed forms and smaller open and closed forms including 7 fine cups
	Marl C	8 body sherds from large jars
	Marl C compact	25 body sherds from large jars and one from a large open form with coarse inner burnish over white firing surface
	Marl C1	22 body sherds from large and medium jars
	Breadmould	2 body sherds one lined with fine slip
WG54 SU1	1 small plate Nile B1	Wallace-Jones 2018: Figure 117:5 red in/out
	1 hemispherical cup base Nile B1	Wallace-Jones 2018: Figure 119:8

	1 carinated cup Nile B1	Wallace-Jones 2018: Figure 118:12 with red rim
	2 plates Nile B2	Wallace-Jones 2018: Figures 122:1 with exterior rope marks and 121:10 red inside
	2 bowls with rolled rim Nile B2	Wallace-Jones 2018: Figures 123:4 and 123:6 red inside and on rim
	1 bottle Nile B2	Wallace-Jones 2018: Figure 127:4 red out
	1 small bottle neck Nile B2	Wallace-Jones 2018: Figure 127:6 rolled rim red in/out with interior turning spiral, red out
	1 small, rounded jar base Nile B2	Wallace-Jones 2018: Figure 127:16 rolled rim red in/out traces of burnish
	1 medium jar Nile B2	Wallace-Jones 2018: Figure 130:14
	2 hemispherical cups Marl AV3	Wallace-Jones 2018: Figures 131:3 fine fabric
	1 medium bowl Marl AV3	Wallace-Jones 2018: Figure 134:4 fine fabric
	1 large bowl Marl AV3	Wallace-Jones 2018: Figure 135:16
	1 water jar Marl AV3	Wallace-Jones 2018: Figure 136:3 with rolled rim
	1 large jar Marl AV3	handmade possibly from the vessel above
	1 flat jar base Marl AV3	signs of hand shaping
	1 bowl Marl C	Wallace-Jones 2018: Figure 138:1 thick cream firing surface
	1 large jar rim Marl C	Wallace-Jones 2018: Figure 140:5
	1 fan shaped scraper Marl AV3	From a fine vessel
	Nile B1	5 body sherds from fine hemispherical cups
	Nile B2	37 body sherds from a wide variety of sizes and vessel types including open forms, bottles, and large closed forms, 4 bottles three red out, one open form, red in
	Nile C	1 body sherd from a large open form
	Marl AV3	40 body sherds from several medium and large jars, one burnished out, also several small plates and cups with very fine fabric
	Marl AV4	1 shoulder of a medium jar burnished coarsely out
		4 pieces four different vessels
	Marl C compact	90 body sherds from medium and large jars
	Marl C	37 body sherds from medium and large jars
	Marl C1	4 pieces from 4 different vessels unlined
	Breadmould	
WG55 SU1	1 hemispherical cup	Wallace-Jones 2018: Figure 118:1 sandy fabric
	2 jars with corrugated necks Marl C	Wallace-Jones 2018: Figures 144:14, 144:17
	2 jars with cup shaped rims	Wallace-Jones 2018: Figures 143:1, 143:4
	3 large, flat jar bases Marl C1	Handmade
	1 jar with rolled rim Marl C2	Wallace-Jones 2018: Figure 141:3
	Nile B1	2 body sherds from beer bottles
	Nile B2	1 body sherd from medium jar

	Nile C Marl AV3 Marl C compact Marl C1 Marl C2 Breadmould	16 body sherds from large jars 15 body sherds from large jars 43 body sherds associated with three different rims, very hard, highly fired very gritty fabric 3 body sherds from closed forms 10 body sherds from large jars 2 pieces from two different vessels unlined
WG55 SU2	9 hemispherical cups Nile B1	five like Wallace-Jones 2018: Figure 118:1 two like Wallace-Jones 2018: Figure 118:8 one red out like Wallace-Jones 2018: 118:14 with red rim
	2 small flat plates Nile B1	Wallace-Jones 2018: Figures 117:3, 117:4
	1 small ring base from a cup Nile B1	Wallace-Jones 2018: Figure 119:16 red out
	1 small, shallow bowl Nile B2	Wallace-Jones 2018: Figure 121:7 red and burnished in/out
	1 flat rim from a cooker Nile B2	Wallace-Jones 2018: Figure 123:6 slightly smoked stained
	2 plates Nile B2	Wallace-Jones 2018: Figure 121:4 with rope marks, 121:2 with hand pinched base red and burnish in/out
	1 open form with incised decoration inside Marl AV3	Wallace-Jones 2018: Figure 4, top incision has almost cut through the clay causing it to break
	5 hemispherical cups Marl AV3	three like Wallace-Jones 2018: Figure 130:14, two like Wallace-Jones 2018: Figure 130:15
	3 small plates Marl AV3	Wallace-Jones 2018: Figures 130:2, 130:3, 130:4
	3 small carinated bowls Marl AV3	two like Wallace-Jones 2018: Figures 132:4, 132:6 with incised decoration
	1 small rounded base Marl AV3	Wallace-Jones 2018: Figure 137:4 but more regular and scraped to shape
	1 small ring base Marl AV3	Wallace-Jones 2018: Figure 133:5
	1 medium jar Marl C	Wallace-Jones 2018: Figure 139:7
	2 medium jars Marl C	Wallace-Jones 2018: Figures 139:9, 139:12
	3 large jars Marl C	two like Wallace-Jones 2018: Figures 140:3, 142:6 (4)
	Nile B1	18 body sherds 2 from the same open form red in/out fabric is fine and sandy, 9 from other cups including one rounded scraped base, 2 from the shoulders of two small closed forms, two red and burnished out one red only
	Nile B2	95 body sherds from large and very large jars some with red out, 20 from one large bowl
	Marl AV3	59 body sherds from medium jars and hemispherical cups
	Marl C	61 body sherds from large jars

	red rim, Nile B1	
	1 flared bottle rim Nile B2	Red in/out Wallace-Jones 2018: Figure 127:14
	1 large plate Nile C	Wallace-Jones 2018: Figure 128:9 blackened and rope marked out
	1 small shallow bowl Marl AV3	Wallace-Jones 2018: Figure 130:6
	Nile B1	5 body sherds from hemispherical cups
	Nile B2	34 body sherds from large jars some with red out
	Nile C	7 body sherds from a huge platter; 6cm at thickest part of body
	Nile E	2 body sherds smoked
	Marl C	59 body sherds from medium and large jars several vessels represented
WG61 SU19	2 carinated cup rims one small one larger Nile B1	Smaller like Wallace-Jones 2018: Figure 118:12 red and burnished in/out, larger like Wallace-Jones 2018: 119:12 red in/out
	1 small jar rim Nile B1	Wallace-Jones 2018: Figure 120:4 red out
	1 small open form possibly a lid Nile B1	Wallace-Jones 2018: Figure 126:1 uncoated
	1 angular form possibly a lid Nile B1	Wallace-Jones 2018: Figure 126:1 red in/out
	1 hemispherical bowl rim Nile B2	Wallace-Jones 2018: Figure 118:3 red in/out
	1 medium basin rim Nile B2	Wallace-Jones 2018: Figure 123:7 red in/out smoked
	7 jars with flared rims Nile B2	four like Wallace-Jones 2018: Figure 127:14, three like Wallace-Jones 2018: 127:15, 6 red in/out, dated by Englebach to early XII dynasty one very heavily smoked
	5 rims from large plates Nile B2/C	Wallace-Jones 2018: Figure 128:4 one red in, one uncoated, Wallace-Jones 2018: Figure 128:7 red in, Wallace-Jones 2018: Figure 128:10 red in rope marks out, Wallace-Jones 2018: Figure 128:11 uncoated, rope marks on rim
	1 large basin rim Nile C	Wallace-Jones 2018: Figure 129:2a red in/out smoke stained
	5 small hemispherical cups rims Marl AV3	all similar to Wallace-Jones 2018: Figure 130:14 one very thin 1-2 mm only
	2 slightly carinated open forms Marl AV3	Wallace-Jones 2018: Figure 132:4, Figure 132:6 with incised wavy design
	1 very small jar rim possibly a model Marl AV3	Wallace-Jones 2018: Figure 134:11
	6 rims from small jars Marl AV3	Wallace-Jones 2018: Figure 134:10, 5 like Wallace-Jones 2018: Figure 135:7
	2 large jar rims Marl C	Wallace-Jones 2018: Figure 140:3, 142:6 (3)
	1 medium jar rim Marl C compact	Wallace-Jones 2018: Figure 139:9

	Marl AV3 Marl C variant Breadmould	9 body sherds two from large jars, six from at least two very hard, fine (2mm thickness) open forms and one from a less fine small open plate 5 body sherds from large jars, fabric is unusual with large numbers of hard, grey rock inclusions up to 4mm in size A concentration of about 20 fragments both coated and uncoated Wallace-Jones 2018: Figure 96 with large, pale, stone inclusions like that in WG65 SU2 3 body sherds from three different vessels unlined
WG61 SU1	1 jar with fine flared neck Nile B1 1 jar with upright rim Marl AV3 Marl AV3 Marl C Marl C2	Wallace-Jones 2018: Figure 12:8 red out Wallace-Jones 2018: Figure 134:3 1 body sherd from a large jar 7 body sherds from medium jars 1 body sherd from a large jar
WG61 SU2	3 hemispherical cups Nile B1 1 medium jar Marl AV3 1 jar with corrugated rim, Marl C 3 jar bases Marl C Nile C Marl C Breadmould	two like Wallace-Jones 2018: Figures 118:1, 118:3 with red in/out Wallace-Jones 2018: Figure 135:13 very fine, dense fabric Wallace-Jones 2018: Figure 144:12 1 flat, 1 rounded handmade, 1 rounded scraped to shape 3 body sherds from large jars 44 body sherds from large jars 2 body sherds uncoated, one base with no hole
WG61 SU7	1 hemispherical bowl Nile B1 1 open form with everted lip Nile B2 1 large rounded jar base Nile C 1 jar rim Marl AV3 1 medium jar Marl C 1 large flat jar base Marl C Marl C Nile B2 Marl AV3 Marl C	Wallace-Jones 2018: Figure 119:6 Wallace-Jones 2018: Figure 126:1 fine fabric, red and burnish out could be a lid Signs of turning in and scraping out, maximum thickness 65mm Wallace-Jones 2018: Figure 135:16 may be a water jar Wallace-Jones 2018: Figure 143:5 Handmade 18 body sherds from large jars 5 body sherds from one large jar 9 body sherds from medium closed vessels and a small plate, very fine, hard, thin fabric 1-5 mm thick 17 body sherds from medium and large jars
WG61 SU10	1 small hemispherical cup Nile B1 1 fine hemispherical cup with	Wallace-Jones 2018: Figure 119:1 red in/out no burnish, outer base cut to shape Wallace-Jones 2018: Figure 118:14

	red rim, Nile B1	
	1 flared bottle rim Nile B2	Red in/out Wallace-Jones 2018: Figure 127:14
	1 large plate Nile C	Wallace-Jones 2018: Figure 128:9 blackened and rope marked out
	1 small shallow bowl Marl AV3	Wallace-Jones 2018: Figure 130:6
	Nile B1	5 body sherds from hemispherical cups
	Nile B2	34 body sherds from large jars some with red out
	Nile C	7 body sherds from a huge platter, 6cm at thickest part of body
	Nile E	2 body sherds smoked
	Marl C	59 body sherds from medium and large jars several vessels represented
WG61 SU19	2 carinated cup rims one small one larger Nile B1	Smaller like Wallace-Jones 2018: Figure 118:12 red and burnished in/out, larger like Wallace-Jones 2018: 119:12 red in/out
	1 small jar rim Nile B1	Wallace-Jones 2018: Figure 120:4 red out
	1 small open form possibly a lid Nile B1	Wallace-Jones 2018: Figure 126:1 uncoated
	1 angular form possibly a lid Nile B1	Wallace-Jones 2018: Figure 126:1 red in/out
	1 hemispherical bowl rim Nile B2	Wallace-Jones 2018: Figure 118:3 red in/out
	1 medium basin rim Nile B2	Wallace-Jones 2018: Figure 123:7 red in/out smoked
	7 jars with flared rims Nile B2	four like Wallace-Jones 2018: Figure 127:14, three like Wallace-Jones 2018: 127:15, 6 red in/out, dated by Englebach to early XII dynasty one very heavily smoked
	5 rims from large plates Nile B2/C	Wallace-Jones 2018: Figure 128:4 one red in, one uncoated, Wallace-Jones 2018: Figure 128:7 red in, Wallace-Jones 2018: Figure 128:10 red in rope marks out, Wallace-Jones 2018: Figure 128:11 uncoated, rope marks on rim
	1 large basin rim Nile C	Wallace-Jones 2018: Figure 129:2a red in/out smoke stained
	5 small hemispherical cups rims Marl AV3	all similar to Wallace-Jones 2018: Figure 130:14 one very thin 1-2 mm only
	2 slightly carinated open forms Marl AV3	Wallace-Jones 2018: Figure 132:4, Figure 132:6 with incised wavy design
	1 very small jar rim possibly a model Marl AV3	Wallace-Jones 2018: Figure 134:11
	6 rims from small jars Marl AV3	Wallace-Jones 2018: Figure 134:10, 5 like Wallace-Jones 2018: Figure 135:7
	2 large jar rims Marl C	Wallace-Jones 2018: Figure 140:3, 142:6 (3)
	1 medium jar rim Marl C compact	Wallace-Jones 2018: Figure 139:9

	2 body sherds with tally marks in black ink Marl AV2	Probably from one vessel
	8 body sherds Marl C	Interiors coated with wax From at least 3 different jars
	Nile B1	88 body sherds from hemispherical cups, mainly uncoated but including 1 rim sherd with red rim and one with red in/out no burnish also 1 small jar neck red and burnished out, fabric is often fine and very sandy. This context has many parallels with material from Kahun
	Nile B2	43 body sherds from hemispherical cups,
	Nile C	167 body sherds from large jars, 38 red wash out, 12 necks with red in/out remainder uncoated some smoked
	Nile E	2 body sherds heavily smoked
	Marl AV3	48 body sherds from several large jars
	1 scraper Marl AV4	Pointed with heavy smoking from a closed form with wavy incised decoration out
	Marl C	334 body sherds from medium and large jars most with smoke staining
	Marl C compact	171 body sherds from medium vessels
	Breadmould	211 body sherds mostly unlined, 6 with slip lining
	Foreign	3 body sherds 1 flat base, clay resembles Syro-Palestinian material from other locations
WG61 SU21	2 shallow plates Nile B1	Wallace-Jones 2018: Figures 117:1, 117:3
	2 carinated cups Nile B1	Wallace-Jones 2018: Figure 118:12 one uncoated with more upright profile one red and burnished in/out
	9 jar rims Nile B2	Wallace-Jones 2018: Figure 127:2, three like Wallace-Jones 2018: Figures 127:3, 127:4, 127:12, 127:14, 127: 5 red out, 127:16
	1 jar base Nile C	Wallace-Jones 2018: Figure 129:4
	1 shallow bowl Marl AV3	Wallace-Jones 2018: Figure 130:14
	2 medium jars Marl AV3	Wallace-Jones 2018: Figure 134:4, 134:5 one with exceptionally fine fabric and a pre-firing pot-mark on shoulder
	1 large jar rim Marl C	Wallace-Jones 2018: Figure 142:4 pot-mark
	1 ostracon with Marl C	Painted in black with lotus (?) design, drawing follows the shape of the sherd
	Nile B1	43 body sherds from hemispherical cups, 3 from at least two shallow plates, 26 from hemispherical cups,
	Nile B2	86 body sherds from large jars, 38 red wash out, 23 jar necks 12 with red in/out
	Nile C	48 body sherds from several large jars 7 with red wash out

	Marl AV3	7 sherds from at least two medium jars 3 from small shallow cups
	Marl C	54 body sherds from medium jars 98 body sherds from large jars
	Breadmould	191 body sherds mostly unlined 16 with slip coating All body sherds show old breaks and signs of wear many are also smoked. This context has many parallels with material from Kahun
WG61 SU32	2 plate rims Nile B1	Wallace-Jones 2018: Figure 117:5 one red in
	1 hemispherical bowl Nile B1	Wallace-Jones 2018: Figure 119:2
	5 carinated cups Nile B1	Wallace-Jones 2018: Figures 118:12 figure 118:12 with straighter sides red and burnished in/out, Wallace-Jones 2018: Figure 118:12 with red rim, 118:16 very fine fabric with thin walls 1-2mm and very fine red rim band
	4 deep open cooker forms Nile B1	three like Wallace-Jones 2018: Figures 119:13, 119:14 red and burnished in/out heavily smoked
	6 large shallow plates Nile B2	two like Wallace-Jones 2018: Figures 121:2 121:3, 121:10, 122:1 all red in 124:4 with red rim
	1 large bowl Nile B2	Wallace-Jones 2018: Figure 124:3 red in
	3 deep open cooker forms Nile B2	Wallace-Jones 2018: Figures 123:5 uncoated 123:6 red in/out 124:8 red and burnished in/out
	1 bottle rim Nile B2	Wallace-Jones 2018: Figure 127:16 red out
	1 flat jar base Nile B2	Handmade red out
	1 ledged lid Nile B2	Wallace-Jones 2018: Figure 126:3 red in/out
	1 very fine bowl Marl AV2	Wallace-Jones 2018: Figure 134:12 extremely thin 1-2 mm
	3 bottle rims Marl AV3	Wallace-Jones 2018: Figures 134:5 135:5 135:15 with pre-firing notches all in very fine thin hard fabric
	1 corrugated rim Marl C	Wallace-Jones 2018: Figure 145:1
	5 jar rims Marl C	Wallace-Jones 2018: Figures 144:3 144:4 144:9 146:4 146:9 pot-marked pre-firing
	1 large body sherd Marl C	four like Wallace-Jones 2018: Figure 145:11, one like 142:6 (4) with three post-firing tally marks on rim
	Nile B1	87 body sherds from shallow hemispherical cups 9 with red and burnish in/out
	Nile B2	92 body sherds 17 from large shallow plates some with red in some with rope marks the remainder from bottles and large jars some with red out some with rope marks one red and burnished out

