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Editors

HARBOR OF THE PHARAOHS TO THE LAND OF PUNT

Archaeological Investigations
at Mersa/Wadi Gawasis, Egypt, 2001-2005

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CONTENTS

ILLUSTRATIONS

TABLES

Chapter 1
Introduction

KATHRYN A. BARD AND RODOLFO FATTOVICH

In 2001 the University of Naples "L'Orientale" (UNO), 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 (UNO/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 project is part of long-term investigations, in progress at UNO 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).

Mersa/Wadi Gawasis was chosen as an area of investigation because this site was already identified in the mid-1970s as the possible Egyptian harbor from where seafaring expeditions were sent to the land of Punt (Sayed 1977).

1.1 The problem: Egyptian trade with Punt

From the Old Kingdom onward, the word "Punt" occurs frequently in Egyptian royal records, private inscriptions, and religious and literary texts as a geographical region from where frankincense and other exotic commodities were imported, as well as a mythical place from where marvelous things came to Egypt (see Kitchen 1982, 2001; Fattovich 1999). The reliefs and associated texts in the temple of Hatshepsut at Deir el-Bahri (ca. 1473-1458 BC), recording a naval expedition to Punt, provide the most detailed description of this region

(Naville 1898; Sethe 1905, 1961; Breasted 1906-7; Millet 1962; Smith 1962, 1965; Herzog 1968; Dixon 1969; Ratié 1979: 139-161; Phillips 1997; Desroches-Noblecourt 2002: 209-239).

Egyptian textual and representational evidence suggests that Punt was a mountainous region close to the sea, where dom palms grew (at least in the area that the Egyptians knew) and baboons were found. The inhabitants bred short-horned cattle and lived in hemispherical huts. Cultivation and exploitation of frankincense trees was controlled, and a simple form of metalworking was practiced. The people of Punt are represented with the same physical features as Asiatics, but with skin tones in brown or black. The society was hierarchical, with a "chief" and "queen" of equal status. According to Posener (1973), a chapel or shrine dedicated to Hathor-weret was built in the region. Long-horned cattle herders of a different ethnic group lived in the hinterland.

The Middle Kingdom "Tale of the Shipwrecked Sailor" describes the "king" of Punt as a huge, bearded snake, covered with gold and lapis lazuli (see Lefebvre 1945: 29-40), which suggests the association of rulers with a snake-god. New Kingdom sources distinguish the *wrw* (chiefs) of Punt from the *hekaw* (rulers) of Nubia, suggesting small-scale polities in the Punt region (Manzo 1999: 29, 35; see also Lorton 1974: 26-38, 60-68; Sachko 1998).

According to the Egyptian sources, Punt was located to the southeast of the upper Nile Valley, and was regarded as a distinct region from the other southern regions (Wawat, Kush, Medjat, Irem) that the Egyptians knew (e.g. Schiaparelli 1916; Zibelius 1972; Posener 1973). In the New Kingdom Punt encompassed four different districts, suggesting that Punt was in an exchange network with the Egyptians (see Zyhlarz 1958; O'Connor 1982; Edel 1983).

Contact with Punt was first recorded in the Old Kingdom (5th-6th Dynasties, ca. 2494-2181 BC). In the Middle Kingdom (ca. 2055-1650 BC) and New Kingdom (1550-1069 BC) contact was frequent. Trade with Punt ceased in the 20th Dynasty (ca. 1186-1069 BC). Some attempts to resume contact may have been made in the 26th Dynasty (ca. 664-525 BC) and Persian Period (27th Dynasty, ca. 525-404 BC), but there is no evidence that this occurred. In Greco-Roman times only mythological references to Punt are reported (see Säve-Söderbergh 1946: 8-30; Kitchen 1971, 1982, 1993).

The main products imported from Punt were frankincense, myrrh, electrum, gold and ebony. In the New Kingdom they were part of a larger list of imports from regions to the south of Egypt, including central and eastern Sudan (Manzo 1999). Bovines were imported at the time of Thutmose III (18th Dynasty; see Zeuner 1963: 239-240; Epstein 1971, I: 505-507). Frankincense and/or myrrh were imported as resin or as trees to be transplanted in Egypt (see Dixon 1969; for the identification of the resins, see Lucas 1937; Lucas and Harris 1989: 91-94; Serpico and White 2000a: 438-442, 2000b).

Information about quantities of imported goods is scarce, as the Egyptian sources provide only (exaggerated?) totals - to emphasize the power of the king. For example, in the temple of Hatshepsut at Deir el-Bahri, "millions, hundred-thousands, ten thousands, thousands, and hundreds of marvels of Punt" are recorded (see Naville 1898; Breasted 1906-7: IV, 112-114). There is also little information about the Egyptian exports. In the temple of Hatshepsut bread, beer, wine, meat, and flour are recorded as the primary exports from Egypt (Breasted 1906-7: IV, 108). Personal ornaments and probably weapons were also exported to Punt, as the chief of Punt in the Deir el-Bahri scene has a dagger similar to Middle Bronze Age types known in Egypt from the 12th to 18th Dynasties (e.g. Petrie 1917: 28-30, Plates 33-34). Egyptian containers with raw materials, such as jars and other vessels, were probably imported and then reused for storage or other purposes.

The reliefs in Hatshepsut's temple suggest that there were specific places where Egyptians and Puntites were directly in contact. The representation of a small shrine suggests that these places were under divine protection. Trade was probably practiced through barter, under the supervision of the chief of Punt and the officer leading the Egyptian expedition.

From Egypt Punt could be reached by river and overland routes, or by maritime routes (Säve-Söderbergh 1946: 8-30; Herzog 1968; Vycichl 1970; Kitchen 1971, 1993; Bradbury 1988, 1996; Manzo 1999; Desroches-Noblecourt 2002: 191-208; Meeks 2003; Espinel 2003). Although caravans were sent to Punt at the time of Pepy II (6th Dynasty; see Newberry 1938), products from Punt were probably obtained through intermediaries along the land routes (Breasted 1906-7: IV, 115-118; Posener 1973; Saleh 1973). Some Egyptian texts of the 18th Dynasty suggest South Arabian trade along the western Arabian peninsula in the mid-2nd millennium BC, but this is uncertain (see Saleh 1972).