	Nile C	38 body sherds of large and very large jars some with red out one with coarse burnish
	Marl AV3	43 body sherds 3 from the same shallow bowl 20 from several shallow cups 14 from medium jars six from large jars
	Marl C	184 body sherds from medium and large jars
	Breadmould	85 body sherds 79 unlined 6 slip lined Much of this deposit is heavily smoked This context has many parallels with material from Kahun
WG61WG65 SU45	1 very fine hemispherical cup rim Nile A	Wallace-Jones 2018: Figure 118:1 but in Nile A
	1 very fine carinated cup rim Nile B1 could almost be Nile A	Wallace-Jones 2018: Figure 118:12
	4 small plate rims, flared Nile B1	Wallace-Jones 2018: Figures 117:5 red in, three like 117:6 one uncoated two with red rim
	7 shallow hemispherical cups rims Nile B1	all like Wallace-Jones 2018: Figure 118:1 one red and burnished in/out five uncoated, one very fine at the rim <1mm with red rim band
	1 almost complete hemispherical cups Nile B1	Wallace-Jones 2018: Figure 118:9 unusually small and deep with pronounced horizontal lines on exterior and deep interior rilling lines. Broken in half probably in antiquity, half is heavily burnt found in a fire pit
	6 cooker rims Nile B1	Wallace-Jones 2018: Figures 119:2 but red and burnished in/out, 119:113 red and burnished in/out two like Wallace-Jones 2018: Figures 119:4 red out, 119:9 red in/out, two like Wallace-Jones 2018: Figure 119:14 red and burnished in/out, all heavily smoked
	1 ring base Nile B1	Wallace-Jones 2018: Figure 119:16 red in/out finger pinched
	2 small plate rims Nile B2	Wallace-Jones 2018: Figures 121:8, 121:9
	4 large plate rims Nile B2	Wallace-Jones 2018: Figure 121:10 red in three like Wallace-Jones 2018: 122:1
	1 small bottle rim Nile B2	Wallace-Jones 2018: Figure 127:8 red out
	2 flared bottle rims Nile B2	Wallace-Jones 2018: Figures 127:3 red out 127:15 red and burnished out
	10 deep cooker rims Nile B2	three like Wallace-Jones 2018: Figures 124:5 red and burnished in/out, 124:6 red and burnished in/out, four like 127:7, traces of red in/out two like 124:8 one uncoated, one red in; all very blackened with soot
	2 upright jar rims Nile B2	Wallace-Jones 2018: Figures 127:1 red out, 127:5 red out

	1 angular lid Nile B2	Wallace-Jones 2018: Figure 126:3
	2 pot stands Nile B2	Wallace-Jones 2018: Figures 124:4 red in/out, 125:5 red and burnished out
	1 body sherd of a small closed form Nile B2	With high quality red and burnished finish
	2 large open plates Nile C	Wallace-Jones 2018: Figures 128:7, 128:10
	1 large deep basin with rolled rim Nile C	Wallace-Jones 2018: Figure 129:1 traces of red in/out rope marks out
	2 large cooker rims Nile C	Wallace-Jones 2018: Figure 129:3 very heavily smoked/soot stained, red out diameter over 30 cm
	1 large cooker rim Nile D	Wallace-Jones 2018: Figure 147:1 heavily smoked stained
	4 shallow cups Marl AV3	Wallace-Jones 2018: Figures three like 130:14, 130:15 with incised decoration and repair hole
	2 small carinated cup rims Marl AV3 one fine enough to be almost Marl AV2	Wallace-Jones 2018: Figures 132:3, 132:4 (AV2)
	2 medium jar rims Marl AV3	Wallace-Jones 2018: Figures 134:5, 134:10
	1 large jar rim Marl AV3	Wallace-Jones 2018: Figure 136:4
	2 rolled rims from very large jars Marl AV3	Wallace-Jones 2018: Figure 136:3 thickest part of vessel wall is 5 cm
	1 body sherd with incised decoration Marl AV3	similar to Wallace-Jones 2018: Figure 132:7
	3 rims and 8 associated body sherds from several medium cookers Marl C	Wallace-Jones 2018: Figure 138:12 all heavily smoked
	4 jar rims Marl C	Wallace-Jones 2018: Figures 143:2, 143:3, 143:4, 143:5
	4 corrugated rims Marl C	Wallace-Jones 2018: Figures 144:14, 144:16 (upright) two like 144:3 (flared)
	2 bag jar body sherds Marl C	Coated in interior with beeswax ridged and scraped as if the wax was poured in as liquid and then scraped out when solid
	Nile B1	41 body sherds from at least five shallow hemispherical cups and from several cookers
	Nile B2	54 body sherds 28 from medium jars 8 from large jars, 6 from open plates 12 soot stained from several cookers
	Nile C	32 body sherds from large jars 4 from large cookers smoked stained
	Marl AV3	15 body from medium jars, 1 body sherd from a very large jar, 1 from a shallow cup with very hard, fine fabric
	Marl C	67 body sherds from large jars
	Breadmould	8 body sherds 3 slip lined
		This context contains a great many cookers all very sooty/heavily smoked. They range in size from a diameter of around 12cm to

		as much as 30+ cm, many are around 16 cm. Many also show signs of red coating and in some cases burnishing although some are uncoated, they are related stylistically in spite of the size difference This context has many parallels with material from Kahun
WG61 SU46	2 hemispherical cup rims one with flat ledge Nile B1 1 cooker with flat rim Nile B2 1 large carinated bowl rim Marl AV3 1 open form rim Marl AV3 3 medium jars Marl C 4 large jars Marl C 1 fine handle Marl C 2 blades Marl AV3 Nile B2 Marl AV3	Wallace-Jones 2018: Figures 118:8, 118:10 Wallace-Jones 2018: Figure 124:8 red and burnished in/out smoked similar to Wallace-Jones 2018: Figure 132:5 very fine, hard fabric, highly fired with incised decoration of way lines above the carination Wallace-Jones 2018: Figure 133:1 fine, hard fabric, elaborate decoration of hatched lozenges and clay buttons on rim Wallace-Jones 2018: Figures 139:9, 139:9, 142:5 Wallace-Jones 2018: Figures 139:12, 143:3, 143:4 143:6 Wallace-Jones 2018: Figure 145:7 hand pulled both with traces of incised wavy decoration, fine, hard fabric 17 body sherds from large jars 5 body sherds from large jars, 3 from at least two hemispherical cups, 2 from a bowl
WG61 SU49	1 cup base Nile B1 1 large plate Nile B2 1 ring base from a closed from Nile B2 1 water jar rim Marl AV3 1 medium jar Marl AV3 1 flat jar base Marl C 9 Breadmoulds Nile B1 Nile B2 Marl AV3 Marl C	similar to Wallace-Jones 2018: Figure 119:16 finger pinched red in/out Wallace-Jones 2018: Figure 121:10 red in/out similar to Wallace-Jones 2018: Figure 128:2 red in/out turned base is applied and wheel finished Wallace-Jones 2018: Figure 134:4 Wallace-Jones 2018: Figure 134:7 with raised decorative band below rim Handmade Wallace-Jones 2018: Figure 120:10 almost complete examples all unlined 6 body sherds from hemispherical cups 8 body sherds from large jars 3 body sherds from medium jars and 5 from open forms both cups and bowls 12 body sherds from large jars
WG63 SU1	1 rounded base from a hemispherical cup Nile B1 2 large plates Nile B2	Wallace-Jones 2018: Figure 119:6 but smaller both like Wallace-Jones 2018: Figure

		121:10
	1 bottle neck Nile D	similar to neck on Wallace-Jones 2018: Figure 127:3 red and burnish out
	1 medium jar rim Marl AV3	Wallace-Jones 2018: Figure 134:5
	1 open deep bowl Marl C	Wallace-Jones 2018: Figure 138:1 pinched out and scraped
	4 jars Marl C	Wallace-Jones 2018: Figures 139:11, 139:12 140:2, 143:4
	Nile B1	78 body sherds from hemispherical cups
	Nile B2	159 body sherds from large jars some red out
	Nile C	48 body sherds from large jars
	Nile D	2 body sherds from a large closed form
	Marl AV3	33 body sherds from large jars, 12 body sherds from medium jars,
	Marl C	204 body sherds from large jars
	Marl C compact	37 body sherds from several large jars hard, fine fabric
	Marl C2	7 body sherds from a large jar
	Breadmould	43 body sherds 15 slip coated
WG63 SU2	1 small jar Nile B1	Wallace-Jones 2018: Figures 33 and 120:4 red and burnished out and on inner lip fine fabric and high burnish
	4 plates Nile B2	Wallace-Jones 2018: Figures 121:2, 121:3, two like 121:10
	1 bottle neck Nile B2	Wallace-Jones 2018: Figure 127:3 red out
	1 small flared jar neck Nile B2	Wallace-Jones 2018: Figure 127:14,
	2 large jars Nile C	Wallace-Jones 2018: Figure 129:4 red out and 129:4 uncoated
	5 medium jars AV3	Wallace-Jones 2018: Figures, 135:7, two like 135:9, two like 135:16, both with very fine fabric
	1 medium jar base Marl AV3	Wallace-Jones 2018: Figure 137:4 very fine fabric, made as a small bowl with body coils added then cut to shape. Technology is inexpert, early XII dynasty? Not from vessels above
	1 incised body sherd pattern Marl AV3	Wallace-Jones 2018: Figure 85 from shoulder of a medium jar
	7 medium jars including 3 cookers Marl C	three like Wallace-Jones 2018: Figures 138:12, 139:9, 141:1, and two like 142:4
	8 large jars Marl C	two like Wallace-Jones 2018: Figures 141:1, 141:3, 143:2, three like 142:6 (2), 142:6 (4) with unusual fabric containing large pale inclusions
	Nile B1	7 body sherds from hemispherical cups
	Nile B2	28 body sherds from large jars
	Nile C	27 body sherds from large jars up to 24 mm thick
	Marl AV3	28 body sherds from small fine open forms, 15 from medium jars and 3 from large jars

	Marl C Marl C compact Breadmould	76 body sherds from large jars 28 body sherds from large jars 23 body sherds unlined The material in this whole area is worn with old breaks
WG 64 Cave 2 pit 2	Marl C Breadmould	1 body sherd from a large jar 1 body sherd unlined
WG65 SU1	1 large jar base Nile C 1 jar base Marl AV3 2 corrugated jar rims Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 129:4 deep rilling marks in wall >5cm thick at base Wallace-Jones 2018: Figure 137:4 with exterior scraping Wallace-Jones 2018: Figures 145:2 and 145:6 1 body sherd from a hemispherical cup 8 body sherds from open forms 17 from at least three large jars 6 body sherds from two very large jars 9 body sherds from a large jar 2 from a medium jar 8 body sherds 5 from at least 2 large jars 3 from a medium jar 24 body sherds unlined
WG65 SU2	2 fine, hemispherical cups Nile B1 1 hemispherical cup Nile B1/2 2 carinated cups Nile B1/2 3 small jar rims Nile B2 2 flared jar rims/necks Nile B2 1 flat jar base Nile B2 1 large plate Nile C 4 large, rounded jar bases Nile C 1 round bowl base Marl AV3 1 small flat jar base Marl AV3 1 medium jar base with ring foot Marl AV3 1 rounded base from a deep open form Marl AV3 2 large, flat jar bases Marl C 3 small plates Marl C 1 medium plate Marl C	both like Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 119:2 fine red slip and burnish in/out both like Wallace-Jones 2018: Figure 118:12 red in/out Wallace-Jones 2018: Figures 127:4, 127:8 red in/out, 127:10 red in/out Wallace-Jones 2018: Figures 127:14, 127:15 Wallace-Jones 2018: Figure 128:1 Wallace-Jones 2018: Figure 128:11 Wallace-Jones 2018: Figure 129:4 with smeared wheel marks lacking some technical control one intensely blackened as if re-used as a fire pit Wallace-Jones 2018: Figure 130:11 Wallace-Jones 2018: Figure 137:1, 137:2, 137:3 very misshapen Wallace-Jones 2018: Figure 137:6 ring shows evidence of turned technology Wallace-Jones 2018: Figure 106 rounded with hole pierce pre-firing Handmade no type one with intense interior burning/smoking as if re-used as a fire pit Wallace-Jones 2018: all like Figure 138:4 ration plate type like Wallace-Jones 2018: Figure 138:4 but larger

	1 medium jar Marl C 2 jars Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 139:7 Wallace-Jones 2018: Figures 143:1 143:4 39 body sherds from shallow cups some almost fine enough to be Nile A 107 body sherds from large jars and 1 from a large shallow open form with heavy interior burning 62 body sherds from large jars many with red out some with rope marks 12 body sherds from small plates 14 from small jars with thin walls (around 3mm) 6 from at least two large jars 23 from small ration type plates 157 body sherds from large jars. 35 from small or medium bag shaped jars often very smoked, 14 from thin walled open forms 2 have very large (5-10mm) flat, cream, stone inclusions 77 body sherds from many different vessels slip lined and unlined There are many parallels for the material from this area from that of Kahun
WG65 SU3	1 water jar rim Marl AV3 No body sherds	Wallace-Jones 2018: Figure 134:10
WG65 SU20	6 hemispherical cups Nile B1 1 carinated cup Nile B1 1 small bottle/jar rim Nile B1 3 deep open cookers Nile B1 3 plates Nile B2 2 deep bowls Nile B2 5 deep open cooker forms Nile B2 3 bottle necks/rims Nile B2 2 large jars Nile B2 2 large plates Nile C 1 small jar rim Marl AV2	five like Wallace-Jones 2018: Figure 118:1 one red and burnished in/out, one like Wallace-Jones 2018: 118:17 uncoated with red rim Too small to type red in/out Wallace-Jones 2018: Figure 120:4, 50 red and burnished out Wallace-Jones 2018: Figures 119: 9, red in/out 119:13, 119:14 red and burnished in/out all heavily smoked Wallace-Jones 2018: Figures 123:3, 123:10, 124:1 both like Wallace-Jones 2018: Figure 123:7 red in/out smoked, Wallace-Jones 2018: Figures 123:4, 123: 5,123:6 red in/out, 124:1, red out/inner lip, 124:7 red and burnished in/out all heavily smoked Wallace-Jones 2018: Figures 127:3, 127:15, red in/out, 127:16 red in/ out heavily smoked, both like Wallace-Jones 2018: Figure 127:5 but larger in size one with red out Wallace-Jones 2018: Figures 128:9, 128:11 Wallace-Jones 2018: Figure 137:9 fine fabric and finish, and small enough to be a personal item

	4 shallow cups Marl AV3	two like Wallace-Jones 2018: Figure 130:12, Wallace-Jones 2018: Figures 130:13, 130:14 very fine fabric and thin walls 1-2mm
	1 medium jar neck and shoulder Marl AV3	Wallace-Jones 2018: Figure 134:3
	1 medium flat jar base Marl C	Wallace-Jones 2018: Figure 138:19 trimmed on outer surface
	1 gaming counter Marl AV3	Circular recut from a body sherd
	Nile B1	23 body sherds from small cups 1 red and burnished in/out 18 body sherds from two different small jars one red/burnished out
	Nile B2	36 body sherds from large jars 26 from beer jars some red out
	Nile C	37 body sherds from very large jars some red out 29 body sherds from cooker forms many with red in/out some with burnish in/out all smoked
	Marl AV3	14 body sherds from three small jars, 33 from medium jars, 5 from a large jar 12 from several small cups
	Marl C	58 body sherds from several large jars
	Breadmould	5 body sherds unlined
WG65 SU27 WG61	5 hemispherical cups Nile B1	Wallace-Jones 2018: Figure 118:14, two like Wallace-Jones 2018: Figure 119:2 uncoated with red rim, different vessels, two like Wallace-Jones 2018: Figure 119:7 one red in one red in/out
	1 carinated cup Nile B2	similar to Wallace-Jones 2018: Figure 118:12 but larger in size and coarser fabric red in/out
	2 small plates Nile B1	both like Wallace-Jones 2018: Figure 121:1 one with red rim
	1 small jar rim Nile B1	Wallace-Jones 2018: Figure 120:2
	6 shallow plates Nile B2	three like Wallace-Jones 2018: Figure 120:2 red and burnished in/out, two like Wallace-Jones 2018: Figures 121:1 121:10
	1 large deep open form Nile B2	Wallace-Jones 2018: Figure 123:6 red in/out
	1 large plate rim Nile B2	Wallace-Jones 2018: Figure 121:10
	3 bottle rims Nile B2	two like Wallace-Jones 2018: Figure 127:3, one like Figure 127:14 red in/out
	2 jar rims Marl C	Wallace-Jones 2018: Figures 143:2, 139:11 with notches made pre-firing like Wallace-Jones 2018: Figures 140:1 and 140:6
	Nile B1	16 body sherds from hemispherical cups
	Nile B2	31 body sherds from medium and 41 from large jars some heavily smoked some with red out, 18 from large plates 2 with red rims
	Nile C	23 body sherds from large jars 14 red out

		some heavily smoked 25 from large open plates some heavily smoked
	Nile E	2 body sherds from a cooker heavily smoked
	Marl AV3	19 body sherds from several large and 2 medium jars
	Marl C	58 body sherds from large jars some heavily smoked one with coating of wax inside, 6 body sherds from small jars
	Breadmould	12 pieces 1 slip lined
		There is an unusually high number of small jars with fine finish here which may have been personal items
WG 65 SU40	1 medium plate Nile B2	Wallace-Jones 2018: Figure 121:1 red in
	1 small jar rim Nile B2	Wallace-Jones 2018: Figure 127:6 red out no evidence of burnish
	1 ring foot from a small jar Nile B2	Wallace-Jones 2018: Figure 128:3 turned and applied before trimming to shape, possibly from the same vessel as the rim above, red and burnished out
	1 bowl with thickened rim Marl AV3	Wallace-Jones 2018: Figure 131:8 fine, hard fabric
	Nile B1	12 body sherds from hemispherical cups
	Nile B2	62 body sherds from medium and large jars
	Nile C	21 body sherds from large jars, 1 from a large plate
	Marl AV3	5 body sherds from medium and large jars, 6 from small cups, 1 from a bowl
	Marl C	88 body sherds from medium and large jars
	Breadmould	9 body sherds 4 with slip lining
WG65 SU44	3 shallow hemispherical bowls	all like Wallace-Jones 2018: Figure 118:6 very fine with thin walls 1-2 mm
	Nile B1	6 body sherds from hemispherical cups
	Nile B1	31 body sherds from medium and large jars
	Nile B2	10 body sherds from large jars, 3 from two large plates
	Nile C	8 body sherds from medium and large jars,
	Marl AV3	3 from small cups
	Marl C	44 body sherds from medium and large jars
	Breadmould	12 body sherds 1 with slip lining
	Gritty foreign fabric probably Syro-Palestinian	1 sherd from a large closed form possibly an amphora
WG66 SU1	Nile B1	8 body sherds from hemispherical cups
	Nile B2	86 body sherds from medium and large jars
	Nile C	43 body sherds from large jars, 4 from large plates
	Marl AV3	7 body sherds from medium and large jars
	Marl C	103 body sherds from medium and large jars
	Breadmould	13 body sherds 2 with slip lining
		Many sherds showing signs of old breaks

		and heavy wear similar to re-used material in WG49
WG66 SU2	1 carinated cup Nile B1 1 medium jar fine sandy Nile B1 1 large plate Nile B2 2 flared rims Nile B2 1 shallow plate rim Marl AV3 1 flared jar rim MarlAV3 4 medium jars Marl AV3 1 corrugated rim Marl C 2 large flat jar bases Marl C 3 rounded bag shaped jar bases Marl C 11 large jars Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C Marl C1 Breadmould	Wallace-Jones 2018: Figure 118:12 Wallace-Jones 2018: Figure 120:8 Wallace-Jones 2018: Figure 122:1 Wallace-Jones 2018: Figure 127:14 one red and burnished out one uncoated Wallace-Jones 2018: Figure 130:2 Wallace-Jones 2018: Figure 134:1 Wallace-Jones 2018: Figures 134:10, 135:1, 136:16 one base Figure 137:4 scraped Wallace-Jones 2018: Figure 144:16 Handmade Handmade like Wallace-Jones 2018: Figure 138:12 but larger Wallace-Jones 2018: Figures 140:4, three like 143:2, four like, 143:3, 143:4, two like 143:5 17 body sherds from hemispherical cups 38 body sherds from medium jars 107 from large jars 54 body sherds from large jars, 9 from large plates 19 body sherds from medium and large jars 164 body sherds from large jars 17 body sherds from large jars 58 body sherds 6 with slip lining Many sherds showing signs of old breaks and heavy wear similar to re-used material in WG49
WG66 SU3	Large pot stand Nile B2 1 small, carinated bowl Marl AV3 1medium jar with straight neck Marl AV3 2 corrugated jar rims Marl C 1 Large round bag jar base Marl C Nile B2 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 125:2 Wallace-Jones 2018: Figure 123:4 Wallace-Jones 2018: Figure 134:4 Wallace-Jones 2018: Figure 144:12, 145:3 Handmade scraped 48 body sherds from large jars 2 from a bottle, red out 13 body sherds from large jars 2 from large flat plates 15 body sherds from medium jars and 7 from hemispherical cups 234 body sherds from large jars 2 from very large jars 1 body sherd unlined There is evidence of many old breaks and sherds are worn and either very large or

		small. There is a mix of pottery from different periods. This area may have been a dump; the larger sherds may have been used as a foundation layer for smaller ones forming a packed surface of some kind
WG 67 SU31 Inside Cave 8	5 hemispherical cup rims Nile B1 1 plate rim Nile B2 1 beer jar neck and rim Nile B2 1 large, scraped, handmade jar base Nile C 1 small jar rim Marl AV2 1 shallow cup Marl AV3 1 plate Marl AV3 2 bowls Marl AV3 1 medium jar rim Marl AV3 1 counter Nile B2 1 small, possibly miniature jar rim Marl C 1 large jar Marl C Juglet type vessel with wheel made ring foot fabric and stub handle, unidentified foreign Nile B1 Nile B2 Marl C Breadmould	Wallace-Jones 2018: Figures 118:1, 118:4, 118:6, 118:10, one rounded, scraped base Wallace-Jones 2018: Figure 124:4 Wallace-Jones 2018: Figure 127:14 red in/out Wallace-Jones 2018: Figure 129:4 4 cm at thickest part of vessel wall Wallace-Jones 2018: Figure 137:9 very fine fabric unusual form Wallace-Jones 2018: Figure 140:13 Wallace-Jones 2018: Figure 130:2 smoked outside Wallace-Jones 2018: Figures 131:3, 131:4 Wallace-Jones 2018: Figure135:5 fine, hard fabric Circular, recut red out Wallace-Jones 2018: Figures 32, 139:8 Wallace-Jones 2018: Figure 139:12 Wallace-Jones 2018: Figures 14,15,16, almost complete but broken into many pieces black with dark red section and traces of burnishing 3 body sherds from small jars uncoated, 24 sherds from several hemispherical cups 1 red /burnished in, 1 body sherd from a carinated cup, red out 12 body sherds from large jars 3 from the same large jar with typical turned/scraped technology 16 body sherds from three large jars 5 body sherds all unlined
WG69 SU1	Nile B1 Marl C Breadmould Foreign	25 body sherds from several hemispherical cups 1 body sherd from a large jar 34 body sherds all unlined Handle and 5 body sherds from a Syro-Palestinian amphora
WG69 SU2	1 hemispherical cup rim Nile B1 1 large jar rim Nile B2 1 shallow cup rim Marl AV3 1 medium jar rim Marl AV3 1 large jar rim Marl C Nile B1	Wallace-Jones 2018: Figure 118:1 Wallace-Jones 2018: Figure 127:13 Wallace-Jones 2018: Figure 131:2 Wallace-Jones 2018: Figure 135:16 Wallace-Jones 2018: Figure 142:6 (4) with four vertical post firing lines on rim 23 body sherds from hemispherical cups

	Nile B2	67 body sherds from large jars 6 from plates
	Marl AV3	19 body sherds from medium and 43 body sherds from large jars
	Marl C	87 body sherds from large jars
	Breadmould	32 body sherds all unlined
WG69 SU3	1 base from a small vessel Nile B1	Wallace-Jones 2018: Figure 119:16 finger pinched red in/out
	1 flared rim of a closed form Nile B1	Wallace-Jones 2018: Figure 120:8 sandy fabric
	1 large open form Nile B2	Wallace-Jones 2018: Figure 121:2 with rope marks externally on rim
	1 large lid? with external modelling B2	Wallace-Jones 2018: Figure 126:4
	1 complete beer jar rim and neck Nile B2	Wallace-Jones 2018: Figure 127:4 red out rim slightly misshapen during manufacture
	3 beer jar rims Nile B2	Wallace-Jones 2018: Figures 127:12, 127:14, 127:15 all red in/out
	1 large pot stand Nile B2	Wallace-Jones 2018: Figure 125:2
	1 large plate Nile C	Wallace-Jones 2018: Figure 129:9
	2 hemispherical cup rims Marl AV3	Wallace-Jones 2018: Figures 130:14, 130:17
	2 bowl rims Marl AV3	Wallace-Jones 2018: Figures 131:3, 131:4
	1 large jar Marl AV3	Wallace-Jones 2018: Figure 136:2 but larger
	2 water jar rims Marl AV3	Wallace-Jones 2018: Figures 134:5, 138:1
	1 small open form with central well and wide flat rim possible a lid Marl AV2/3	Wallace-Jones 2018: Figure 138:12 Wallace-Jones 2018: Figure 103 fine hard fabric
	1 small, fine bowl Marl C	Wallace-Jones 2018: Figure 145:4
	1 cooker rim Marl C	Wallace-Jones 2018: Figure 138:12
	1 corrugated rim Marl C	Wallace-Jones 2018: Figure 145:6
	4 medium jar rims Marl C	Wallace-Jones 2018: Figures 138:8, 138:16, 139:6, 139:7
	15 jar rims from large jars Marl C	two like Wallace-Jones 2018: Figure 139:12, one with four pre-firing notches, two like Wallace-Jones 2018: Figure 140:1, two like Wallace-Jones 2018: Figure 140:2, two like Wallace-Jones 2018: Figure 140:5 141:1, two like Wallace-Jones 2018: Figure 141:3, 143:4, 142:4, two like Wallace-Jones 2018: Figure 142:5
	3 large, flat bases Marl C	Handmade, diameter 30-40cm
	Nile B1	283 body sherds from hemispherical cups including one scraped, rounded base some with red in/out some with red/burnish out, some with red and burnishing in/out. This is an unusually high proportion of B1 sherds
	Nile B2	23 body sherds from bottles 44 from

		medium jars 59 from large jars two with red and burnish on outer surface
	Nile C	19 body sherds from large plates, 51 from large jars, 8 from very large jars some with red out
	Marl AV3	82 body sherds from medium and 27 from large jars one with rope marks, 17 from open forms small cups and large bowls
	Marl C	77 body sherds from medium and 344 body sherds from large jars
	Marl C1	35 body sherds from large jars
	Breadmould	183 body sherds 24 with slip lining also 4 complete examples one with a hole in the base
	Unidentified fabric, soft and low fired, parts of a large platter possibly made locally	similar to Wallace-Jones 2018: Figure 126:6
	Foreign Syro-Palestinian	3 Syro-Palestinian amphora sherds from the same vessel as WG69 SU1 2 body sherds of another Syro-Palestinian amphora similar to the one in SU1 above but from a different vessel. Some traces of red slip and possible burnishing, also combed horizontal bands on the surface, the fabric is a little sandier containing rounded sand grains and fewer grey particles
	Foreign, unidentified, flat base, possibly Minoan	Fabric is very fine and hard with a smooth texture and few inclusions wheel made and cut off the wheel with string, traces of burnish in/out over a pinkish surface. Many sherds in this context have old breaks c.f. WG49
WG69 SU4	1 hemispherical cup rim Nile B1 fine fabric almost Nile A	Wallace-Jones 2018: Figure 118:6
	1 lid with internal ledge Nile B1	Wallace-Jones 2018: Figure 119:5 red in/out
	1 shallow cup rim Marl AV3	Wallace-Jones 2018: Figure 130:11 hard, fine fabric and thin walls no more than 2 mm at thickest point
	1 jar rim Marl AV3	Wallace-Jones 2018: Figure 135:7
	3 jar rims Marl C	Wallace-Jones 2018: Figures 140:1, 140:5 with thick, white firing surface, 146:2 (4)
	4 jar rims Marl C1	Wallace-Jones 2018: Figures 143:2, 143:3, two like 143:4
	1 bell shaped bread mould may be Old Kingdom	Extrememy abraded
	Nile B1	45 body sherds from hemispherical cups including one shallow, scraped rounded base
	Nile B2	113 body sherds from medium and large

		jars 41 from bottles 6 from large plates
	Nile C	26 body sherds from large and very large jars, 4 from large plates
	Marl C	87 body sherds from large jars many with thick, white firing surface
	Breadmould	28 body sherds 2 slip lined
WG69 SU5	1 small open form with rolled interior lip and small hole pierced in the centre possibly a lid Marl AV3	Wallace-Jones 2018: Figure 101 similar to 133:3 but larger
WG70 Cleaning	Nile B1	4 body sherds from hemispherical cups
	Nile B2	1 body sherd from a small jar
	Nile C	2 body sherds from large jars
	Marl C	29 body sherds from large jars
	Breadmould	1 body sherd slip lined
	1 hemispherical bowl rim Nile B1	Wallace-Jones 2018: Figure 118:1
	1 large jar base Nile C	Wallace-Jones 2018: Figure 129:4
	1 jar rim Marl AV3	Wallace-Jones 2018: Figure 135:5
	2 jar rims Marl C	Wallace-Jones 2018: Figures 141:6, 142:3
	1 large, flat jar base Marl C	Handmade
WG70-72-73 SU2	5 hemispherical bowl rims Nile B1	Wallace-Jones 2018: Figures, 118:3, 118:6, 118:8, two like Figure 118:2
	1 large jar base Nile C	Wallace-Jones 2018: Figure 129:4
	1 small jar possibly in the form of a pomegranate Marl AV3	Wallace-Jones 2018: Figure 137:11 very fine walled may have been made as two bowls joined vertically surface is badly abraded illegible ink hieroglyphs on the upper shoulder
	Nile B1	6 body sherds from hemispherical cups
	Nile C	14 body sherds from large jars some red out some smoked
	Marl AV3	22 body sherds from medium and large jars some smoked
	Marl C	35 body sherds from large jars some smoked some with white firing surface
	Breadmould	6 body sherds unlined
WG70 SU1	1 hemispherical cup rim Nile B1	Wallace-Jones 2018: Figure 118:3
	1 medium plate rim Nile B2	Wallace-Jones 2018: Figure 128:8
	3 plate rims Nile C	Wallace-Jones 2018: Figures 128:6, 128:9, 128:10
	1 bowl rim Marl AV3	Wallace-Jones 2018: Figure 131:3
	1 bowl rim Marl C	Wallace-Jones 2018: Figure 138:2
	4 small/medium corrugated jar/bottle rims Marl C	Wallace-Jones 2018: Figures 144:1, 144:5, 144:13, 145:3
	12 jar rims Marl C	Wallace-Jones 2018: Figures 138:6, 139:7, 139:12, 140:2, two like Figure 140:5, two like Figures 141:2 (1) 142:5, 143:7, 144:8, one too small to type
	1 counter Marl C	Circular recut

	Nile B1	1 body sherd from a hemispherical cup red in/out, 1 body sherd from a bowl body sherds
	Nile B2	3 body sherds from a large plate 10 from large jars
	Nile C	7 body sherds from large plates 14 body sherds from large jars medium and large jars
	Nile E	2 body sherds smoked
	Marl AV3	122 body sherds from medium jars, 2 from bowls
	Marl C	290 body sherds from large, medium and small jars one with reed shelter h, some with white firing surface
	Marl C compact	14 body sherds from small and medium jars some with white firing surface
	Breadmould	17 body sherds unlined
WG70 SU3	2 hemispherical cup rims Nile B1	Wallace-Jones 2018: Figures 118:1, 118:6
	3 plate rims Nile B2	two like Wallace-Jones 2018: Figures 121:1, 121:4
	1 small bottle rim	Wallace-Jones 2018: Figure 127:6 red in/out
	2 medium bottle rims Nile B2	Wallace-Jones 2018: Figures 128: 6 red out 128:10 red out
	1 pot stand Nile B2	Wallace-Jones 2018: Figure 125:1
	2 large plate rims Nile C	Wallace-Jones 2018: Figures 127:4, one too damaged to type
	3 large bowl rims Nile C	two like Wallace-Jones 2018: Figures 128:4, 129:1
	2 large jar bases Nile C	both like Wallace-Jones 2018: Figure 129:4
	3 bowl rims Marl AV3	Wallace-Jones 2018: Figures 130:1, 130:14, 132:1,
	1 bowl base Marl AV3	Wallace-Jones 2018: Figure 130:7
	3 medium water jar rims Marl AV3	Wallace-Jones 2018: Figures 135:2, 135:8, 135:16
	1 small plate Marl C	Wallace-Jones 2018: Figure 138:4 similar to ration plate type
	17 jar rims Marl C	Wallace-Jones 2018: Figures 139:12, three like Figure 140:2, three like Figures 140:4, 140:5, 142:4, 144:16, two like Figure 145:2 two like Figure 146:4 (no pot-mark), two too damaged to type
	1 flat jar base Marl C	Handmade
	Nile B1	15 body sherds from hemispherical cups, 2 from a small jar 1 from a small plate
	Nile B2	17 body sherds from large jars, 7 from bottle some red in/out 7 from medium plates
	Nile C	86 body sherds from large jars, one with

		rope marks, 12 from at least 9 plates
	Nile E	4 body sherds
	Marl AV3	49 body sherds from several medium jars 31 from several large jars, six heavily burned, one with rope marks, 12 from at least three medium bottles, 19 from small open forms
	Marl C	445 body sherds from many large jars some with white firing surface some blackened one inscribed k3 nb mh, 2 from small jars
	Breadmould	52 body sherds all unlined
WG71 SU5	2 hemispherical cup rims Nile B1	both like Wallace-Jones 2018: Figure 118:1
	1 small bowl rim Nile B2	Wallace-Jones 2018: Figure 124:2
	Nile B1	11 body sherds from hemispherical cups
	Nile B2	11 body sherds from open forms,
	Nile C	5 body sherds from large jars
	Marl AV3	2 body sherds from bowls, 1 from a large jar,
	Marl C	1 body sherd from an open form, 11 from large jars
	Breadmould	1 body sherd unlined
WG71 SU6	1 ring foot base Nile B1	Wallace-Jones 2018: Figure 123:1 red in/out finger pinched
	1 hemispherical cup base Nile B1	Rounded scraped to shape
	2 bowl bases Nile B2	both like Wallace-Jones 2018: Figure 121:9
	Nile B1	3 body sherds from hemispherical cups
	Nile B2	11 body sherds from open forms
	Nile C	4 body sherds from the same large plate
	Marl AV3	4 body sherds from medium jars
	Marl C	6 body sherds from at least two large jars
WG72 SU2	1 jar bottle Nile B2	Wallace-Jones 2018: Figure 127:15
	2 large plate rims Nile C	Wallace-Jones 2018: Figures 121:1, 121:10
	2 large jar bases Nile C	Wallace-Jones 2018: Figure 129:4
	1 bowl rim Marl AV3	Wallace-Jones 2018: Figure 130:14
	5 corrugated jar rims Marl C	Wallace-Jones 2018: Figures 144:4, 144:8, 144:15, 144:16, 144:17
	2 jar rims Marl C	Wallace-Jones 2018: Figures 141:2, (1) 141:2, (7)
	2 flat jar bases Marl C	Handmade
	Nile B2	14 body sherds from medium and large jars
	Nile C	11 body sherds from large plates and large jars
	Nile E	3 body sherds smoked
	Marl AV3	22 body sherds from several bowls one with incised "s" decoration some very fine
	Marl C	120 body sherds from medium and large jars
	Breadmould	14 body sherds unlined

WG72 SU3	1 large flat jar base Marl AV3 Marl AV3	Handmade 2 body sherds from one large jar
WG 73 SU1	1 medium jar rim 2 bottle rims Nile B2 1 large plate rim Nile C 1 corrugated jar rim Marl C 1 small jar rim Marl C 5 large jar rims Marl C Nile B1 Nile B2 Nile C Marl AV3 Marl C Breadmould	Wallace-Jones 2018: Figure 127:5 Wallace-Jones 2018: Figures 127:3, 127:17 Wallace-Jones 2018: Figure 128:6 Wallace-Jones 2018: Figure 144:12 Wallace-Jones 2018: Figure 139:6 Wallace-Jones 2018: Figures 146:1, 146:4, 146:6, 146:9, 146:10 no pot-marks 2 body sherds from the same hemispherical cup 2 body sherds from closed forms 3 body sherds from large jars and 3 from 2 large plates 3 body sherds from medium jars 3 from open forms 142 body sherds, one with hieroglyph of a boat, some smoked, some with white firing surface from medium and large jars 9 body sherds unlined
WG73 SU2	1 medium jar rim Marl AV3 1 large plate rim Nile C 1 unidentified vessels possibly foreign Marl AV3 Marl C	Too small to type Wallace-Jones 2018: Figure 128:6 Wallace-Jones 2018: Figure 147:7 fine, hard fabric with smooth buff surface painted in red with vertical lines 2 body sherds from a medium jar 3 body sherds from two large jars
WG74 SU1	1 hemispherical cup almost complete Nile B1 1 ring foot possibly from a carinated cup Nile B1/2 2 large jar bases Nile C 2 plate rims Nile C 3 jar rims Marl C 1 scraper Marl AV3 Nile B1 Nile C Mar AV3 Marl C	Wallace-Jones 2018: Figures 39, 41a, 41b ineffectually repaired before firing in antiquity Wallace-Jones 2018: Figure 128:2 finger pinched but finished by turning both like Wallace-Jones 2018: Figure 129:4 Wallace-Jones 2018: Figures 128:5, 128:8 Wallace-Jones 2018: Figure 146:7, two like Figure 146:9 no pot-marks Fan shaped 2 body sherds from 2 hemispherical cups 45 body sherds from large jars 7 body sherds from large jars 48 body sherds from large jars
WG74 SU3 under mud bricks	Marl AV3 Marl C	1 body sherd from a medium jar 7 body sherds from large jars
WG75 SU1	2 hemispherical bowl rims 1 bowl rim Marl AV3 2 jar rims Marl C Nile B1 Nile B2	Wallace-Jones 2018: Figure 118:1, 118:4 Wallace-Jones 2018: Figure 131:2 Wallace-Jones 2018: Figures 140:5, 146:10 no pot-mark 3 body sherds from hemispherical cups 3 body sherds from a medium plate, 2 from medium jars

	Nile C	18 body sherds
	Nile E	3 body sherds smoked
	Marl AV3	17 body sherds from at least two closed forms one with incised decoration like figure 132:8, 5 body sherds from bowls
	Marl C	96 body sherds from medium and large jars some with white firing surface
	Breadmould	1 body sherd unlined
WG76 SU1	6 large jar rims Marl C	Wallace-Jones 2018: Figures 146:4, 146:9, 146:12, 146:15 no pot-marks, two too damaged to type
	Nile B1	2 body sherds from a hemispherical cup
	Nile B2	2 body sherds from closed forms
	Marl AV3	1 body sherd from a medium jar
	Marl C	140 body sherds from several medium and large jars
WG76 SU2	2 jar rims Marl C	Wallace-Jones 2018: Figures 143:4, one too damaged to type
	Nile C	2 body sherds from large jars
	Marl C	28 body sherds from large jars
	Breadmould	2 body sherds unlined

Appendix 2
Bread molds at Mersa/Wadi Gawasis

S. Terry Childs

The goal of this report is to provide a comprehensive understanding of the production and use of ceramic bread molds excavated at Mersa/Wadi Gawasis. The bread molds found over the entire site primarily conform to Type C, #9, of the bread mold typology devised by Jacquet-Gordon and dated to the Middle Kingdom (Jacquet-Gordon 1981: Figure 4). This type is a fairly long, tapered shape with walls that flare slightly at both the wide and narrow ends and have an air hole at the narrow end, which are standard characteristics of the molds found at the harbor site. Additionally, a small number of bread mold fragments were found without a small air hole at the narrow end, which fits Jacquet-Gordon's Type C, #11 (Jacquet-Gordon 1981: Figure 4).