Maritime expeditions were sent to Punt in the Old, Middle, and New Kingdoms: in the 6th Dynasty, reign of Pepy II (ca. 2278-2184 BC); in the 11th Dynasty, Mentuhotep II (ca. 2055-2004 BC), and Mentuhotep III (ca. 2004-1992 BC); in the 12th Dynasty, Senusret I (ca. 1985-1965 BC), Amenemhat II (ca. 1911-1877 BC), and Senusret III (ca. 1870-1831 BC); in the 18th Dynasty, Hatshepsut (ca. 1473-1458 BC), Amenhotep II (ca. 1427-1400 BC), and Amenhotep III (ca. 1390-1352 BC); and in the 20th Dynasty, Ramesses III (ca. 1184-1153 BC) (Kitchen 1982). In the New Kingdom Puntites also conducted trade with small boats, which are depicted in a Theban tomb that most likely dates to the reign of Amenhotep II (ca. 1427-1400 BC) (Davies 1935: 46-49). These boats consisted of a circular raft with a triangular sail.

Textual evidence dating to the Middle Kingdom indicates that maritime expeditions were complex enterprises and were possibly associated with the exploitation of mineral resources in the Eastern Desert. They may have involved a large number of men (over 3,000 according to some sources) and could be several months long (see Bradbury 1988; Sayed 2003). According to the textual and representational evidence, the ships had a flat hull, with short half-decks, a squared sail, and two steering oars. Rowers provided additional energy for navigation. These ships could have a crew of 120 or more men, including ordinary sailors, two officers (a pilot or bow-man and helmsman), and several "directors of a ship's contingent of rowers" (Jones 1995: 40-42, 53-56, 70-71; Vinson 1994; Jones 1995; Ward 2000).

The location of Punt and the routes there from Egypt have been debated for over a century (see Meeks 1997; Kitchen 2004) because the Egyptian textual and representational evidence only provides a general picture of Punt, the routes there, and the imported products (see Beaux 1990: 295-306; Pirelli 1993; Manzo 1999: 15-39; Harvey 2003). To the ancient Egyptians Punt was an exotic country *par excellence*, and the trade with Punt was embedded in royal ideology, used for propaganda of the power of the pharaoh, who could extend his dominion as far as the limits of the world (see Beaux 1990: 295-306; Liverani 1990: 240-246).

Many different hypotheses have been suggested to identify Punt with a specific geographical region, including Syria, Sinai, the Eastern Desert in Egypt and/or Sudan, the Upper Nile, the Eritrean-Sudanese lowlands, Eritrea, northern Somalia, the western Arabian Peninsula, southern Arabia, India, and East Africa (see Herzog 1968; Kitchen 2002, 2004). At present, the best candidates for the location of Punt are eastern Sudan and/or the northern Horn of Africa (i.e., northern Ethiopia, Eritrea, and the Eritrean-Sudanese lowlands), and southern Arabia (Kitchen 1982, 1993, 2004; Fattovich 1996b; Meeks 2003).

The land routes are most likely the same as later routes from Egypt to the African interior along the Nile Valley and/or to southern Arabia along the western Arabian peninsula (see Amin 1970; de Maigret 1997). The African routes along the Nile Valley may be mentioned in the sequence of southern districts in Tuthmose III's list of toponyms at Karnak (see Schiaparelli 1916; Zyhlarz 1958; Zibelius 1972; Priese 1974; O'Connor 1982). These routes may have included land caravan routes and a fluvial route along the Nile (see Bradbury 1996; Desroches-Noblecourt 2002: 191-208). Archaeological evidence from the region of Kassala (eastern Sudan) suggests that the Gash Delta was included in a network of contacts with Nubia and Egypt in the

late 3rd to mid-2nd millennia BC, and was probably a gateway to Punt from the Nile Valley (see Fattovich 1991, 1996).

The existence of a maritime route to Punt has also been debated for a long time (Meeks 1997). Most scholars agree that the Egyptians were navigating to Punt along the Red Sea as far as the coasts of present-day eastern Sudan/Eritrea and Yemen, based mainly on the marine fauna which are represented in the Hatshepsut reliefs (e.g. Säve-Söderbergh 1946; Kitchen 1971; Uphill 1988; Sayed 1989; Obsomer 1995). Some scholars, however, reject a maritime route, based mainly on textual evidence, suggesting that the ancient Egyptians were navigating only on the Nile, (see Herzog 1968; Bradbury 1996; Vandersleyen 1991, 1996; Desroches-Noblecourt 2002: 191-208). Archaeological evidence of ancient Egyptian maritime activity along the Red Sea in pre-Greco-Roman times is scarce.

The occurrence of shell and tortoise shell ornaments, from the Red Sea and/or Indian Ocean, in Badarian graves (ca. 4500-4000 BC) (see Krzyzaniak 1977: 76-77); rock drawings in the Eastern Desert of Naqada II oared boats (ca. 3500-3200 BC) (Zarins 1996; for a different interpretation of these drawings see Wilkinson 2003); images of conch shells carved on a colossal statue of the god Min from Coptos (dating to Dynasty 0/1st Dynasty); and sea shells, obsidian, gold and ebony from the northern Horn of Africa in royal tombs of the 1st and 2nd Dynasties (ca. 3000-2686 BC) suggest the inclusion of the Red Sea in an Egyptian interaction network in Predynastic and Early Dynastic times (see Petrie 1896: Plates 3, 4; Lucas and Harris 1989: 434-436; Zarins 1996; Wilkinson 1999: 170). To date, a few potsherds dating to the end of the Predynastic Period/Early Dynastic Period (ca. 3200-3000 BC), from a cave along the Wadi Sodmein near Quseir, are the only evidence of Egyptian presence on the Red Sea coastal plain in the late 4th - early 3rd millennia BC (Prickett 1979: 290-291).

Better archaeological and epigraphic evidence of Egyptian maritime activity along the Red Sea in pharaonic times has been recorded at Mersa/Wadi Gawasis (see Sayed 1978; Bradbury 1988) and Ayn Soukhna (Adb el-Raziq, Castel, Tallet and Ghica 2002; Abd el-Raziq, Castel and Tallet 2006a, 2006b). A few coastal sites have also been recorded in the Sinai, but their relation to seafaring expeditions is uncertain (see Mumford and Parcak 2003).