The discussion below is based on fieldwork conducted during the four field seasons between 2003-2004 and 2006-2007. The vast majority of the bread mold fragments found and analyzed were excavated in the WG19/25/26/27/44 excavation units of the site (the "production area"), which was at the base of a sandy slope that ended near the harbor's edge. Additionally, some bread mold fragments from other areas of the site were counted and analyzed when they were brought to my attention.

There are several environmental factors that need to be acknowledged here since they compromise some of the analysis below. One factor is the erosion and collapse of the fossil coral rock above the excavation area that caused large rocks, sand, and archaeological remains to be carried down and spread across the area. This surficial spread of materials was exacerbated by steady winds down the slope of the excavation area, so the bread molds in the upper levels of the excavations were not likely always *in situ*. More importantly, there were significant layers and nodules of salt that both covered large portions of the artifacts and also compacted archaeological remains at different levels in the stratigraphy. The salt percolated up from the salty ground water in the harbor sand over several thousand years and became concentrated particularly where artifacts lay. The density and extent of the salt made it difficult to examine standardized characteristics of numerous bread molds.

Context

The excavations at WG 19/25/26/27/44 were located at the base of the western terrace slope of Wadi Gawasis. This area has been identified as an extensive production area where some basic subsistence activities were carried out during the estimated 12-20 seafaring expeditions from the *Saww* harbor at the site (Bard and Fattovich 2018: 177). A series of fire-pits of various types and shapes and dumps in relation to a number of living surfaces were found (Perlingieri and Childs 2006). There was evidence of food production, probably bread and beer; minor tool repair or manufacture; production of ceramic bread molds and terra cotta platters; gypsum plaster production; and other activities that supported temporary camp life. There was no evidence of the manufacture or repair of prestige items in this area.

The excavations at WG 19/25/26/27/44 yielded abundant evidence to support the interpretation of five phases of occupation and work in the area (Bard and Fattovich 2007: 73-76; Perlingieri and Childs 2006). Phase 5, the most recent period of occupation, was characterized by scattered small fire-pits with a few pottery sherds. Medium-sized fire-pits and occasional dumps occurred in Phase 4. Phase 3 and Phase 2 were distinguished by the presence of medium-sized circular fire-pits associated with living floors and well delineated zoned activity areas with dumps of bread molds and other pottery sherds. Phase 1 was also characterized by well-defined zones of activity based on a number of fire-pits and dumps, many of which contained fragments of bread molds. The pottery evidence from the area of excavation indicated occupation during the second half of the Middle Kingdom, and early Middle Kingdom in Phase 1 (Bard and Fattovich 2007: 76; see also 4.1.a Egyptian ceramics, 2006-2007).

Bread mold analyses

I examined and counted almost 8,500 fragments of bread molds according to their provenience during the four field seasons I worked at Mersa/Wadi Gawasis, mostly excavated from WG 19/25/26/27/44 (see Appendix 2, Table 1). Given the long conical shape of the bread molds, I sorted all the sherds into three groups: the narrow tip end; the rim of the wide end where the bread could be removed; and body sherds from between the two ends. Additionally, well over 500 fragments were large or intact enough to conduct detailed analysis of standard characteristics pertaining to their manufacture and use. These were the length of the fragment, the exterior and interior diameters of the two ends, the presence and color of a thin slip that coated the interior of many bread molds, wall thickness, and paste density. I also recorded notes on other noteworthy features. These characteristics will be discussed in detail below as they pertain to the manufacture and use of bread molds found at the harbor site.

The evidence from the thousands of fragments revealed the following three sizes of bread molds at the site:

- The predominant size was approximately 27-30 cm long, although no complete mold was found. The wide end had an external diameter of 7.0-7.5 cm. and an internal diameter of 5.0-5.5 cm. Its narrower end had an average external diameter of 4.5-5.0 cm and an internal diameter of 0.8-1.2 cm. that made a small air hole. The wall thickness at the wide end varied on average between 1.2-1.7 cm, while the wall thickness at the narrow end varied on average between 1.4-2.2 cm.
- A few fragments of smaller sized bread molds were excavated primarily in WG 19 and had an external diameter of 3.5-3.8 cm, and an internal diameter or air hole of 0.2-0.6 cm at the narrow end. The length of this type and the diameter at the wide end is not known due to the paucity of fragments.
- A small number of larger sized bread molds were found in WG 24 and WG 26. These had external diameters of approximately 6.0-6.5 cm at the narrow end and an average internal diameter at the air hole of 1.2-1.8 cm. The wide end had an average external diameter of 8.0-8.5 cm and an internal diameter of 6.0-6.5 cm. The length of this type was at least 27-30 cm.

I was also interested in examining the large number of bread mold fragments in light of both the activity areas in which they were found and the temporal phases identified at WG 19/25/26/27/44. Therefore, I counted the fragments in each stratigraphic unit (SU) or feature associated with each temporal phase based on some revisions to the first verion of the stratigraphic matrix of the excavation unit (see Bard and Fattovich 2007: Figure 32).

Appendix 2, Figure 1 shows that bread molds were present in all five phases of occupation. Notably, however, there were no fragments found in many of the SUs associated with particular phases, most often in fire-pits and on some living surfaces, so these SUs are not shown in Figure 1 due to lack of space. As well, some of the SUs could not be associated with a Phase but contained bread mold fragments. The counts from all the SUs that I analysed are provided at the end of this report in the attached Table.

The primary findings from analysis of Figure 1 are:

Phase 5: Many bread mold fragments occurred throughout the SUs associated with this phase, but were not directly associated with the six fire-pits found. Some of the fragments could have been brought down the terrace slope from occupation areas located higher on the terrace due to erosion.

Phase 4: It is associated with the fewest bread mold fragments; only in one fire-pit and a living surface beneath it.

Phase 3: Three out of five identified dumps contained bread mold fragments, while a few fragments were found in only two of twelve fire-pits.

Phase 2: The majority of mold fragments were found on living surfaces (SU30 and SU13) or in the two dumps excavated. Only one of the eleven fire-pits contained a few fragments.

Phase 1: All seven excavated dumps contained bread mold fragments while fragments were found in only two of eight fire-pits. SU28 was a large dump with a very high density of fragments that was bounded by charcoal and loose reddish-brown sand.

Of the 8,441 bread mold fragments excavated, counted, and examined, there were 782 narrow tip ends, mostly intact, and 914 rim sherds at the wide end (see the attached Table). It is not surprising that there would be more rim sherds at the wide end than at the narrow end. This is because the wide end of the bread mold was larger in area and more susceptible to breakage, had a thinner wall than the narrow end, and may have been purposely broken to extract the baked bread (Jacquet-Gordon 1981; Perlingieri and Childs 2006).

The 781 narrow tip ends are of particular interest because they provide an opportunity to estimate the number of whole bread molds used in the production area during each phase. In fact, this number means that at least 781 bread molds were used at Wadi Gawasis during the 12-20 expeditions carried out there over 180 years during the Middle Kingdom (Bard and Fattovich 2018: 177). If the bread molds were only used once, that is a small amount of bread to feed the assembly of workers at the site.

Appendix 2, Table 2 provides a breakdown of the number of the narrow ends relative to the total number of fragments found by Phase. The data reveal some variation in the number and percentage of the narrow ends by phase, particularly the higher percentage in Phase 1. The amount of variation is not great, however. It must be acknowledged that some of the narrow tips could not be assigned a Phase; however, the number and percentage of "Other" are also provided in Table 2 and correlate to the data provided in Appendix 2, Table 1 at the end of this report. Although "Other" includes a somewhat higher percentage of narrow ends than by temporal Phase, many are from higher SUs (i.e., SU3) that probably should be in Phase 5, were carried down the terrace slope over several millennia from locations above WG 19/25/26/27/44, or were excavated at other excavation units.

Phase	**# narow ends**	**Total # of fragments**	**%**
5	99	1,226	8.1%
4	26	438	5.9%
3	71	885	8.0%
2	143	2,626	5.4%
1	235	1,685	13.9%
Other	206	1,569	15.2%
Totals	**780**	**8,429**	**9.2%**

Table 2. *Number and percentage of bread mold fragments at the narrow end by temporal phase.*

Bread mold production

Detailed analysis of approximately 500 large fragments of bread molds provides good evidence of their manufacture. The bread molds were made using a coarse clay that was tempered with vegetal materials. This temper burned out when the molds were fired, which increased the porosity of the clay and reduced the risk of breakage during bread baking. Impressions of chaff-like organics are visible on the surface and in cross-sections of many of the bread mold fragments. The bread mold was formed by hand, most likely around a tapered dowel to create its conical shape. In fact, the pores created by the chaff-like temper showed a clear circular orientation in cross-section, which strongly suggests that the clay was formed around a dowel.

Other pieces of evidence that the bread molds were produced by hand are:

- Both exterior ends were slightly flared, in some cases with suggestions of finger indentations to push the clay outwards. The slight flaring at the edges of the narrow end perhaps created more surface area to stand the mold base as is seen in the register showing bread making in the Theban tomb of Antefoker (Davies 1920: Pl. X).
- The rims at the wide end of the bread mold varied significantly in shape: squared, rounded, or slanted inward. No standardization was evident for this feature.
- The interior shaft was very often off center so that the mold walls varied in thickness.

Once the long, tapered shape was formed, it was dried sufficiently to shrink the clay and pull out the dowel, but possibly not to a leather hard state. The narrow end was solid with no air hole.

The next production stage is of particular interest because many of the bread molds, no matter the average size, had a carefully made slip of very fine-grained clay on its interior. The addition of a slip required another stage in the manufacture of the bread molds and strongly suggests specialized production by skilled craftspeople. In fact, bread molds are the only ceramic form made in the Middle Kingdom that had an internal slip lining.

The slip was made by one of two ways: 1) levigating a relatively coarse clay in water so that the coarser clay grains settled to the bottom, or 2) suspending a very fine-grained clay, different from the clay used for the main body of the mold, in water. The fluid suspension of clay was then poured into the partially dried mold up to the top of the wide end and carefully and quickly rotated to maximize an even distribution of the slip as it was quickly absorbed into and adhered to the pipe wall (Rice 1987:150). The slip was always a different color than the clay body of the mold, usually a light tan although I also observed many shades of tan, red, and grey. Once an approximately one-millimeter slip coat was created, the remainder of the clay suspension was poured out of the mold.

A small air hole was then poked through at the narrow end from inside the pipe. This action created a small bulge around the exterior of the air hole on most of the narrow ends analyzed, which indicates that the clay was not completely dry at this production stage. It is likely that the small hole at the narrow end of the bread mold performed several functions. One was to avert a pressure build-up that would prevent all the bread dough from filling up the mold, as well as to minimize any pressure when the mold was fired, which then reduced the risk of breakage. The hole would have also averted pressure from the steam and expanding bread in the mold when the bread was baked.

The likely function of the slip was as a non-stick surface to prevent the bread dough from adhering to the mold wall and to make it easier to slide out after baking. Since the baked bread was shaped as tapered sticks, it could have badly stuck to the porous outer clay without the slip. Possible evidence that the bread may have still been hard to remove from the mold with the slip is that most of the wide ends of the bread molds were broken and none were found intact at the site. Only about 11% of all the fragments analyzed were from the wide end.

The final production stage was that the bread molds were fired to a low temperature after the slip liner and clay body were completely but carefully dried. Nicholson's experiments with forming similar conical molds used at Amarna and then firing them in a small oven resulted in firing temperatures in the 350-500° C range (Nicholson 1989). It should be noted that the clays used to make the slip and the mold wall had a similar coefficient of expansion since the slip rarely flaked off the mold wall from differential shrinkage during firing, which meant that clay selection was important. It is also possible that the clay used to make the coarse body of the mold was levigated down to a much finer grained clay for the slip layer as Nicholson did in his experiments. A good reason to fire the molds was to minimize the chance they broke during transport to a bread-making location and then handled.

Where Were the Bread Molds Produced?

Given the number of steps and level of craftsmanship involved in bread mold manufacture, a key question is where were the molds excavated at Mersa/Wadi Gawasis made – in the Nile Valley and transported across the Eastern Desert to the harbor site or at the site itself? Perlingieri and Childs

(2006) recognized that some bread molds probably were made in the Nile Valley given their characteristics common to Jacquet-Gordon's Type C, #9 (1981), but also proposed that some bread molds were made at the site. Wallace-Jones (2018: 26-27; see also 4.1.h Bread molds and platters) agreed to some extent, but hypothesized that the majority of bread molds were manufactured in the Nile Valley and transported to the harbor with many other supplies, including a wide variety of ceramic vessels and foods.

Upon reexamination of the bread mold data, I hypothesize that the majority of the bread molds found at the harbor were made in the Nile Valley, while some were made locally. There is strong evidence for both production locations.

The evidence for production in the Nile Valley is:

- The level of craftsmanship required to make the bread molds. In particular, the expertise needed to find the clay necessary to make the slip and create the uniform slip layer in the molds was likely outside the capabilities of the seafaring expedition members at Mersa/Wadi Gawasis.

- The color of the slip layer varied quite extensively, which could suggest that the bread molds were made at a number of different locations in the Nile Valley. The slip color of many mold fragments analyzed in detail was a light tan, but a large number of fragments varied in shades of tan/brown, red, and grey. This hypothesis should be tested using chemical and petrographic analyses of the various slips found. It also would be helpful to correlate the slip colors with the temporal Phase with which they are associated to see if there are any significant groupings over time.

- The amount of water needed to make the slip (Wallace-Jones 2018: 15-16). Fresh water was available at a well at Bir Umm Al-Huwaytat, approximately 7 km from the site (Bard and Fattovich 2018: 30). This distance suggests it is unlikely that the water needed to make the slip-lined bread molds was transported to the site on any regular basis.

- The similarity of the body clay used to form the bread molds with those found at other Middle Kingdom sites (Wallace-Jones 2018: 26).

Appendix 2, Figure 2 shows the number of fragments from the narrow end of the bread molds by temporal Phase that I counted and analyzed over 4 field seasons. We know that many more fragments were found at Mersa/Wadi Gawasis over the 10 field seasons of the project (see Bard and Fattovich 2007: 112, 114, 117-125; Appendix 1), but the greatest density by far was found in WG 19/25/26/27/44. If we consider the number of bread molds used in Phases 2 and 1 (more than 380) and the number of expeditions that might have occurred during those time periods (3-5 of the 12-20 hypothesized by Bard and Fattovich (2018: 177), there may have been 100-150 bread molds brought to the site per expedition. That is not an unreasonable number to bring across the Eastern Desert from the Nile Valley.

The evidence for some bread mold production at Mersa/Wadi Gawasis is:

- The abundance of fire-pits discovered in WG 19/25/26/27/44 and dated to Phases 3-1, which could have been open fires covered with local wood and bush as fuel to fire the hand-made bread molds (Perlingieri and Childs 2006). Gerish identified local mangrove wood in several fire-pits excavated in WG19, 26, and 27, along with discarded wood from ship parts (Bard and Fattovich 2007:177). The dumps where numerous bread mold fragments were recovered were located nearby. Some of the fire-pits were deep and lined with large ceramic sherds (SU50, SU58, and SU66 in WG 19), which would have facilitated effective firing of ceramic vessels by improving air circulation (Rye 1981: 98).
- The presence of ceramic wasters, and small lumps of clay in WG 25 and WG 26. The latter could have been used to make the molds or other types of ceramics. Additionally, we conducted an informal survey of the wadi to find possible clay sources during several field seasons and were successful in finding small veins of clay nearby.
- The presence of abundant chaff-like organics that could have been used to temper the clay. Large quantities of chaff were found near SU71 in WG 26, a dump, and SU30, a living floor, across SUs 19, 25, and 26 where many bread mold fragments were also found.
- Several unfired or minimally fired pieces of bread mold were recovered. These were very friable, which underscores the importance of firing the molds in order to transport or handle them during bread baking. The vegetal temper was still intact in several fragments.
- Over ten fragments were found without a small air hole at the narrow end, which fits Jacquet-Gordon's Type C, #11, from the Middle

Kingdom (Jacquet-Gordon 1981: Figure 4). However, I believe it indicates that all the steps in bread mold manufacture were not completed before firing, which suggests a lack of expertise by the bread mold maker. Interestingly, several very crudely made bread molds had a bulge at the narrow end of the molds where an uncompleted air hole had begun to be pushed through, but was not completed.

- A wood dowel-like object was found at the edge of SU77 in WG 26, a fire-pit, which was burned and was not intact. It was approximately 16 cm. long and 4-5 cm. in diameter at the wide end. These dimensions, except that the full length of a bread mold was not present in the remains found, are similar to those of the majority of bread molds. Gerish identified the wood as cedar while in the field, clearly from a ship part. However, it is possible that this piece of wood was reworking and used to make bread molds at the site.

- Wallace-Jones (2018: 15, 35; 4.1.h Bread molds and platters) suggests that some molds were made locally because many mold fragments did not have an interior slip. It is possible that the people who made the molds locally did not have either the resources, mostly water, or the expertise to create the interior slip. However, it is important to consider that many of the mold fragments found were seriously coated in salt, which may have caused the slip to fall or flake off the main ceramic body over time. Also, I found many mold fragments with large areas of interior slip that were in the process of flaking off. Finally, Appendix 2, Table 1 below shows that 70% of the mold fragments that were checked for an interior slip had one, which I suspect is a somewhat low percentage due to the likelihood of flaking on some. Therefore, I agree that it is likely that the bread mold producers at Mersa/Wadi Gawasis did not coat the mold interior with a slip, but I think there were relatively few molds that did not have the slip and all bread molds that came from the Nile Valley had an interior slip.

Hypotheses about bread mold function and use at Mersa/Wadi Gawasis

The evidence strongly suggests that the majority of the bread molds were transported to Mersa/Wadi Gawasis from the Nile Valley, so any bread baking was done at the harbor. A key question then – is for whom or for what purpose was the bread baked? Bread molds have been found at various Middle Kingdom sites, including mortuary temple sites such as Abydos (Wegner 2007), Kahun (Jacquet-Gordon 1981: 16), and Riqqeh (Jacquet-Gordon 1981: 16), Nubian forts such as Quban (Smith 2012: 398) and Mirgissa (Jacquet-Gordon 1981:16), and at the New Kingdom city of Amarna (Rose 1987). I propose two hypotheses for consideration, which require further testing in the future with the recognition that the function of the baked bread could have changed over the ca. 180 years of the expeditions.

Hypothesis #1 – The bread baked in the molds was rationed for the members of the expedition at the site and, possibly, prepared to take on expeditions to Punt.

Wallace-Jones (1981: 26) proposed that the bread produced in the molds were "a part of a bread ration for those garrisoned at Mersa Gawasis both during preparations for an expedition and as rations to take to sea." She based this hypothesis on the presence of many similar molds in domestic contexts at Quban (Smith 2012: 398). I find this hypothesis intriguing, but question it if my finding above is relatively accurate. Were 100-150 bread molds brought to the site per expedition sufficient to make the bread necessary to ration to the estimated "few hundred individuals" (Bard and Fattovich 2018:106) on a daily or frequent basis at the harbor site and for food on the ships to Punt?

This begs the question of whether or not the bread molds were reused. Several bread molds, usually the larger size, had 2 or 3 layers of interior slip that were over 2mm thick. This suggests that some of the molds were reused and possibly slipped again after each use (Perlingieri and Childs 2006: 119). Wallace-Jones (2018:15) challenged this idea given the difficulties of relining and refiring the molds without cracking the slip layers. I tend to agree, but more so because I do not think the people baking the bread at the harbor had the expertise to reline the molds after baking a loaf.

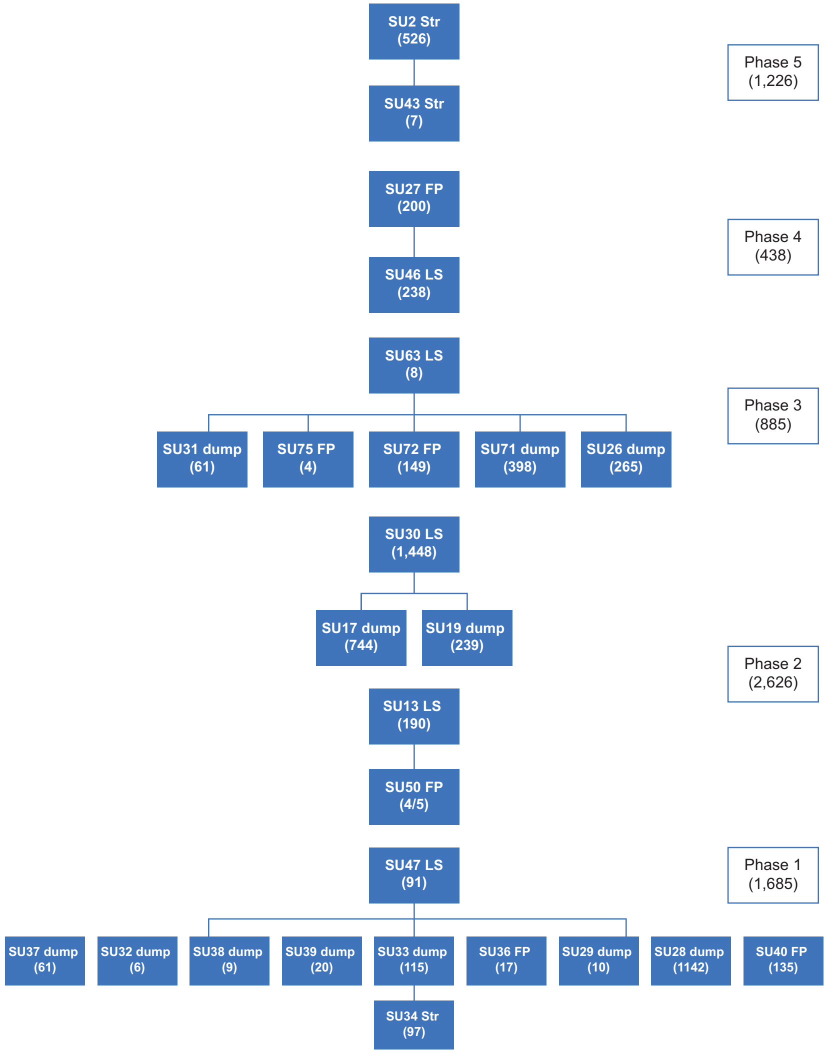
Another potentially useful observation is that Borojevic and Childs (2018) used some slip-lined ancient bread molds to experiment with bread baking and the slip lining stayed intact in test #5 when the bread came out of the mold. Although many of the wide ends of the lined bread molds had to be broken to extract the bread, it is likely that many other molds could be reused a number of times. Still, would reuse of some of the bread molds have yielded enough bread to ration to the several hundred expedition members while on land and at sea?

Another possibility is that bread for rationing was made in the open fire-pits on the numerous platters found at the site (Perlingieri and Childs 2006: 119-120; Wallace-Jones 2018: 28; 4.1.h Bread molds and platters) and the bread molds were used for another purpose. The platters could have been used to make a flat, round bread that did not require expertise in either the manufacture of the platters, which were made at Mersa/Wadi Gawasis, or in the baking of the bread.

Hypothesis #2 – The bread baked in the molds was used for religious, cult, or ceremonial purposes.

The care and expertise required to manufacture the bread molds of the Middle Kingdom suggests that the bread produced in the molds had a special use. Bread molds of the type excavated at Mersa/Wadi Gawasis have been found at a number of mortuary cult sites during Middle Kingdom times. While there is no evidence of mortuary practices at Mersa/Wadi Gawasis (Bard and Fattovich 2018: 154), a number of shrines were excavated there. Evidence of ritual offerings, including shells, pieces of anchor, and a few ceramics, were found at several shrines, one of which may have related to a sailors' cult to the god Min (Ibid:128-129) and another to Osiris (Ibid: 138-140). Given the importance of bread in ancient Egypt, might the bread baked in the molds also been left as offerings to gods to help ensure a successful expedition?

The possible special use of the bread baked in the bread molds might also be tied to the two small, plaster-lined ovens found in WG 17 (Bard and Fattovich 2007: 69; 2018: 111, 120). It is likely that these ovens were used to bake bread in molds similarly to what is depicted in the tomb of Antefoker (Davies 1920: Pl. X), as opposed to in the open fire-pits at WG 19/25/26/27/44. If special bread was baked in molds and ovens for funerary cults in the Nile Valley, it is possible that similar bread was baked in special ovens for cults to gods such as Min and Osiris. Bard and Fattovich (2018: 153) note that "…religious beliefs and practices at *Saww* were outside the normal living context of town, cult center, home and mortuary cults for personnel on the expeditions." It is possible, therefore, that the bread baked in the bread molds imported from the Nile Valley were used by the expedition leadership to ensure a successful return from Punt.



Str – Stratum; FP – Firepit; LS – Living surface

Figure 1. *Count of bread mold fragments by Phase and associated with specific stratigraphic units (SU).*

Appendix 2, Table 1

	#by type of bread mold sherds				Internal slip		
	Wide end	Pointed tip	Body	Total	#	%	
WG 16, Tr2, SU19		8		8	7	88%	
WG 16, Tr2, SU48	15	6	9	30		50%	*
WG 16, Tr2, Sq. 2, SU?		1		1			
WG 17, SU1		1	1	2	2	100%	
WG 18, SU1		1	2	3	1	33%	
WG 18, SU2		1		1			
WG 18, SU4	2	1	8	11		50%	*
WG 18, SU6	1		14	15		62%	*
WG 18, SU8	10	17	68	95		66%	*
WG 24, C1, SU23	3	1	3	7			
WG 24, C1, SU30			1	1			
WG 24, D1-D2, SU28		1	5	6			
WG 30, D5, SU70		1	1	2			
Cave 4b, surface		3		3	2	67%	
WG 19, A1, surface			5	5			
WG 19, A1, SU1			12	12			
WG 19, SU17	5	17	6	28	23	82%	
WG 19, A1, SU17	86	17	583	686			
WG 19, A1, SU30	39	10	172	221			
WG 19, A1, SU31	6	6	25	37			
WG 19, A2, SU17	4	1	9	14			
WG 19, A2, SU30	14	1	57	72			
WG 19, A2, SU 35	26	3	41	70			
WG 19, A3, Surface		16	39	55		64%	*
WG 19, A3, SU1	12	9	175	196			
WG 19, A3, SU2		1	16	17		50%	*
WG 19, A3, SU3	12	2	99	113	8	7%	*

WG 19, A3, SU4	33	19	211	263	79	30%	*
WG 19, A3, SU7	16	13	65	94	51	54%	*
WG 19, A3, SU39	1	5		6	3	50%	
WG 19, A4, SU1	2	7	100	109			
WG 19, A4, SU39	1	5	8	14	14	100%	
WG 19, B1, SU17	5	1	10	16			
WG 19, B1, SU36	1	1		2	2	100%	
WG 19, B2, SU24	5	2	77	84			
WG 19, B2, SU26	7	1	62	70			
WG 19, B2, SU27	26	7	167	200			
WG 19, B2, SU28	43	166	928	1137		90%	*
WG 19, B2, SU36	4	1	10	15			
WG 19, B2-B3, SU40	15	3	117	135			
WG 19, B3, SU26	7	1	136	144			
WG 19, B3, SU28			5	5			
WG 19, B3, SU38	2	7		9	8	89%	
WG 19, B4, SU1	2	1	38	41			
WG 19, C1, SU13	7	3	59	69			
WG 19, C1&C2, trench	2	7	4	13	9	69%	
Test trench, mixed levels	3	40	2	45	36	80%	
WG 19, C1&C2, SU13	2	1	22	25			
WG 19, C2, SU19	14	5	220	239			
WG 19, C2, SU24	17	4	126	147			
WG 19, C2, SU26	3	2	33	38			
WG 19, C2, SU29	2	8		10	9	90%	
WG 19, C3, SU26	1	1	11	13			
WG 19, C4, surface	1	7	16	24			
WG 19, D1, SU13	1		10	11			
WG 19, D1, SU47	11	10	35	56			
WG 19, D1-2, SU50		4	1	5	5	100%	
WG 19, D2, SU47	1	4	12	17			
WG 19, D3, SU1	2	2	6	10			
WG 19, E1, SU1			4	4			
WG 19, E1, SU2	1			1			
WG 19, E1, SU13	5		14	19			

WG 19, E1, SU46			2	2			
WG 19, E1, SU63	2	2	4	8			
WG 19, E3, SU1	3		11	14			
WG 19, E3, SU13	6	4	56	66			
WG 25, D1, SU2	3	1	31	35			
WG 25, D1, SU30	1	35	2	38	35	92%	
WG 25, D1, SU87	34	4	207	245			
WG 25, D1, SU90	3	2	27	32			
WG 25, D2, SU2	2	1	19	22			
WG 25, D2, SU30	1		19	20			
WG 25, D2, SU37		8		8	7	88%	
WG 25, D1&D2, SU1	3	4	13	20	8	40%	
WG 25, D1&E1, SU30	68	14	473	555			
WG 25, D2&E3, SU1	1		4	5			
WG 25, D2&E2, SU1		2		2	2	100%	
WG 25, D3-E3, SU33	2	4	109	115			
WG 25, E1, surface		2		2	2	100%	
WG 25, E1, SU30	4	1	33	38			
WG 25, E1, SU31	4		20	24	10	42%	
WG 25, E1, SU32		6		6	5	83%	
WG 25, E2, SU1	3	4	11	18			
WG 25, E2, SU30	8	5	106	119			
WG 25, E3, SU1	2	3		5	2	40%	
WG 25, E3, SU2	11	7	125	143			
WG 26, SU3	3	1	1	5	4	80%	
WG 26, A5, SU2-3	1	3	5	9	4	44%	
WG 26, A5, SU2	1	15	11	27	17	63%	
WG 26, C4, SU95		10		10	8	80%	
WG 26, C4-D4, SU1	3		32	35			
WG 26, C4-D4, SU95	33	10	95	138			
WG 26, C4-D4, SU97	2		6	8			
WG 26, C5, SU30	12	10	70	92		50%	*
WG 26, D1, SU37	2		22	24			

WG 26, D2, SU37	1	1	27	29			
WG 26, D5, SU1	6		29	35			
WG 26, D5, SU2	31	14	227	272			
WG 26, D5, SU34	2	6	89	97			
WG 26, D5, SU71	14	1	64	79			
WG 26, D5-E5, SU71	24	18	272	314			
WG 26, D5, SU72	27	30	92	149		88%	*
WG 26, D5, SU75		1	3	4	2	50%	
WG 26, D5-E5, SU30	5	5	40	50			
WG 26, E4, SU1		1	26	27			
WG 26, E5, SU1	10	7	51	68		80%	
WG 26, E5, SU30	46	9	188	243			
WG 26, E5, SU71		5		5	5	100%	
WG 26, E5, SU73		3		3	2	67%	
WG 27, A5, SU1	9	13	58	80			
WG 27, B1, SU46	5	6	35	46			
WG 27, B5, collapse	3	22	2	27	18	67%	
WG 27, C1, SU46		2	5	7			
WG 27, B5-C5, SU43	2	3	2	7	6	86%	
WG 27, B5-C5, SU46	29	10	138	177			
WG 27, D5, SU1	1	1	10	12			
WG 27, D5, SU46		1	5	6			
WG 44, A1, SU3	3	2	8	13			
TOTALS	914	782	6745	8441	396	70%	

KEY

* internal slip recorded only on large pieces with visible interior not covered in salt

SUs that I considered Other and not associated with a clear temporal Phase

Appendix 3
Ship timbers

Timber type

Transverse timbers
Type 1 — transverse structural timber (e.g. deck beam, framing element)

Hull-planks
Type 2 — ship hull planks, cedar, including gribble and 0.65-2.25 cm thick deep mortise-and-tenon joints

Deck-planks, chamfered
Type 3 — Short cedar planks (75-90 cm long x 20-35 cm wide x 5 cm or less thick, with chambered ends on lower face

Planks with ligatures
Type 4 — Acacia planks with shallow mortise-and-tenon joints less than 0.5 cm thick and ligatures

Auxiliary equipment
Type 5 — Steering components, oar looms, stanchions, crutches and other ship equipment

Other planks, undetermined and lacking identifiable features
Fastenings and debitage   Tenons and dovetail tenons, wood debris from reshaping and cleaning timbers

Catalog #	Timber type	Identification	Season	Area	Sq/trench	SU	Wood ID	disposition	Overall Dimensions (cm)
T32	Type 1	beam	2005	WG 30/ WG 16	outside C2/C3	3	*Cedrus libani*	Cave 2	329 x 28 x 18
T48	Type 1	reworked beam fragment; wedge-shaped	2005	WG 24	Room 1, C1-D1	57	Cedrus libani	not recovered	
T66	Type 1	beam with stanchion hole; beneath T55	2010	WG 39	Cave 3 A 10	20	*Cedrus libani*	in situ	92 (visible) x 21.5 X 9?
T67	Type 1	beam with rabbet remaining, center cut away	2006-7	WG 39	Cave 3 A 10	20			17 (visible) x 14 x 8
T3	Type 2	plank fragment with square hole; CZ 2005: 21 Timber 3	2004	WG 24	Entrance	35	cedar type wood	not recovered	42 x 17 x 3
T4	Type 2	plank with square hole, too soft to recover; CZ 2005: 21 Timber 4	2004	WG 24	Entrance	35		not recovered	120 x 10 x 3rem
T5	Type 2	plank fragment with mortise; CZ 2005:21 Timber 5	2004	WG 24	Entrance	35	*Cedrus libani*	Quft	69 x 12.5 x 11.5
T7	Type 2	plank fragment with mortise and paint; CZ 2005:21 Timber 7	2004	WG 24	D1, outside entrance	11		not recovered	40 x 14 x 5rem
T16	Type 2	large hull plank with reworked pointed end	2005	WG 24	Room 1	56	*Cedrus libani*	in situ	237 x 38 x 17.5
T18	Type 2	plank with lashing channels; CZ 2005: 21 WG24 Timber 1	2004	WG 24	Entrance	32	cedar type wood	Cave 1	134 x 16 x 11
T19	Type 2	plank; CZ 2005: 21 WG24 Timber 2	2004	WG 24	Entrance	32	*Cedrus libani*	excav	130 x 10 x 10rem
T20	Type 2	NW side with T21, T22; in situ	2005	WG 24	Entrance, west wall		*Cedrus libani*	in situ	110 x 26 x 11.5
T21	Type 2	NW side with T20, T22; in situ	2005	WG 24	Entrance, west wall		*Cedrus libani*	in situ	148 x 26 x 11.5
T23	Type 2	threshold across corridor	2004	WG 24	Entrance corridor below T18	32	*Cedrus libani*	Cave 1	96 x 13 x 12
T27	Type 2	hull plank section (north)	2005	WG 24	C2/C3	57	*Cedrus libani*	Cave 1	77 x 22 x 16.5
T28	Type 2	hull plank section (south)	2005	WG 24	C2/D2	57	*Cedrus libani*	Cave 1	104.5 x 22.5 x 22.5