1.2 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 harbor of *Saww* from where seafaring expeditions were sent to Punt (Sayed 1977, 1978, 1979a, 1979b, 1980, 1983, 1999).

The discovery of a small shrine built with blocks of limestone and two possible anchors at the base in the central sector of the site was particularly significant (Sayed 1977). This structure was a memorial stela recording an expedition of the "Overseer of the audience-chamber" Ankhow to the land of Bia-Punt during the reign of Senusret I (ca. 1956-1911 BC). Another stela recording an expedition to Bia-Punt, of Senusret I's vizier Antifoker, was found in the western sector of the site (Sayed 1977). The expedition recorded in this text consisted of 3,756 men.

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.

Inscriptions uncovered by Sayed, recording expeditions during the reigns of Senusret I, Amenenhat II, Senusret II, and Senusret III, suggested that the site was used during the 12th Dynasty. Calibrated

radiocarbon dates of three samples taken from pieces of wood, rope, and halfa grass found at the site, however, suggested a longer use of the site, from the late 3rd to mid-2nd millennia BC (Sayed 1993: Figure 1).

After Sayed's excavations Alessandra Nibbi visited Mersa/Wadi Gawasis in the late 1970s, followed by Honor Frost's visit in 1991. 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. In 1994 Cheryl Ward (1996) conducted an underwater survey at Mersa Gawasis and did not find any ancient evidence.

1.3 The UNO/IsIAO and BU Research Project

The main goal of the UNO/IsIAO and BU project is to better understand a) the organization of seafaring expeditions along the Red Sea in pharaonic times, and b) the development of maritime trade to Punt.

The research has been 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 is the creation of a detailed map of the Mersa/Wadi Gawasis area, to facilitate archaeological heritage management of the site.

The multidisciplinary project consists 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 are

recorded in a database which can be used for archaeological heritage management by the Egyptian authorities (for the methodology see Bard *et al.* 2003).

After a preliminary visit to the site in March 2001, five field seasons have been conducted: in December 2001–January 2002, December 2002–January 2003, December 2003–January 2004, December 2004–January 2005, and December 2005–January 2006.

Preliminary reports have been published in Bard, Fattovich, Koch, Mahmoud, Manzo and Perlingieri 2001; Bard, Fattovich, Arpin, Childs, Mahmoud, Manzo, Perlingieri and Zazzaro 2004; Bard, Fattovich, Arpin, Childs, Lim, Perlingieri, Pirelli and Zazzaro 2005; Bard and Fattovich 2003-2004, 2004, 2005, 2006; Fattovich, Mahmoud, Manzo, Perlingieri and Zazzaro 2002, 2005; Fattovich, Mahmoud, Manzo, Perlingieri, Pirelli and Zazzaro 2003; Fattovich 2004, 2005, 2006; Fattovich and Bard 2006a, 2006b, 2006c; Manzo and Pirelli 2006; Perlingieri and Childs 2006; Ward 2006; Zazzaro and Abdel Maguid 2006.

Participants in the expedition fieldwork were: Trina Aprin (BU), geoarchaeologist (2003-04, 2004-05, 2005-06); Kathryn Bard (BU), archaeologist (2001, 2003-04, 2004-05, 2005-06); Alfredo Carannante (University "Suor Orsola di Benincasa," Naples, Italy), malacologist (2005-06); S. Terry Childs (US National Park Service, Washington DC, USA), archaeologist and archeometallurgist (2003-04, 2004-05, 2005-06); Glen Dash (BU), geophysicist (2005-06); Andrea D'Andrea (UNO), surface surveyor (2005-06); Rodolfo Fattovich (UNO/IsIAO), archaeologist (2001, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06); Rainer Gerisch (Free University, Berlin, Germany), paleobotanist (2005-06); Magaly Koch (BU), geologist (2001); Chen Sian Lim, (National University of Singapore, Singapore), archaeologist (2004-05); Elsayed Mahfouz (University of Assyut, Assyut, Egypt), Egyptologist (2002-03, 2005-06); Abdel Moneim Mahmoud (Ain Shams University, Cairo, Egypt), geomorphologist (2001, 2001-02, 2002-03, 2003-04); Andrea Manzo (UNO), archaeologist (2001, 2001-02, 2002-03, 2003-04, 2005-06); Giuseppe Morganti

(Soprintendenza Archeologica di Roma - IsIAO, Rome, Italy), architect (2005-06); Mohammed Mustafa Abdel Maguid (SCA, Alexandria, Egypt), nautical archaeologist (2005-06); Carla Pepe (University "Suor Orsola di Benincasa," Naples, Italy), archaeologist (2005-06); Cinzia Perlingieri (UNO), archaeologist, ceramic analyst and illustrator (2001, 2001-02, 2002-203, 2003-04, 2004-05, 2005-06); Rosanna Pirelli (UNO), Egyptologist (2002-03, 2004-05, 2005-06); Gwendaline Plisson (Sorbone, Paris, France), archaeologist (2005-06); Fathma Selim (Qena University, Qena, Egypt), Egyptologist (2001-02); Abdel Moneim Sayed (University of Alexandria, Alexandria, Egypt), Egyptologist (2001-02); Stefano Tilia (Trerre, Rome, Italy), surface surveyor (2001-02, 2002-03, 2004-05, 2005-06); Benjamin Vining (BU), geophysicist (2005-06); Cheryl Ward (Florida State University, Tallassee, USA), nautical archaeologist (2005-06); Chiara Zazzaro (UNO), archaeologist (2001-02, 2002-03, 2003-04, 2004-05, 2005-06).

The Supreme Council of Antiquities, Cairo, was represented by Saad Ekhet Abd Elhafz (2001-02), Elal Mahmud Ahmed (2002-03, 2004-05), Moamen Saad (2003-04), and Amer Gad El-Karim (2005-06), Quseir Inspectorate, Quseir.

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Chapter 2
The Site

KATHRYN A. BARD, RODOLFO FATTOVICH, MAGALY KOCH AND ABDEL MONEIM MAHMOUD

2.1 Location and description of the site

K. A. Bard and R.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 (Figure 1).

A paved road along the coast and a railway, which cross 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. Excavation in the western sector demonstrates the preservation of stratified man-made features that have been protected by the collapse of coral from the terrace and accumulation of wind-blown sand (see Sayed 1983: 27-28).

Above the wadi, on the desert pavement of the Middle Pleistocene coral terraces, lithics and debris of a flake industry are found in many places. This was an optimal environment for early Holocene hunter-gatherer-fishers. On the northern edge of the western terrace two concentrations of lithics have been found (26°34"03'N, 34°01"25'E; 26°33"56'N, 34°01"29'E). The tools consist of large flakes, perhaps of Levallois type.

On the southern coral terrace above the Wadi Gawasis, to the west of the railroad (26°33"05'N, 34°02"08'E), are three or four stone mounds, ca. 5-6 m in diameter, and a few circular features. In the same area some unfinished quartz beads were also found on the surface.

Several sites are also located on the terraces to the west of the railroad between the Wadi Gawasis and Wadi Gasus. They are, from south to north:

1. A cluster of five rectangular features, ca. 1.5 m x 0.5 m in area (26°33"37'N, 34°01"44'E). Three of these features are oriented approximately along a north-south axis, and two have a northwest-southeast axis. These features are probably graves, and their orientation suggests pre-Islamic ones.
2. Two possible tumuli, ca. 5–6 m in diameter (26°3"42'N, 34°01"42'E).
3. A disturbed mound of coral blocks (26°33"48'N, 34°00"06'E), most likely the Roman watch-tower that Sayed recorded in 1975 (see Sayed 1977: 149).

Another Roman watch-tower(?) was also recorded on top of a terrace outcrop along the Wadi Gawasis, ca. 400 m to the west of the site.

At present the region is less arid than expected, with extensive evidence of a playa from a recent (1999) flash flood. Gazelles are still seen in the wadi today and would have been more numerous in the past.

2.2 Topography

K. A. Bard and R. Fattovich

Archaeological remains are visible on top, along the slope, and at the base of the coral terrace.

Sixteen stone mounds were recorded and excavated by Sayed along the eastern edge of the coral terrace near the seashore, and at the southwestern and western edges of the terrace, near the Wadi Gawasis and the playa (Sayed 1978). Eleven mounds (Features 1-11) are now visible in the eastern sector of the site near the seashore. Three main types of structures have been recorded:

1. Structures with internal chambers, made with coral blocks and slabs of conglomerate stone, and surrounded by a gravel mound, which partially covers the coral blocks and slabs. Limestone fragments, most likely from anchors, were often associated with these structures (Features 2, 3, 5, 6, 7, 8, 9, and 10).
2. Two structures made with coral blocks (Features 1 and 11). A concentration of large conch shells was associated with one of them (Feature 1), which had horizontally placed tree branches within the masonry.
3. A circular enclosure of coral blocks (Feature 4), inside of which was a small circular chamber.

In the central sector of the site a shrine built with anchors, which was associated with a 12th Dynasty stela of Ankhow, was excavated by Sayed in 1976 (Sayed 1977). This stela recorded an expedition to Punt, but it has subsequently suffered much damage. Other shrines were possibly located near the seashore in this sector of the site, as a badly preserved, inscribed stela was found in the rubble along the railway (Fattovich, Mahmoud, Manzo, Perlingieri, and Zazzaro, 2002).

Four circular structures made with coral blocks are located in the western sector of the site. Most of these structures were associated with small inscribed stelae dating to the Middle Kingdom, and sometimes with arrangements of limestone anchors. These structures have been interpreted as ceremonial monuments of 12th Dynasty maritime expeditions (Sayed 1977, 1978, 1979a, 1983). They have been re-investigated by the UNO/IsIAO and BU expedition in order to better understand their construction and function.

Small circular pits, ca. 2.0-2.5 m in diameter, are scattered on top of the terrace, with two main clusters in the central and northern sectors of the site. On the surface these pits are encircled by concentrations of small pebbles. Their use is uncertain. Similar

features are visible in the area of the Roman station along the Wadi Gasus (see Bard, Fattovich, Koch, Mahmoud, Manzo, and Perlingieri 2001). Similar pits were also excavated in the hinterland of Quseir el-Qadim, but were not associated with any artifacts (see Prickett 1979).

Concentrations of Middle Kingdom potsherds have been found on top of the terrace in the central and western sectors of the site. Excavation of one of these concentrations to the west of the railroad suggests that they are the remains of light structures with thin post-holes, ca. 5-6 cm in diameter, which sometimes still contained fragments of a wooden pole (Fattovich, Mahmoud, Manzo, Perlingieri, and Zazzaro 2002). A wall made with coral blocks, at least 10-15 m long, is also visible along the top of the terrace along the southern edge, in the southwestern sector of the site.

In the mid-1970s Sayed excavated a possible storeroom on a flat area along the slope of the southwestern side of the terrace facing the Wadi Gawasis, where he found much Middle Kingdom pottery (Sayed 1979b). A mound at the base of the slope, consisting of potsherds probably discarded from this area, contained large fragments of bread molds and jars, sometimes with short hieratic inscriptions or engraved pot marks.

Rock-cut caves of different sizes, most likely used as storerooms, were found along the slope of the western edge of the terrace. At the base of the western terrace structures associated with bread molds, pottery, and a small amount of copper have also been recorded (Bard, Fattovich, Koch, Mahmoud, Manzo, and Perlingieri 2001; Bard, Fattovich, Arpin, Childs, Mahmoud, Manzo, Perlingieri, and Zazzaro 2004).

Workshops possibly for the manufacture of lithic tools are located on the top of the terrace in the northern and central sectors (Fattovich, Mahmoud, Manzo, Perlingieri, and Zazzaro 2002). Evidence of unfinished limestone anchors was also found by Sayed at the base of the southwestern terrace (Sayed 1979b).

2.3 Geology and Geomorphology

A. M. A. Mahmoud

A preliminary geological survey in 2001-02, 2002-03, and 2003-04 was aimed at investigating the geomorphologic and geological events of the Late Pleistocene and Holocene and their implications for human settlements.