T29	Type 2	reworked hull plank; wedge-shaped	2005	WG 24	C2/D2	57	*Avicennia marina*	not recovered	31 x 7.5 x 3.5 rem
T33	Type 2	hull plank as header in Cave 3 entrance; in situ	2005	WG 30	Cave 3 entrance	71	*Cedrus libani*	in situ	(35) x 43.5 x 22.5
T34	Type 2	knife-shaped plank with boxes	2005	WG 32	open air storage with boxes	9	*Cedrus libani*	Quft	293 x 43 x 14.5
T36	Type 2	reworked hull plank; wedge-shaped above T41	2005	WG 30	D5	3	acacia-type wood	Cave 1	50 x 8 x 5.5
T39	Type 2	hull plank section	2005	WG 24	C3	57	*Cedrus libani*	Cave 1	98.5 x 23 x 11
T40	Type 2	split and bent debitage fragment	2005	WG 24	Room 1 Test Tr	34	cedar type wood	Cave 2	36.3 x 4.5 x 2
T52	Type 2	heavily reworked Type 2; cut for dendro	Review	WG 39	Cave 3 B2	9	*Cedrus libani*		46 x c.11.8 x 5.8
T53	Type 2	completely decayed hull plank	Review	WG 32	C5	*25*	*Cedrus libani*		86 x 20.4 x c. 3
T57	Type 2	plank with tenon in mort; salt encrusted	2006-7	WG 55	Cave 7 C1	10			114 x c.23.5 x c.12
T61	Type 2	plank with small peg	Review	WG 39	Cave 3 A8		*Cedrus libani*	*in situ*	230 (exposed) x 14-24 x 6.5
T64	Type 2	plank segment		WG 39	Cave 3		*Cedrus libani*		106 x 50.5 x 22.5 Th
T79	Type 2	hull plank reworked into wedge	2007-8	WG 32	C5	25	*Cedrus libani*		56.5 x 9.4 x 3.5 max th
T80	Type 2	burned and calcined plank on foreshore	2009-10						
T62	Type 2	Type 2 hull plank reworked into wedge	Review	WG 39	Cave 3 A8	15	*Cedrus libani*		31 x 7 x 6
T63	Type 2	Type 2 hull plank reworked into wedge	Review	WG 39	Cave 3 A10	15	*Cedrus libani*		26 x 7.8 x 6; hole 1.6 diam
T93	Type 2	Hull plank	2009-10	WG 32	entrance Cave 6		*Cedrus libani*	Cave 2	120 rem x 20 rem x 6.5 rem
T24	Type 2?	SE side of entrance	2004	WG 24	Entrance	32		Cave 1	34 x 9 x 8
W143.2	Type 2	hull plank fragment, gribble throughout	2005	WG 30	D4	3	*Cedrus libani*	Cave 2	5 x 3 x 2
T8	Type 3	chamfered ends, ligature grooves; CZ 2005:22 Timber 8	2004	WG 24	Room 1 Test Tr	34	*Ficus sycomorus*	Cave 1	77 x 28.5 x 4.5
T9	Type 3	square peg; CZ 2005: 21 Timber 9	2004	WG 24	Room 1 Test Tr	34	*Cedrus libani*	Cave 1	81 x 13.5 x 4.3

T10	Type 3	deck plank, no fastenings	2004	WG 24	Room 1 Test Tr	34		Cave 1	67.5 x 16.5 x 4.2
T11	Type 3	chamfered ends	2004	WG 28	Cave 1			Cave 1	77 x 26 x 4.5
T15	Type 3	chamfered ends, inscribed on underside. BOX LID?	2005	WG 16	Trench 2	19	*Ficus sycomorus*	Cave 2	90 x 36.5 x 4
T25	Type 3	plank fragment reworked as Type 3, heavy marine borer infestation	2005	WG 30	D5 (north)	62	*Cedrus libani*	Cave 1	77 x 15 x 7
T26	Type 3	chamfered ends	2005	WG 30	D5 (south)	62	*Cedrus libani*	Cave 1	77 x 21.5 x 6
T47	Type 3	chamfered end, fragment	2005	WG 24	Room 1, D2	57	*Cedrus libani*	Cave 1	45 x 8.5 x 5
T51	Type 3	heavily reworked Type 2	Review	WG 24	Cave 2 Rm 1	disturbed	*Cedrus libani*		82R x 18 x 2.2-5.5 th
T65	Type 3	heavily reworked Type 2; deck plank	Review	WG 39	Cave 3 A10		*Cedrus libani*		82 r x 26.2 x 6 Th
T73	Type 3	heavily reworked Type 2; deck plank	Review	WG 33					69.5 x 23.5 x 3.3 to 5 th
T82	Type 3	deck plank, carved to accommodate rigging	2009-10	WG 61	D2/D3-E2/E3	19	*Cedrus libani*		80.5 x 26 x 6 max th
T84	Type 3	deck plank, inscribed marks	2009-10	WG 61	D2/D3-E2/E3	19	cedar type		67.5 x 29.5 x 4 max th
T86	Type 3	reworked Type 2 hull plank S side T72	2009-10	WG 32	N side	46	*Cedrus libani*		38 x 10.4 x 3.3 max th
T94	Type 3	deck plank, small	2009-10	WG 65	A-B 2/3 hearth outside Cave 8	27	*Cedrus libani*		46.5 x 13.8 x 3.3 max th
T95	Type 3	deck plank, broken but complete	2009-10	WG 61	C4	27			49.4 x 27 x 5.1
T97	Type 3	deck plank	2009-10	WG 39	Cave 3				81 x 13.4 x 5.7
W130	Type 3	deck plank, chamfered end, fragment	2004	WG 24	inside entrance	26		Quft	22.5 x 8 x 4.5
T17	Type 3?	plank beneath T16; in situ	2005	WG 24	Room 1	56	Cedrus libani	in situ	? X ? X 3.5
T22	Type 3?	NW side filler under T21, T20; in situ	2005	WG 24	Entrance, west wall		Cedrus libani	in situ	79 x ? X 3.5
T12	Type 4	holes pass through this small plank	2004	WG 28	Cave 1			Quft	c 72 x 16 x 3
T13	Type 4	smaller of two joined planks	2005	WG 30	C4/C5	62	Acacia nilotica	Cave 1	122 x 19 x 3.4
T14	Type 4	larger of two joined planks	2005	WG 30	C4/C5	62	Acacia nilotica	Cave 3	203 x 25 x 3.8
T31	Type 4	reused as part of a ramp; lashed and m-t	2005	WG 30	C5	69	Acacia nilotica	unknown	163 x 30 x 4.2

T37	Type 4	plank seam with black coating	2005	WG 30	C4	62	acacia-type wood	Cave 1	49 x 9.2 x 4
T41	Type 4	plank with lligature holes	2005	WG 30	D5	62	Acacia nilotica	Cave 3	238 x 26 x 4.5
T75	Type 4	reworked Type 2 with ligature; sheer plank	2006-8	WG 55	C2/C1	2	*Cedrus libani*		94.2 x 21.2 x 4 max th
T81	Type 4	reworked Type 2 with mortise & ligatures	2009-10	WG 65	B2	2	*Cedrus libani*		42.5 x 7.5 x 4 max th
T83	Type 4	thin plank, badly damaged by insects, black material along edge	2009-10	WG 61	DE23	19	*Ficus sycomorus*		67 x 31 x 3
T1	Type 5	Quarter rudder blade (CZ 2005: Blade 1)	2004	WG 24	Entrance Corridor	26	*Acacia nilotica*	Quft	180 x 35 x 12
T2a	Type 5	Quarter rudder blade, upper portion (CZ 2005: Blade 2)	2004	WG 24	Entrance Corridor	26	*Faidherbia albida*	Quft	200 x 40 x 15
T2b	Type 5	Quarter rudder blade, lower portion (CZ 2005: Blade 2)	2004	WG 24	Entrance Corridor	26	*Acacia nilotica*	Quft	see above
T30	Type 5	stanchion?, squared section	2005	WG 16/ WG 30	loose on slope		cedar type wood	Cave 1	57 x 6 x 6
T44	Type 5	y-shaped crutch	2005	Cave 4	see cave notes	1	*Acacia nilotica*	Cave 4	189 x 18 x 6.9
T45	Type 5	knob, possible oarlock	2005	WG 24	Room 1, on top of T16 tip	56	*Ficus sycomorus*	Cave 1	9.5 x 10.2 x 6, 19 cm circumference
T46	Type 5	pegged strip, superstructure?	2005	WG 30	C5	3	*Cedrus libani*		38 x 4 x 2.8
T59	Type 5	stanchion?, squared section	2006-7	WG 39	Cave 3 B9	surface below collapse			69 x c.12 x c. 8
T70	Type 5	charred Y-shaped crutch, rectangular section	2006-7	WG 39	Cave 3 A8	15			c. 111 x 12 x ?
T72	Type 5	steering oar blade	2009-10	WG 32	N side	46	*Faiderbia albida*	Cave 2	
T78	Type 5	charred block, glassy charred substance	Review		Cave 3		deciduous *Quercus*		
T85a	Type 5	steering oar blade	2009-10	WG 32	S side	46	*Faiderbia albida*		
T87	Type 5	small plank, heavily encrusted	2009-10	WG 32	N side, bet blades	46	*Acacia nilotica*		92 x 11 x 3.6
T88	Type 5	half-round fragment of a loom, spar or pole	2009-10	WG 32	S side, bet blades	46	*Acacia nilotica*		52 x 5 x 2.3 max

T89	Type 5	half-round fragment of a loom, spar or pole	2009-10	WG 32	N of T72	46	*Cedrus libani*		85 x 7 x 5 max
T90	Type 5	unknown; beneath and obscured by T72	2009-10	WG 32	under T72	46	*Cedrus libani*	in situ	
T91	Type 5	probable steering oar loom	2009-10	WG 32	bet T72 & T85	46	*Acacia nilotica*	in situ	12 cm max diam; oval section
T96	Type 5	square-sectioned stanchion or stake	2009-10	WG 61	D2	45	unid		30.5 x 6 x 5,7
T92	Type 5 (?)	obscured by salt; with other steering components	2009-10	WG 32	bet T72 & T85	46	unid		obscured
W143.3	Type 5	half-round fragment of a loom, spar or pole	2005	WG 24	Room 1	34	*Ficus sycomorus*	Cave 1	7 x 3 x 1.5
W147	Type 5	wedge-shaped fragment	2005	WG 24	E5	43	*Ficus sycomorus*	Cave 1	13.5 x 10.5 x 2.5
W393	Type 5	probable oar loom; half-round	2005	WG 55	E3	5			40 l rem x 4.7
W402	Type 5	probable oar loom; half-round	2005	WG 55	C2	2			60 l rem x 4.7
W960	Type 5	probable oar loom	2009-10	WG 64	A1	2			75 x 5 cm diam
W961	Type 5	probable oar loom	2009-10	WG 64	A1	2			53 x 6 cm diam
W963	Type 5	probable oar blade fragment	2009-10	WG 64	A1	2	resembles Nile acacia		43 x 9 max x 1.7 maxth
W964	Type 5	spar with pentagonal section	2009-10	WG 64	A1	4			23.5 x 7
W965	Type 5	probable oar loom and oar blade fragments	2009-10	WG 64		2			6.8 rem length x 5 diam for loom, blade section 23 x 6 x 3.5 max th
T6	type unassigned	poorly preserved plank with two square holes	2004	WG 24	entrance	35		Quft	96 x 20 x 5rem
T42	type unassigned	plank in poor condition, no features	2005	WG 24	Room 1, C3-D3	64	*Cedrus libani*	not *recovered*	84 x 20 x 3.3
T43	type unassigned	plank fragment by T41, charred area	2005	WG 30	C5 (north)	3		Cave 1	28 x 9.5 x 5

T54	possible Type 2	poor condition, one end shattered; part of T55	2006-7	WG 39	Cave 3 A10	11			55 (pre-removal) x 14 x 3.8
T55	possible Type 2	displayed curvature when found due to ancient charring and damage	Review	WG 39	Cave 3 A9-A10	11	*Acacia nilotica* **peg only**		370? x 20 cm wide x 40 cm thick
T55/2	possible Type 2	inner piece/south side of T55	2006-7		Cave 3		*Acacia nilotica*		
T56	possible Type 2	poor condition, part of T55	2006-7	WG 39	Cave 3 A9	11			68 x 26 x 4
T58	probably Type 3	Probable deck plank	2006-7	outside	Cave 2 downslope				52 x c.13.5 x 3.5
T60	worked wood, other	thin plank, dovetail-shaped ends	2005	WG 16	Trench 2	75	*Cedrus libani*	unknown	145 x 11 x 2
T69	type unassigned	plank degraded by salt	2006-7	WG 39	Cave 3 A9	16?			50 x c. 6.5 (visible) x 3.8
T71	type unassigned	thin plank, no features	2011	WG 33		2	*Cedrus libani*		77 x 9 x 2.2 th
T74	type unassigned	not recovered	2006-8	WG 55	C1 Cave 7 Entrance	11		in situ	77 x 17 x 4.5th no width
W29	type unassigned	plank fragment, poorly preserved	2005	WG 24	Room 1				c. 24 x 19 x 3
T85b	peg	peg from T85	2009-10	WG 32	from T85	46	*Acacia nilotica*		
T64b	tenon	tenon 6 from garboard plank T64	2009-10	WG 39	Cave 3 A9	16	*Acacia nilotica*		87 x 46+ x 22
T38	tenon	Tenon, size I	2005	WG 30	D4	50	acacia type		29 x 5 x 2
W8.1	dovetail	dovetail tenon half; pry mark on lower surface	2005	WG 24	Room 1	34	*Acacia nilotica*	Cave 1	16rem x 3--6 x 3.2
W8.2	tenon	tenon fragment from above T16	2005	WG 24	Room 1	34	*Ficus sycomorus*	Cave 1	18 x 10 x 3
W23a	tenon	tenon, broken end, size I	2005	WG 24	Room 1, C2	53	acacia type		15 x 3.2 x 1.4
W41	tenon	tenon, fragment, size I	2005	WG 30	D4	50	acacia type		27 x 4.7 x 2

W43	tenon	tenon, half, size I, drilled hole with wear ring (odd)	2005	WG 30	D4	50	acacia type		12.2 x 3.7 x 1.2
W61.1	tenon	tenon fragment from above T16	2005	WG 24	Room 1, B3	53	*Acacia nilotica*	Cave 2	12.5 x 7 x 1.2
W67.1	dowel	faceted dowel	2005	WG 24	Room 1, C3	53	acacia type		14.2 x 1.2 x 1.2
W67.3	tenon	tenon frag, size I	2005	WG 24	Room 1, C3	53	acacia type		11.5 x 1.4 x 1.4
W70	dovetail	dovetail tenon half	2005	WG 30	C4, C5	62	acacia type	ramp	17R x 3--7 x 3.7
W74	tenon	tenon, half, size I	2005	WG 24	Room 1, C4	64	acacia type		17 x 6.5 x 1.5
W89	tenon	tenon, fragment, chopped and torn, size I	2005	WG 24	Room 1, C1	53	acacia type		17 x 2 x 1.6
W91	tenon	tenon, half, size I	2005	WG 30	D5, E5	50	acacia type		14 x 4.5 x 1.4
W93.1	tenon	broken tenon, dubbed	2005	WG 30	D5, E5	65	acacia type		23 x 3.8 x 1.8
W93.2	tenon	tenon, half, size I	2005	WG 30	D5, E5	65	acacia type		10.5 x 3 x 1.8
W93.3	dovetail	dovetail tenon half, adze gouges on top and edge	2005	WG 30	D5, E5	65	acacia type		10R x 3.5--6.5 x 3.5
W8.1	dovetail	dovetail tenon half; pry mark on lower surface	2005	WG 24	Room 1	34	*Acacia nilotica*	Cave 1	16rem x 3--6 x 3.2
W93.4	tenon	tenon, half, bevel tip. Size?	2005	WG 30	D5, E5	65	acacia type		11 x 3 x 1.2
W106	tenon	tenon tip, size I	2005	WG 24	Room 1, C4	53	acacia type		6.5 x 2 x 1.6
W107	tenon	tenon, size I, half. 1.2 cm diam drilled hole	2005	WG 24	Room 1, C3	57	acacia type		15 x 15.5 x 1.2
W131	tenon	tiny tenon	2004	WG 24	D2	24	acacia type		8.5 x 3.5 x 0.9
W136	tenon	partial tenon, size I	2004	WG 24	inside entrance	26	acacia type		19.5 x 4.5 x 1.4
W138	tenon	tenon, size I, half	2004	WG 24	inside entrance	25	acacia type		13.5 x 4.9 x 0.9
W146	tenon	partial tenon, size I	2004	WG 24	Room 1	34	acacia type		13.2 x 5 x 1.2
Dovetail 1	dovetail half	dovetail tenon half, chisel marks/steps at midpoint	2005	Cave 3 surface	not collected		acacia type	surface scatter	15.6R x 3--6 x 4.5
Dovetail 2	dovetail half	dovetail tenon half, chisel marks/steps at midpoint	2005	Cave 3 surface	not collected		acacia type		16.5R x 2.1--5 x 3
Dovetail 3	dovetail half	dovetail tenon half, chisel marks/steps at midpoint	2005	Cave 3 surface	not collected		acacia type		11.2R x 2.2--4.2 x 2.8
Dovetail 4	dovetail half	dovetail tenon half, chisel marks/steps at midpoint	2005	Cave 3 surface	not collected		acacia type		18.2R x 2.7--5.7 x 4.6
Dovetail 5	dovetail half	dovetail tenon half, chisel marks/steps at midpoint	2005	Cave 3 surface	not collected		acacia type		16R x 2-4.5 x 4
Tenon 1	tenon	tenon, size I, 1.4 cm diam exit hole, 1.6 cm entrance drilled. Chisel tip	2005	Cave 3 surface	not collected		acacia type		27 x 4.5 x 1.8