The area is covered with Middle to Late Pleistocene marine and gravel terraces, which run parallel to the shoreline, and are cut by the bed of the wadi (Figure 2). The marine terraces consist of coralline algal limestone with pelecypods and gasteropods, which were created through eustatic sea level changes, coastal erosional processes, and tectonics. A series of seven terraces was recognized. The lowest one (ca. 2-4 m ASL), dating to the Holocene, is located directly along the seashore. The highest ones (ca. 100-140 m ASL) are located about 2-3 km inland and are Pliocene to Pleistocene in age.

The second terrace (ca. 4-6 m ASL), dating to the Terminal Pleistocene, is where most of the excavations have been conducted. The terrace covers 2 m of conglomerates, consisting of coarse-grained sand at the base and grit, to bladed gravel at the top. The gravel is mainly composed of igneous, volcanic and sedimentary rocks. The igneous gravels are granite, trachyte, and pegmatites. The volcanic rocks are basalt and rhyolite. The sedimentary rocks are mainly chert. Patches of tufa deposits are encountered near the site. These deposits are snow-white calcareous vesicular to spongy-like sediments underlined by poorly sorted, fluvial yellowish-brown sand. This suggests fresh water, which could be contemporary with the site.

2.4 Remote sensing

M. Koch

A Landsat 5 Thematic Mapper (TM) image of January 1, 1987 was utilized for studying the geological and geomorphologic setting of Wadi Gasus and Wadi Gawasis. Interpretation of the image

processing results was aided by a geological map of the area at a scale of 1:100,000 (EGSMA 1987), as well as topographic maps at a scale of 1:50,0000 (EGSMA 1989). Localized field observations were also conducted for verifying image processing results. Several image processing routines were applied with the aim of highlighting major landscape units, which have been shaped by the recent geologic and tectonic history of the area.

The Red Sea basin region underwent a sequence of tectonic activities leading to the opening of the Red Sea as a consequence of the African plate moving away from the Arabian peninsula. Continental rifting began approximately 25 million years ago and was accompanied by uplift, subsidence, extension and normal faulting along the rift margins. The thinning of the continental crust resulted in the emplacement of igneous rocks and the subsequent creation of oceanic crust at the rift center. Isostatic mass compensation caused the rift margins to undergo uplift and erosion and subsequent subsiding and tilting of faulted blocks on both sides of the rift. Thus, landscape evolution in the Red Sea area is strongly influenced by rift tectonics and climatic changes. The last pluvial period ended five million years ago. At present, the Red Sea Hills form a rugged mountain range of Precambrian igneous and metamorphic rocks which are overlain by Mesozoic and Cenozoic marine sediments along the coastal area. Numerous wadis are deeply incised in the Arabian-Nubian Massif and some of them constitute natural routes connecting the Red Sea coast with the Nile Valley.

The selection of image processing methods included standard image enhancement procedures (contrast stretching and sharpening), high-pass filtering and principal component analysis. A color composite of bands 7, 4, and 2 (displayed as red, green, and blue) depicts Cretaceous, Tertiary and Quaternary geological rock formations as pale colored units with little contrast (Figure 3). The exception is a relatively dark-colored rock outcrop belonging to the Upper Proterozoic Hammamat formation at the upper reaches of Wadi Gawasis. The Quaternary rock formation consists of wadi deposits,

sand, conglomerates and coral reefs, which form numerous terraces. Terrace surfaces are generally covered by desert pavement rocks, which render them a greyish colored appearance on the image composite. Tertiary rocks appear in light blue colors due to high reflectance values of chalk, limestone and gypsum composing this unit. In contrast, Cretaceous rocks show light reddish colors due to the presence of iron rich sandstone and clastics.

Both Wadi Gasus and Wadi Gawasis cut through the above mentioned rock sequence and run parallel to each other for most of their courses. Wadi Gasus generally has a wider wadi floor surrounded by eroded terraces and hills, whereas Wadi Gawasis shows a narrower wadi bed flanked by more pronounced escarpments. The width of Wadi Gawasis changes abruptly at the contact between the Upper Proterozoic (Hammamat) and Cretaceous rock formations. This contact is probably due to a fault system running parallel to the rift, which has caused uplifting of the western (older) Hammamat block and subsidence of the eastern (younger) Cretaceous block. In geomorphological terms, Wadi Gawasis seems to be younger than Wadi Gasus because its wadi course is generally shorter and narrower than the latter one and is flanked by well defined escarpments. This is an indication of the erosive activity of Wadi Gawasis, which has not yet reached the stage of maturity as in Wadi Gasus, where erosion has ceased giving way to the deposition of wadi infill materials. It could well be that the younger wadi is being tectonically controlled by an active fault belonging to the transform fault system of the Red Sea rift. This could have important implications in terms of groundwater occurrence since groundwater flow in bedrocks is restricted to open and tectonically active faults, such as normal (extensional) and transform (strike slip) faults. However, this point needs further clarification by a detailed geophysical investigation.

A second image processing procedure consisted in applying a high pass filter to band 5 of the TM image in order to enhance textural features (Figure 4). The filtered image was combined with the original image by adding 80% of the original values back to the filtered image.

This enables a better visual interpretation of textural differences between landscape components, since tonal variations due to topographic effects are added back to the filtered image. On this image, wadi floor deposits appear as smooth surfaces and lithologic units show a more or less well dissected surface. Nevertheless, there are some minor differences visible between the major lithologic units. Quaternary formations (mainly terraces) show a finer texture than Tertiary limestone outcrops, which have generally a less developed drainage system. Thus, this image product emphasizes changes in surface roughness between the different landscape components.

Finally, a principal component analysis was conducted to increase the color contrast between the lithologic units, wadi deposits, as well as beach deposits. The first three components contain statistically uncorrelated information that can be combined in a color composite image (Figure 5). This procedure enhances even subtle variations in surface composition that are usually not visible when using standard band combinations. The principal component composite shows main rock formations in contrasting colors (Quaternary rocks in purple/blue; Tertiary rocks in yellow; Cretaceous rocks in red, and Upper Proterozoic rocks in green). It is interesting to note that upstream wadi deposits have a color similar to the Upper Proterozoic rock formation, whereas downstream the color becomes more similar to the Quaternary deposits. As the stream power diminishes toward the coast the wadi bedload becomes less gravelly and more sandy. The cobbles and gravels are mainly older crystalline rocks from the Red Sea Hills, and the finer particles represent younger sedimentary rocks. Another interesting observation on this principal component image is that playa deposits at the wadi outflow and coral reefs along the coast are clearly visible. Channels breaking through the coral reefs are located at the mouth of Wadi Gasus and Wadi Gawasis, suggesting that these wadis may have once been suitable for boats entering the natural harbors when the sea level was higher.