Tenon 2	tenon	tenon, size II	2005	Cave 3 surface	not collected		acacia type		12.5 x 3(ends) x 4.2 (center) x 1.2
Tenon 3	tenon	tenon, size I	2005	Cave 3 surface	not collected		acacia type		22.5 R x 4 (end) x 4.5 (center) x 1.7
Tenon 4	tenon	tenon, size II	2005	Cave 3 surface	not collected		acacia type		14.2 x 2.8 (end) x 4 x 1.4
W9	tenon	complete tenon, size III	2005	WG 24	Room 1	34	*Acacia nilotica*	Cave 1	11.5 x 4.2 x 1
W23	tenon	tenon fragment, size I	2005	WG 24	Room 1, B2	53	*Acacia nilotica*	Cave 1	28 x 2.7 x 1.8
W33	tenon	complete tenon, size II	2005	WG 30	D5	3	*Acacia nilotica*	Cave 1	15.4 x 3.8 x 0.9
W51	tenon	tenon fragment, size I	2005	WG 30	D4	62	*Acacia nilotica*	Cave 2	12.2 x 3.7 x 1.2
W53	tenon	complete tenon, size II	2005	WG 24	Room 1, C2-C3	57	*Acacia nilotica*	Cave 2	11.2 x 3.5 x 1
W135	tenon	tenon fragment, size I	2005	WG 24	Room 1	26	*Acacia nilotica*	Cave 2	13.5 x 3.3 x 1.6
W143.1	tenon	tenon fragment, size I	2005	WG 24	Room 1	34	*Acacia nilotica*	Cave 2	11rem x 1.4 x 1.2
W145	tenon	tenon, size I	2005	WG 24	Room 1	34	*Acacia nilotica*	Cave 2	13.2rem x 5 x 1.2
T98	tool	tool handle, octagonal section		WG 60	D5	1	*Avicennia*		42 x 3-3.2
T99	tool	tool handle, octagonal section		WG 60	D5	1	*Avicennia*		45 x 3-3.4
T100	tool	tool handle, octagonal section		WG 60	D5	1	*Avicennia*		50 x 3.5
T101	tool	adze handle & blade support (2 pcs)	2009-10	WG 64			*Avicennia* and *Cedrus libani*		55 x 3
T68	possible tool handle	described as straight with faceted sides, tapered at ends	2006-7	WG 39	Cave 3, A8-9	15	cedar type		66 cm (surviving) x 7.5 x 8 max th

Appendix 4
Wood and charcoal studies

Field seasons of research stays

- 2005-2006: January 5 to 16, 2006 / wood, charcoal;
visit to the permanent exhibition in the fort of
El-Quseir, study of woody plants near the excavation
(see 6.2.a, and Bard and Fattovich 2007: 170-188)
- 2006-2007: December 28 to January 12 / wood, charcoal (see 6.2.b)
- 2007-2008: December 24 to January 10 / wood, charcoal (see 6.2.c)
- 2009-2010: December 28, 2009 to January 11, 2010 / wood, charcoal;
visit to the mortuary temple of Hatshepsut
at Deir el-Bahari (see 6.2.d)
- 2010-2011: December 26, 2010 to January 13, 2011 / wood, charcoal;
study of modern charcoal, recording of vegetation stands
in Wadi Gasus and Wadi Gawasis (see 6.2.e)

Excavation units of studied material /

- 2005-2006: WG 16$^{/w}$, WG 19, WG 24$^{/w}$, WG 26, WG 27,
WG 29^{w}, WG 30$^{/w}$, WG 30/16^{w}, WG 31, WG 32$^{/w}$, WG 35,
WG Cave 3, WG Cave 4^{w}
- 2006-2007: WG 24^{w}, WG 26, WG 32$^{/w}$, WG 33, WG 38,
WG 39$^{/w}$, WG 40, WG 41, WG 42, WG 44, WG Cave 2^{w}
- 2007-2008: WG 19, WG 24^{w}, WG 32$^{/w}$, WG 33$^{/w}$, WG 37,
WG 39$^{/w}$, WG 44, WG 46, WG 47$^{/w}$, WG 50, WG 52$^{/w}$,
WG 53$^{/w}$, WG 54$^{/w}$, WG 55$^{/w}$, WG exterior and slope
towards entrance of Cave 2^{w}
- 2009-2010: WG 32$^{/w}$, WG 33$^{/w}$, WG 39^{w}, WG 46, WG 52,
WG 54$^{/w}$, WG 55$^{/w}$, WG 56$^{/w}$, WG 60^{w}, WG 61$^{/w}$,
WG 61/65$^{/w}$, WG 65$^{/w}$, WG 66, WG 67
- 2010-2011: WG 24^{w}, WG 31, WG 32^{w}, WG 40, WG 54,
WG 61$^{/w}$, WG 64$^{/w}$, WG 65, WG 69, WG 70$^{/w}$, WG 70/72,
WG 71$^{/w}$, WG 72, WG 73, WG 74, WG 75

(excavation unit without superscripted character(s): charcoal; $^{/w}$ and wood, ^{w} wood only)

Appendix 5
Remote Sensing at Mersa/Wadi Gawasis

GLEN DASH

I: Introduction

In 2004 the first man-made caves were found at Wadi Gawasis, excavated into the fossil coral terrace. In 2005, I was asked if remote sensing could be employed to find additional caves. If they were like the others, they would lie five to six meters below the surface of the terrace. Although we could employ electromagnetic induction, magnetometry and ground penetrating radar to the task, it was unclear whether any of these technologies would work. Given the current technology, five to six meters is still a long way down.

But in addition to this challenge, the site also offered some unique opportunities. The coral terrace at Wadi Gawasis has well-defined, exposed strata. We knew that if we were able to measure the electrical properties of each individual stratum, we could predict which of the technologies would work best. During our 2005-2006 geophysical season, we measured their properties with electromagnetic induction tools. From this we were able to conclude that radar would be our best bet.

In 2006-2007, we gathered our field data and analyzed it using the software program GPR-Slice. We found that we could detect the caves despite their depth, due in part to the practical nature of their builders. The ancient Egyptians carved the caves out of rock that had been softened by water percolating down from the top of the terrace. Although the caves themselves would have been difficult to detect, the fingerprint of this water movement was plainly visible.[1]

II: Ground Penetrating Radar Basics

Ground Penetrating Radar (GPR) is sometimes aptly referred to as "electromagnetic sounding." GPR works much the way early underwater acoustic sounding (sonar) devices worked, although with radio waves

[1] Readers can find addenda and errata at: http://www.DashFoundation.org/Mersa-Wadi-Gawasis.html.

rather than sound. Early sonar gear worked through a process known as "pinging." A surface ship used an acoustic transmitter to produce a ping, and an acoustic receiver to listen for a return. The distance to the target could be calculated if the speed of sound in water was known.

Most ground penetrating radar devices used in archaeological surveys work in an analogous way. They have a transmitter that produces an electromagnetic ping that travels down through the soil, and a receiver which listens for a return. If the velocity of the electromagnetic ping is known, the distance to the target can be calculated.

In a typical GPR system, the ping produced by the transmitter is a pulse of radio frequency energy known as a "wavelet." This is used to energize a transmitting antenna (Figure 1). The returning signal is picked up by the receiving antenna and is coupled to a radio frequency receiver. A signal processor helps separate the signal from the noise, and the user views the results on a display.

III: The Soils at Wadi Gawasis

The primary goal of our 2005-2006 and 2006-2007 geophysical seasons at Mersa/Wadi Gawasis was to develop a method for detecting additional caves. As a practical matter, the easiest way to do this was from the top of the western coral terrace. Whether or not we could successfully use geophysical techniques to detect the caves at Wadi Gawasis would depend on the nature of the soil we found there.

Figure 2 shows the western slope of the terrace at the time of the survey (Vining, field notes 2005-2006). Above the entrance to Cave 2 there are five layers of rock strata. The topmost layer, designated Stratum 1, is thin and consists of gravel, alluvium and lag deposits. Beneath that is a two meter plus layer of porous fossil coral (Stratum 2), supported by a layer of massive coral (Stratum 3). Stratum 4 consists of beach conglomerate. The cave is cut into Stratum 5, which consists of massive conglomerate.

In electrical terms, we classify soils using three parameters: *conductivity*, *permittivity* and *permeability*.

Conductivity (s) is a measure of how easily electrical current moves through a medium. As a general rule, the higher the soil's water content and salt concentration, the greater the conductivity. Soil conductivity is measured in Siemens per meter (or equivalently, mhos per meters).

Permeability (m) is a measure of how easily a medium can be magnetized. Most soils have fairly low concentrations of iron and other ferrous metals and therefore cannot be easily magnetized. In fact, at the frequencies we will use, the magnetic properties of soil are about the same as air. Permeability is measured in units of Henries/meter and for air it is about equal to 4p x 10^{-7} Henries/meter.

Permittivity (e) is a measure of how easily a medium can be electrically charged. Permittivity is measured in units of Farads/meter and the permittivity of air is about the same as a vacuum, 8.85 x 10^{-12} Farads/meter. The permittivity of soils varies considerably and is strongly influenced by their water content. Materials are usually rated in terms of *Relative Permittivity* (κ), which is the permittivity relative to a vacuum. Soils generally vary in relative permittivity from 2 to 25.

During our 2005-2006 survey, we measured the conductivity of the strata using an EM31 electromagnetic induction meter. We placed the meter up against the vertical surface of the terrace at the points indicated in Figure 2. We took a total of 17 measurements, half of them in "parallel" (||) mode and half in "perpendicular" (^) mode. The mode refers to the direction of the magnetic field produced by the instrument in relation to the plane of the surface. A perpendicular field penetrates farther into the soil but covers less area. A parallel field covers more area but penetrates less deeply. For our purposes, we deemed the perpendicular measurements most relevant, since they penetrate farther into the terrace and have less of a tendency to cross layers.

Using this conductivity data, we were able to construct the simplified electrical model of the strata at Mersa/Wadi Gawasis shown in Figure 3.

We could only estimate the permittivity of the strata. Daniels states that the relative permittivity of dry, sandy soils varies from 4 to 10 (Daniels 2004: 90). We also know that both permittivity and conductivity rise with water content. Therefore, we assigned a relative permittivity of four to the uppermost layer in our model (Stratum 2), and ten to the bottom layer (Stratum 5). We used interpolation to estimate the permittivity of the intervening layers.

From this model we were able to determine that ground penetrating radar was the best method for detecting caves at Wadi Gawasis.[2]

[2] See G. Dash, "How Deep Can We See? The Depth Penetrating Characteristics of Ground Penetrating Radar," http://dashfoundation.com/downloads/archaeology/working-papers/How_Deep_Can_We_See_(rev_of_9-30-08).pdf.

IV: The 2006/2007 Field Season at Wadi Gawasis

In December, 2006 and January, 2007, Benjamin Vining of Boston University, with support from the Glen Dash Charitable Foundation, undertook a ground penetrating radar study at Mersa/Wadi Gawasis. To conduct the study, Vining used a Geophysical Survey Systems (GSSI) SIR-2000 radar system with a 200 MHz antenna. The data he collected can be found at http://www.DashFoundation.org/HowDeep/RadarFiles.zip.

Figure 4 shows the location of six transects that Vining surveyed. Transects 1 and 2 run roughly south-north and are separated by approximately 5 meters. Transects 3 and 4 run east-west along a common pathway, as do Transects 5 and 6.

The SIR-2000 system is designed to automatically transmit wavelets into the ground as its "radar sled"; the box containing its antennas, is pulled along a pathway. The interval between transmissions is adjustable by the operator. For example, in Figure 5(a) we have simulated the transmission of one wavelet every 3 meters along Transect 1. The recorded traces are placed side by side for convenience, creating what is known as a "*wiggle trace*" plot. In Figure 5(b) we have decreased the interval to one trace every 30 centimeters. Note that the combination of traces begins to look like a profile of the subsurface.

More detail can be discerned by color encoding the data. In Figure 6, we have transformed each trace by assigning different colors to portions of it depending on its amplitude at any given time. The result is known as a *radargram*.

The radargram for Transect 1 is shown at the bottom of Figure 6. The interface between Stratum 2 and 3 can be clearly seen. Beneath this, some reflections can also be seen at approximately 80 nanoseconds, reflections which are well correlated with the location of some of the known caves.

These data were then processed using the "GPR-Slice" software written by geophysicist Dean Goodman. The software takes two or more nearby radar profiles and combines them to produce a map of reflected energy. It does this by "slicing" horizontally across individual radar profiles at a common depth, then "gridding" vertically to create individual volume units. The amount of energy within each volume unit is then calculated by squaring the amplitude of the signals each volume contains. The resulting map identifies the sources of reflected energy from the subsurface.

Figure 7 contains the reflected energy map for Transect Pair 1-2. The areas in orange and red exhibited the most reflected energy from any given strata and the areas in green and blue relatively less. In Figure 8, we have added the locations of known caves. The locations of Caves 1, 2, 3, 4 and 7 are well correlated with the map of reflected energy. However, there were also strong reflections detected at depths where no caves were found as of the time of the survey. In some cases, the reflections were from locations near to the surface.

Daniels has offered an explanation:

> "Water movement through sandy soils is not uniform and is strongly influenced by soil layering. Coarser or finer textural layers redirect and concentrate water movement into preferential pathways. The pathways move water and solutes laterally over restrictive layers and downward through discontinuities in these strata. These flow paths or *fingers* occupy a small part of the soil but account for most of the water movement and chemical transport." (Daniels 2004: 105)

The water movement Daniels describes is probably the cause of the patterns of reflected energy found in Figure 8. Water has percolated down from the surface, finding its way through the less restrictive rock and along fissures. The water movement left behind more porous, less homogenous rock, with many surfaces to reflect radar energy. The ancient Egyptians apparently took advantage of such places for their caves. Partially eroded rock, naturally, is easier to carve. That is fortunate for us, because it is easier to find the fingers than the caves themselves. In looking for more caves, we can start by looking for the "fingers" Daniels describes.

In Figure 9, we have plotted the returned energy profiles for the other two pairs of transects, 3-4 and 5-6. These run roughly east-west, and display evidence of the same kind of layering and fingers we found in the north-south pair 1-2. That means that the effect Daniels describes occurs not only along the edge of the terrace, but throughout its volume. Note also that Cave 6, which was not detected along Transects 1-2, appears clearly in the data from Transects 5-6. The cave may have been too close to the edge of the terrace to have been detected in Transects 1-2.

V: Conclusions

Wadi Gawasis, with its exposed profile and caves, offers a unique opportunity to combine geophysical experimentation with archaeological investigation. By measuring the individual strata, we were able to estimate the conductivity and permittivity of each. Using these data, we were able to predict that ground penetrating radar could detect the presence of caves.

Our field study revealed that the ancient Egyptians carved their caves into relatively soft rock. This rock had been weakened by water transport from the top of the terrace. The water transport produced porous "fingers" vertically throughout the terrace, and horizontally along preferential rock layers. The radar readily detected these fingers. The ancient Egyptians apparently took advantage of such places to excavate their caves, some of which were directly detected by radar.

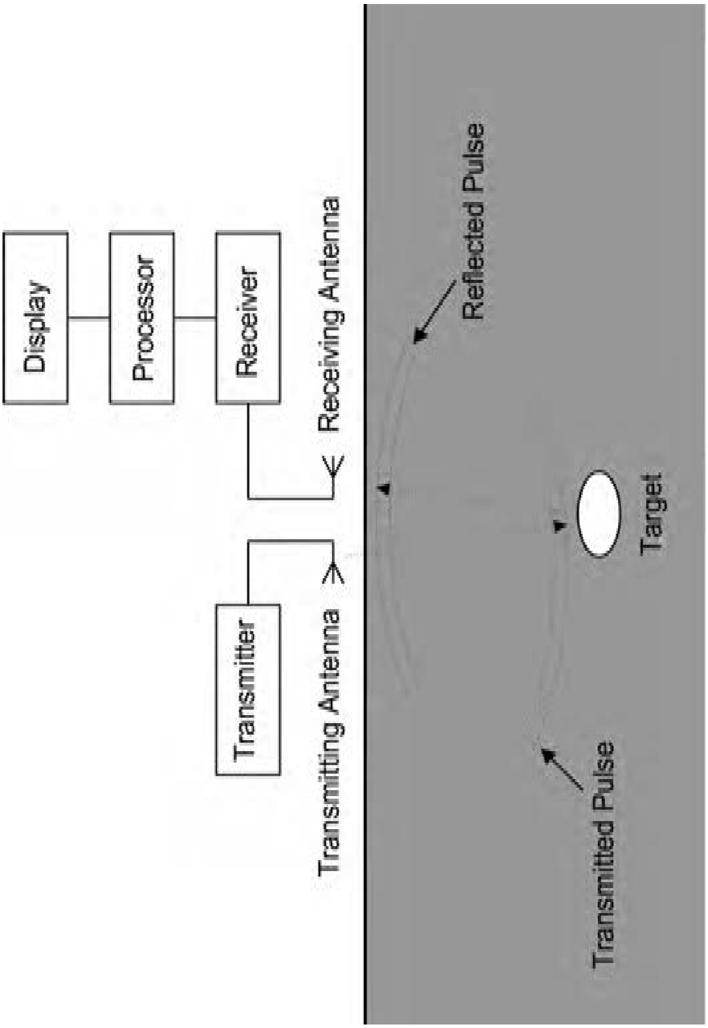


Figure 1: *Block diagram of a Ground Penetrating Radar system.*

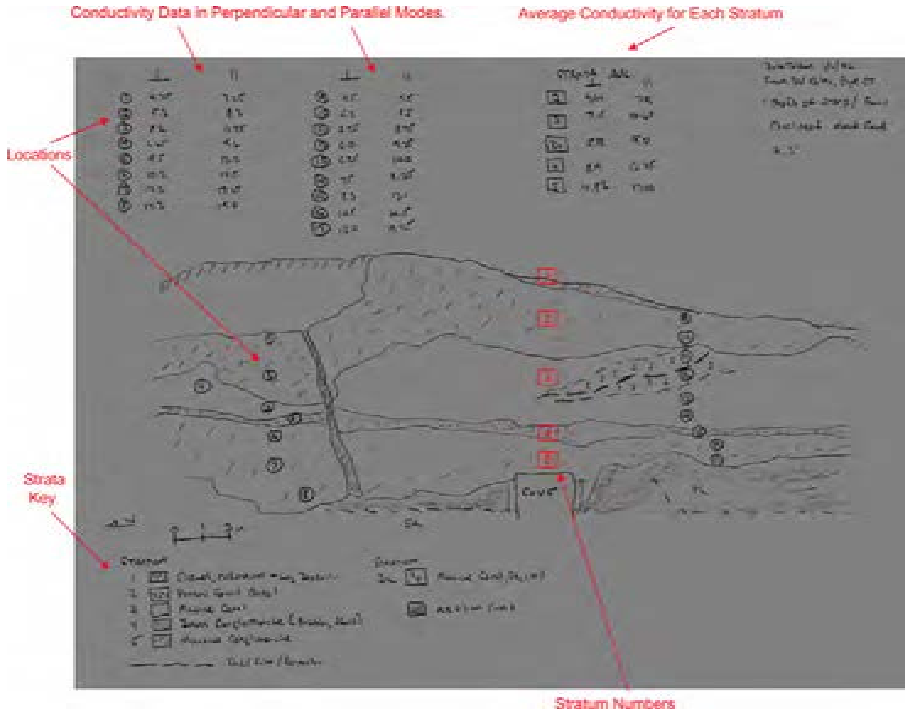


Figure 2: *Profile of the western slope of the terrace at Wadi Gawasis showing the locations where conductivity data was collected. Conductivity was measured using a Geonics EM-31 probe in both perpendicular (⊥) mode and parallel (‖) mode. (Credit: Dash as transcribed from Vining, field notes 2005-2006)*

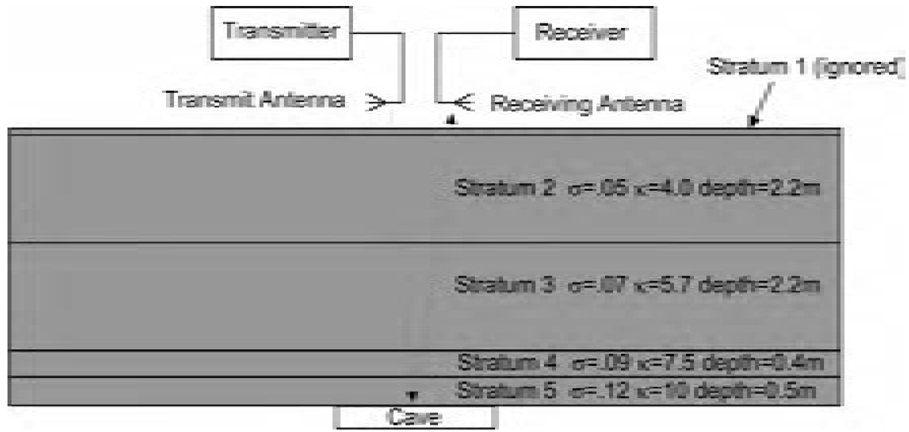


Figure 3: *A simplified model of the strata at Wadi Gawasis. A radar signal would travel through a thin surface layer and four subsurface layers of varying properties. It would reflect off an air-filled cave and return to the surface.*

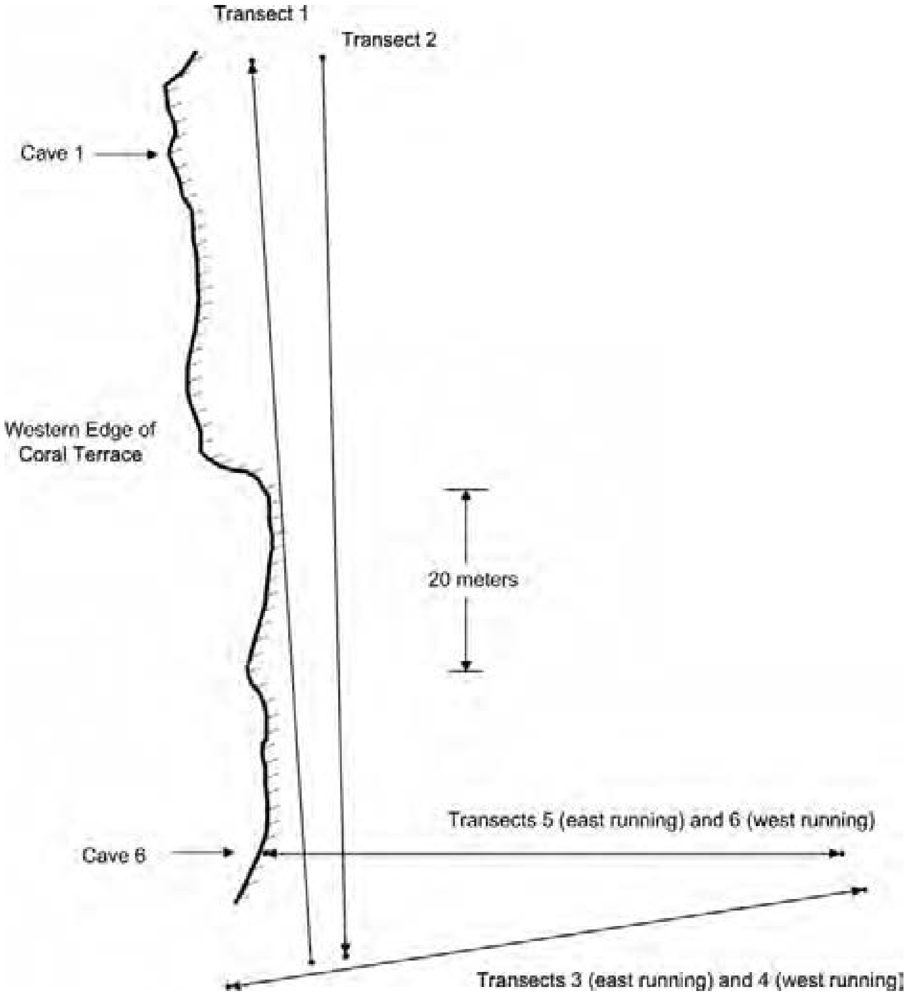


Figure 4: *During a 2006-2007 field season, Benjamin Vining conducted radar surveys along six transects near the western edge of the coral terrace. Transects 1 and 2 ran south and north. Transects 3 and 4 ran roughly east and west. Two more east-west transects, 5 and 6, were run just to their north. (Credit: Vining, field notes 2006-2007).*

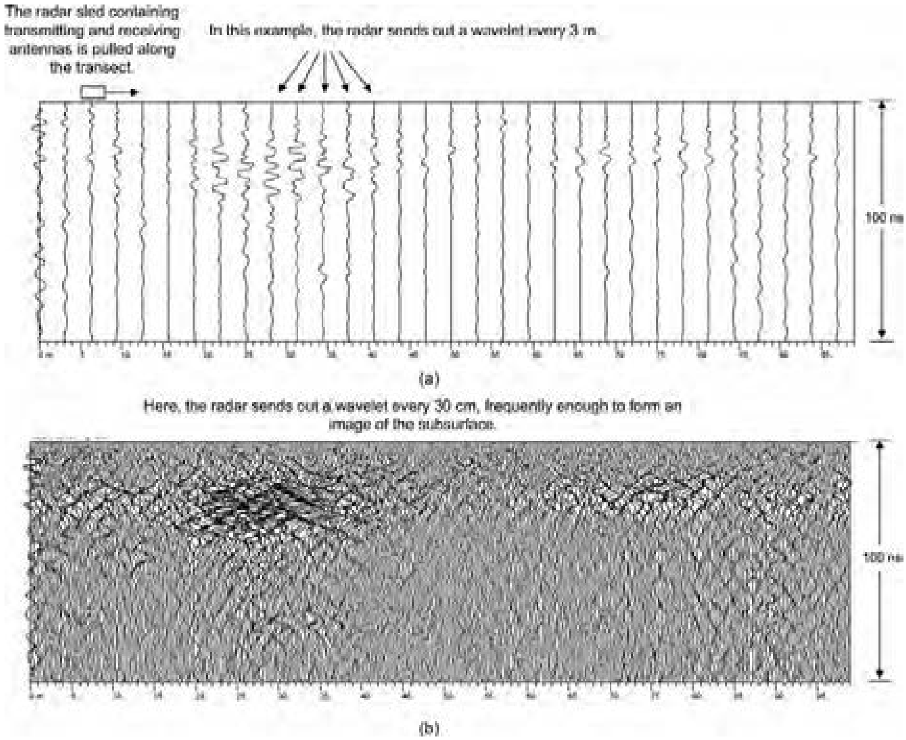


Figure 5: *A subsurface radar profile is recorded by dragging a radar sled along a predetermined pathway. The radar can be adjusted to transmit a radar pulse, or wavelet, at intervals as it is dragged along. The received signal, or trace, is recorded at each location. At the top (a), the interval between transmissions is about 3 meters. At the bottom (b), the interval is reduced to about 30 cm and an image begins to form.*

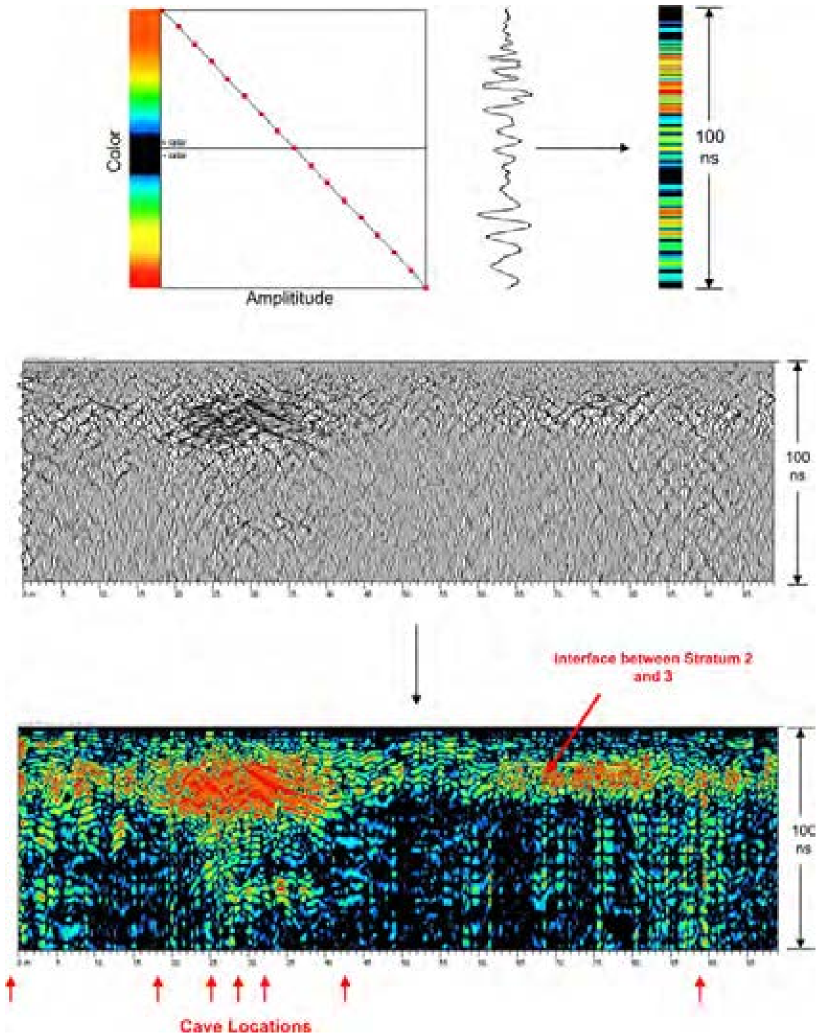


Figure 6: *An alternative presentation to the wiggle trace plot of Figure 5 is the radargram. The radargram at the bottom was produced by encoding each trace as a series of colored bands, as shown at the top. The bands represent the amplitude of a given trace at a given time. Placed side by side, these colored bands convert a wiggle trace plot to a radargram. Shown here is the radargram for Transect 1. The interface between Stratum 2 and 3 is clearly visible at approximately 25 nanoseconds, as is a hint of the caves at about 80 nanoseconds.*

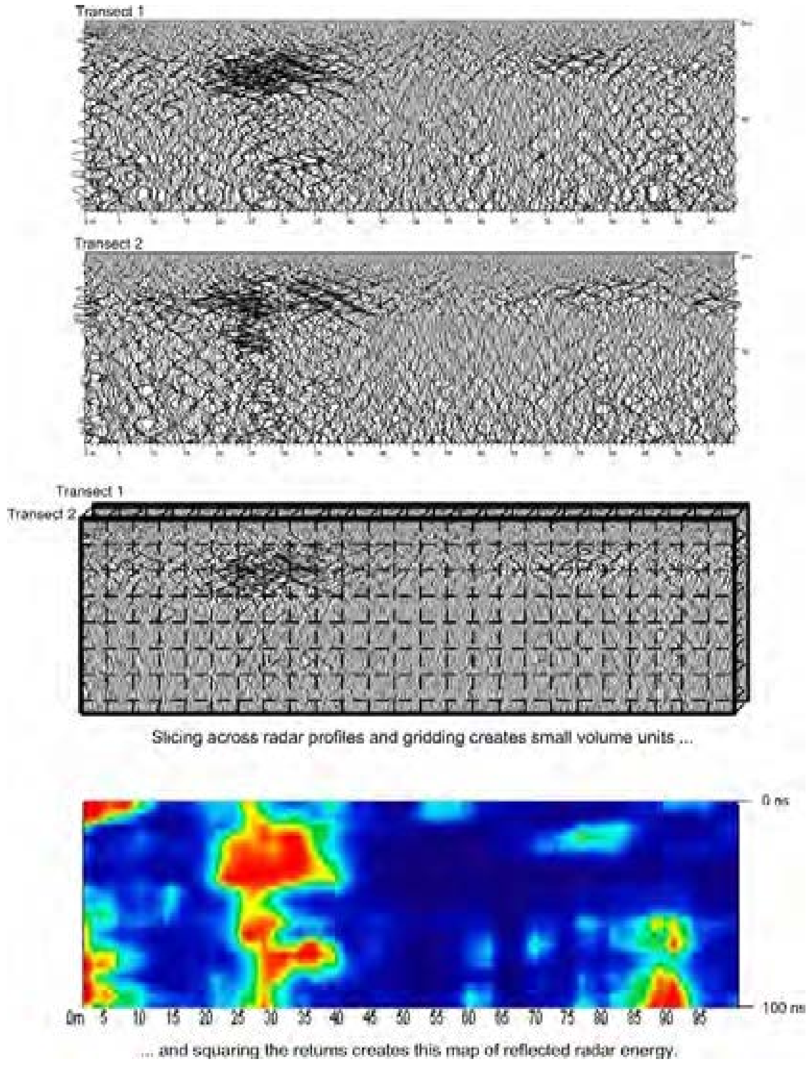


Figure 7: *More detail can be extracted by combining the information from two or more parallel transects using GPR Slice. The software electronically places two or more transects side by side and then slices and grids these to create small volume units. It then calculates the total energy reflected from each unit. The result is the profile shown at the bottom, which is a map of the relative reflected energy from a vertical slice of the subsurface.*

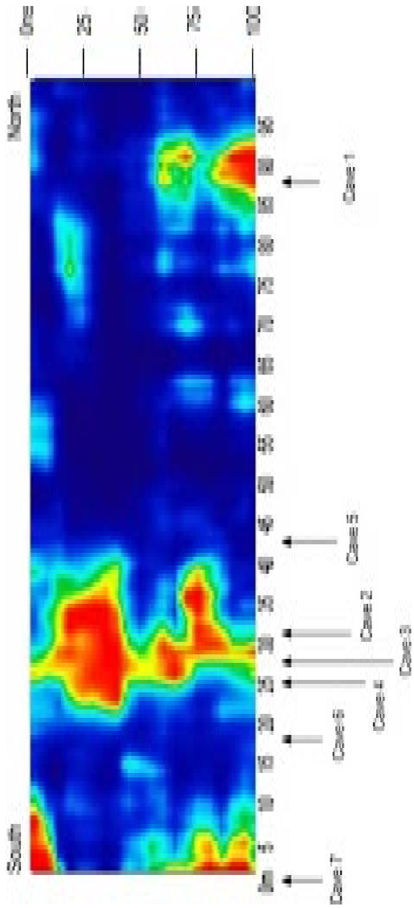


Figure 8: *The reflected energy profile along north-south Transects 1 and 2 correlates well with the locations of Caves 1, 2, 3, 4 and 7.*

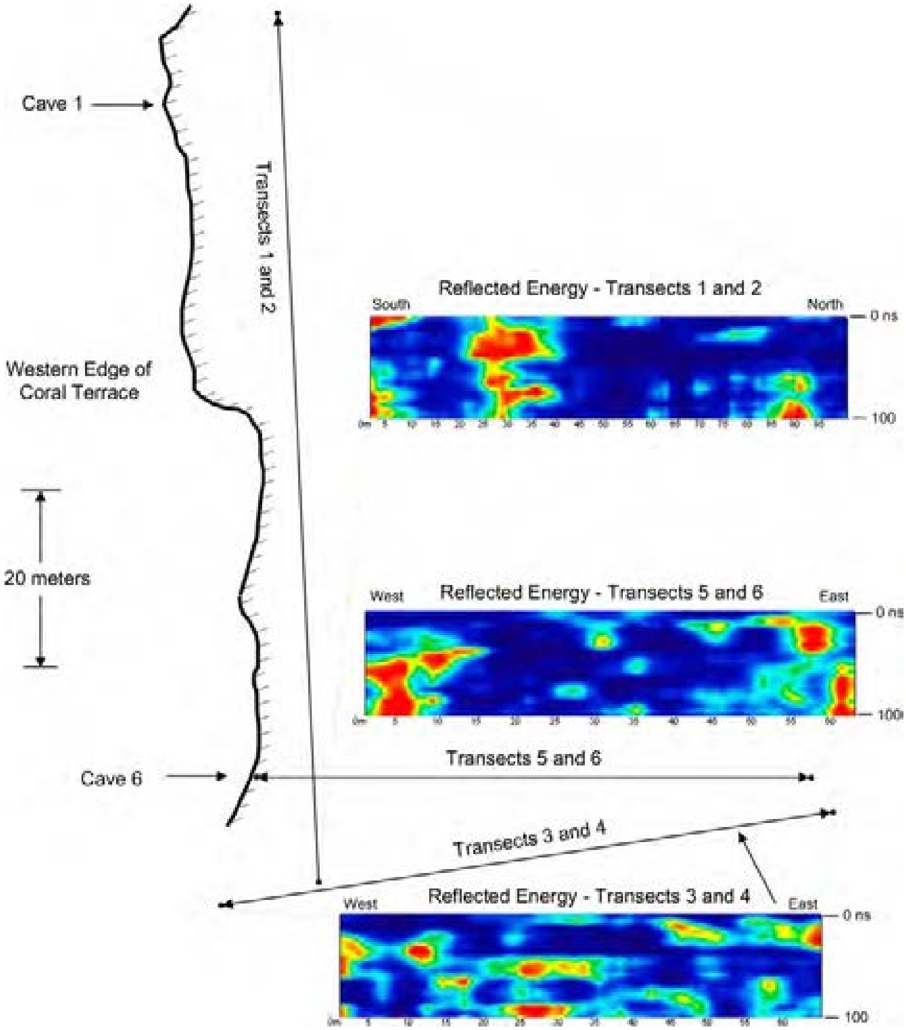


Figure 9: *The map of reflected energy for these three pairs of transects shows areas where the rock is less homogeneous and therefore more reflective. This heterogeneity is likely caused by the movement of water from the top of the terrace either downward or preferentially across certain soil layers.*

Grafica Elettronica srl, Napoli
Università degli studi di Napoli "L'Orientale"
prodotto nel mese di ottobre 2021

ISBN 978-88-6719-198-7