Chapter 3
Fieldwork

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Fieldwork at Mersa/Wadi Gawasis in the 2001-02 to 2005-06 field seasons consisted of three main components: 1) archaeological excavations and mapping, 2) geophysical survey, and 3) geoarchaeological investigations.

Archaeological excavations were conducted in the following areas of the site: 1) eastern terrace, 2) western terrace, 3) southern slope, 4) western slope, and 5) western slope base. Most of the site to the west of the railroad was mapped, and over 3000 points were recorded in a database in order to generate a 3D map of the site.

The geophysical survey covered the western edge of the fossil coral terrace, where man-made rock-cut caves are located, the base of the southwestern slope of the terrace along the wadi bed, and the base of the western slope along the edge of the wadi.

Geoarchaeological test excavations were conducted on the top of the western terrace and at the base of the southwestern and western slope of the terrace.

3.1 Archaeology: methodology and fieldwork procedures

K. A. Bard and R. Fattovich

Archaeological excavations were conducted using the "Stratigraphic Unit" (SU) procedure (see Harris 1989) within excavation units of 10 m x 10 m, which were divided into squares of 2 m x 2 m.

"Soil strata" and "features" were the basic components of the stratigraphic sequence. Soil strata consist of the different kinds of soil

deposited as a result of both human and natural activity through time. Soil strata over 20 cm in thickness were excavated by distinguishing artificial levels, ca. 5-10 cm deep, in order to record their internal stratigraphy. Features are all man-made structures. The identified features were recorded separately and artifacts were recorded with reference to each feature rather than squares. The vertical and horizontal relationships of the Stratigraphic Units (SU) in each excavation unit are represented in a "Harris Matrix."

Excavated sediment was sieved with a 0.5 cm or 0.2 cm mesh. All artifacts and ecofacts, together with samples of charcoal for radiocarbon dating, were collected. The collected materials were stored in the storehouse of the Supreme Council of Antiquities in Qift.

TLS and differential GPS were used in the surface survey to generate a 3D map of the site.

3.2 Excavations

K. A. Bard, S. T. Childs, R. Fattovich, E. Mahfouz, A. Manzo, C. Perlingieri, R. Pirelli, C. Ward, and C. Zazzaro

Thirty-seven excavation units were opened on the top of the eastern and western terraces, the southern and western slopes of the terrace, and the base along the southern and western slopes of the terrace (Figure 6).

2001–02: Three circular structures (WG 1, WG 4-5, and WG 9), three stone structures (WG 3-6, WG 7, and WG 8), and one superficial concentration of pottery (WG 2) were investigated on top of the western terrace.

2002–03: Excavations were conducted along the southern terrace slope (WG 10, WG 11, WG 13, WG 14), and on the eastern terrace near the seashore (WG 12).

2003–04: Nine excavation units were opened along the western terrace slope (WG 16, WG 17, WG 19, WG 21, WG 22), the southern terrace slope (WG 15, WG 18), and on the eastern terrace (WG 20, WG 23).

2004–05: Five excavation units were opened along the western terrace slope and at the base of the western slope (WG 24, WG 28, Cave 1, WG 25/26/27), as well as on the eastern terrace (WG 29). Along the western terrace slope an isolated man-made cave (WG 28, Cave 1) and an area of three man-made caves (WG 24, Caves 2, 3, 4) were discovered. A geoarchaeological test trench (WG 30) was also opened at the edge of the former playa where gypsum accumulations were visible on the surface.

2005–06: Excavations of WG 24, Cave 2, WG 19/25/26/27, and WG 29 were enlarged along the western terrace slope, at the western terrace base, and on the eastern terrace, respectively. Two more caves (Caves 5, 6) were discovered in the area of WG 24, Cave 2 and initial investigations of these caves were conducted. Three units were opened along the western terrace slope and at the base of the terrace (WG 31, 33, 34). Two test pits (WG 35 and WG 36) were excavated at the base of the southern slope of the coral terrace, along the shore of the wadi, where anomalies were recorded in the magnetometer survey. One test trench for geoarchaeological investigations (WG 37) was excavated at the base of the colluvial slope.

WG 11, WG 13, and WG 14 were test excavations of sand deposits along the southern slope of the terrace. These deposits were the result of recent accumulations of sand and contained few archaeological materials, which had most likely been washed down from the nearby terrace.

Reports of each field season, with detailed descriptions of the excavations, are published on-line at the website www.archaeogate.org.

3.2.a Excavations, eastern terrace

Eastern terrace, WG 12[1]

This excavation unit was opened to investigate a structure (Feature 8), which had already been partially excavated by A. M. Sayed. This

[1] Excavation was conducted by A. Manzo and C. Zazzaro.

structure consisted of an oval mound of gravel, ca. 6-7 m x 5.5-6 m in area, which encompassed two small contiguous chambers, built with vertical and horizontal slabs of conglomerate stone along an east-west axis.

Six stratigraphic units were distinguished. SU1 and SU3 were strata of eolian sand and gravel, respectively. SU2 was the natural bedrock of the fossil coral terrace where the structure was erected and partially cut. SU4 and SU6 were the architectural components of the structure, and SU5 was a man-made pit.

Excavations demonstrated that the structure originally consisted of two small chambers made with vertical slabs of conglomerate stone. The two chambers were 1.2 m x 1 m and 1 m x 1 m in area; the stone slabs were ca. 0.85-0.9 m high. The eastern one was open, facing east. The vertical slab, which closed the chamber to the west, was cut to fit the side slabs. The western chamber was intentionally filled with gravel. Large fragments of stone anchors and a limestone slab were found in a pit in the floor of this chamber. These finds included fragments of the rounded top of a limestone anchor (37.5 x 26 x 15 cm), with a groove for the rope on one side, a fragment of a possible grinding stone in porous rock, and a well dressed limestone slab (55 cm x 55 cm x 10 cm). The stone slab walls were reinforced with coral blocks, which formed a circular arrangement and was covered with the gravel of the mound. Coral blocks were also used to support the base of the mound. These conglomerate stone slabs, coral blocks, and gravel had all been collected locally, from on top of the coral terrace and along its edges, along the bay and the wadi (Figure 7).

Small pieces of fossil coral, limestone, and conglomerate stone (with an average size of 10-25 cm x 6-15 cm), some conch shells, and a few basalt pebbles were mixed with the gravel of the mound. Most likely, the basalt pebbles had been transported down the wadi, as they originate in the Basement Complex several kilometers inland.

Concentrations of potsherds and fragments of limestone were found on the terrace near the corners of the chambers, which suggests that they were intentionally placed there before the mound was

erected. The location of these materials on the top of the terrace confirms that this was the surface on which the structure was built.

The ceramics associated with this structure date to the late 12th – 13th Dynasties.

Eastern terrace, WG 20[2]

This excavation unit, 12 m x 14 m in area, was to investigate a stone structure (Feature 4) that had already been partially excavated by A. M. Sayed in the mid-1970s and was later damaged by more recent human activity.

Nine Stratigraphic Units were distinguished. They included: a deposit of loose, soft eolian sand over the whole unit and the surface of the coral terrace on which the structure was built (SU1, SU2); an oval enclosure inside of which was a horseshoe-shaped stone arrangement (SU3, SU5); two possible post-holes, ca. 20 cm in diameter and 30 cm deep, and ca. 16 cm in diameter and 27c m deep (SU7, SU8); a rectangular hole, 45 cm x 22 cm and 25 cm deep, with an arc-shaped edge inside the hole and a few fragments of limestone at the bottom, immediately to the north of the opening of the enclosure (SU9); and two pits, 1.5 m x 1.2 m in area and 1.5 m deep, and 1.0 m x 0.7 m in area and 40 cm deep (SU4, SU6), which were most likely from Sayed's excavations as they had been refilled and covered with a stratum of straw.

The oval enclosure was built with rocks of fossil coral and conglomerate stone. Ca. 0.5-1.0 m thick and 0.2-0.4 m high, it delimited an area of ca. 12 m x 10 m, with an opening to the east-north-east. The horseshoe-shaped stone arrangement was ca. 1.0 m x 1.2 m in area, with an opening to the east in the southwestern sector, abutting the enclosure wall. Several post-holes were found inside the enclosure (Figure 8).

The plan and construction technique of this structure are different from those of other structures in the same sector of the site, e.g.

[2] Excavation was conducted by R. Fattovich and A. Manzo.

Feature 6 and Feature 8. No slabs of conglomerate stone were used in this structure, which was only built with coral rocks. The inner horseshoe-shaped arrangement was built after the oval enclosure. Fragments of limestone from an anchor found inside a hole near the opening of the enclosure suggest that this structure was related to maritime activity.

Only a few potsherds, which date to Middle Kingdom, were associated with this structure.

Eastern terrace, WG 23[3]

This excavation unit was opened to investigate a structure (Feature 6) that had already been partially excavated by A. M. Sayed. The feature consisted of an oval structure of coral rocks, ca. 6-7 m x 4.5 m in area, with a possible opening and a small chamber built with slabs and blocks of stone at the east. Slabs of conglomerate stone were also visible on the surface.

Nine stratigraphic units were distinguished. They included: strata of eolian sand and ashy soil (SU1, SU9); the bedrock of the coral terrace, where the structure was erected (SU2); architectural components of the structure (SU3, SU4, SU5, SU7); and man-made pits and post-holes (SU6, SU8, SU10, SU11).

Excavations demonstrated that this structure consisted of two small chambers built with vertical slabs of conglomerate stone surrounded by a mound of coral rocks and conglomerate stone. The floor of both chambers was the surface of the fossil coral terrace on which the structure was built. Fragments of limestone, conch shells, potsherds, and small branches of wood were found in the mound. In front of the entrance of the eastern chamber a small, shallow hearth and a concentration of potsherds were excavated (Figure 9).

The eastern chamber of this structure, 1.8 m x 1.0 m in area, was open to the east. A limestone anchor was beneath (and was partially covered by) the south wall of conglomerate stone, near the chamber

[3] Excavation was conducted by A. Manzo.

entrance. The anchor (60 cm long and 40 cm wide) had a groove and a circular hole for rope at its rounded top, and a square hole near the flat base. The western chamber of the structure, however, had been greatly damaged. This chamber was closed off with no entry, and a small round hole, which was empty, had been cut in the floor.

Another almost whole anchor was found by A. M. Sayed in 1976 and was left near this excavation. The anchor, broken in several fragments, still exhibited a circular hole and a groove for the rope at the top, and a possible square hole near the flat bottom. Most likely, this anchor was originally symmetrical to the one still *in situ* near the entrance of the eastern chamber.

The ceramics associated with the structure date to the late 12th - 13th Dynasties.

The structures in WG 12 and WG 23 were constructed in different ways despite the similarity of the monuments. Both structures consisted of two small chambers built with vertical conglomerate slabs inside a mound of limestone fragments, shells, potsherds, and other materials. In WG 12 a pit was found and the walls of the chambers were sustained with a mound of coral and conglomerate blocks. In WG 23 no pit was found and the mound was made of gravel covering an arrangement of coral blocks. These differences are most likely due to the different dates of the monuments. WG 12 was built in the early Middle Kingdom, while WG 23 dates to the late Middle Kingdom.

Eastern terrace, WG 29[4]

This excavation unit was excavated during the 2004-05 and 2005-06 field seasons at the edge of the fossil coral terrace along the seashore, in order to investigate a roughly circular mound of sand and coral rocks (Feature 1). This structure had already been partially excavated by A. M. Sayed.

Three stratigraphic units were distinguished. They included: strata of superficial eolian sand covering the structure, and more

[4] Excavation was conducted by R. Fattovich.

compact, reddish sand at the base of the structure (SU1, SU3); and the structure construction of coral rocks and slabs of conglomerate stone (SU2).

Excavations demonstrated that the structure consisted of an oval platform, ca. 9 m x 10 m in area and ca. 1.2 m high, with an east-west orientation and a ramp to the west. The platform was constructed with slabs of conglomerate stone covered with rocks of fossil coral and limestone (Figure 10). Originally, the top of the structure was covered with slabs of conglomerate stone, which have now deteriorated, with a framework of mangrove wood in the center. On the top of the platform over 650 conch shells and eight *Tridacna* shells were collected. No other species were found. The conch shells (*Lambis lambis*) were always broken in the same way at the top to extract the mollusk.

Evidence of a hearth was found at the junction between the ramp and the platform to the south of the ramp. A hearth was also recorded at the base of the southeastern side of the platform.

A few fragments of limestone, perhaps from an anchor, were found at the northwestern side of the structure. Very few potsherds were found along the base of the platform. Fragments of wood were also scattered through the excavated area, and the lower part of a possible pole was still *in situ*.

Very few potsherds, dating to the Middle Kingdom, were collected.

3.2.b Excavations, western terrace

Western terrace, WG 1[5]

This excavation unit, 4 m x 4 m in area, was opened in the central sector of the western terrace to investigate a feature marked on the surface by a circle of black pebbles.

Four stratigraphic units were distinguished. They included: strata of eolian sand and gravel (SU1, SU2); a man-made feature (SU3); and the bedrock on which the structure was erected (SU4).

[5] Excavation was conducted by A. Manzo.

The feature consisted of a ring of compacted sand covered with black pebbles, ca. 5 cm wide, 5-10 cm high, and 2.7 m in diameter, delimiting a shallow circular pit in the bedrock (Figure 11). The occurrence of artifacts on the bedrock suggested that this was the surface of the terrace when the structure was built.

The ceramics associated with these features date to the Middle Kingdom.

Western terrace, WG 2[6]

This excavation unit, 8 m x 8 m in area, was opened near the railroad, in an area where a huge, roughly circular concentration of potsherds and a few scattered pieces of coral were visible on the surface.

Four stratigraphic units were distinguished. They included: a stratum of soft eolian sand, pebbles, and small pieces of fossil coral, ca. 10 cm deep, with a great quantity of potsherds, mainly in the central sector of the unit (SU1); a lower stratum of sand and deteriorated bedrock, only a few centimeters thick (SU2); a stratum of hard, compact yellowish sand with pieces of white rock (probably gypsum), from greatly deteriorated bedrock (SU3); and a number of wooden poles ranging from 5-6 cm to less than 1 cm in diameter (SU4) (Figure 12).

No coherent arrangement of post-holes was recognized. Their occurrence, however, suggested that light shelters had been erected in this area.

The ceramics associated with these features date to the early 12th Dynasty.

Western terrace, WG 3/6[7]

Two contiguous excavation units, 10 m x 10 m in area total, were opened at the western edge of the fossil coral terrace in order to

[6] Excavation was conducted by C. Perlingieri.
[7] Excavation was conducted by C. Perlingieri and C. Zazzaro.

investigate some features that were visible on the surface: 1) a roughly circular arrangement of coral rocks that originally formed a tumulus (Feature a), ca. 8.0-9.0 m in diameter, and had probably been partially excavated by A. M. Sayed; 2) an elongated pit (Feature b), ca. 3.0 x 1.5 m in area, in the south central sector of the excavated area[8]; and 3) four small, very shallow circular pits, ca. 0.4-1.0 m in diameter, in the center of the excavated area.

Twelve stratigraphic units were distinguished. They included: superficial strata of sand with pebbles and small rocks (SU1, SU2); an elongated pit (Feature b) filled with sand (SU3, SU4); a stratum of soft sand with a great quantity of vegetal material (mainly shrubs with leaves and branches (SU5); deteriorated bedrock (SU6); three small shallow circular pits, ca. 40-50 cm in diameter and 10-12 cm deep (SU7, SU8, SU12); a small shallow ovoid pit, ca. 0.5 m x 1.0 m and 15 cm deep (SU9); a possible floor of compacted sand (SU10); and a sterile stratum of sand (SU11) (Figure 13).

Two large eroded blocks and many pieces of limestone, most likely from an anchor, were found inside the elongated pit (Feature b), but their stratigraphic location was uncertain.

Despite the poor preservation of the circular structure (Feature a), a stratified deposit was identified, mainly in the western sector of the trench, as the eastern sector was heavily eroded. The deposit was excavated to a depth of ca. 25 cm. Two phases of structure use, which were separated by a stratum of sterile sand (SU11), could be identified.

The earlier phase of use (Phase 2) consists of a stratum of sand with a well preserved, elongated pile of leaves and branches (SU5), which overlap the bedrock (SU6) in the eastern sector of the excavation unit. This stratum was associated with some small pieces of fossil coral and cordage, at the southwestern edge of the unit. The pile of leaves and branches, ca. 2.80 m long and 70-90 cm wide, had an irregular S-shape with rounded edges, and was associated with

[8] This pit was probably a test excavation by A. M. Sayed.

many potsherds and pieces of cordage. This feature was near an alignment of limestone and coral blocks, which partially covered it.

Phase 1 consists of the remains of the superficial tumulus (Feature a), a floor of compact sand associated with potsherds, cordage, and some coral blocks (SU5), and possibly the shallow pits (SU7, SU8, SU9, SU12). The meaning of the pits, however, is uncertain as no artifacts were associated with them (Figure 14).

The ceramics associated with the structure date to the early 12th Dynasty.

Western terrace, WG 4/5[9]

Two contiguous excavation units, 4 m x 16 m in area total, were opened at the western edge of the terrace, where four circular features were visible on the surface. These features included two circular concentrations of black pebbles delimiting areas with a less dense and finer grained soil (F1, F3), one circular concentration of sand (F2), and one circular concentration of sand and coral rocks (F4). All archaeological materials on the surface of the excavation unit were systematically collected before the excavation.

Twenty stratigraphic units were distinguished. They included: strata of windblown sand (SU1, SU2, SU3, SU4, SU10, SU11, SU15); two strata of sand mixed with ash and charcoal flakes (SU13, SU16); a wooden pole in a post-hole (SU5); two man-made features of compacted sand with scattered pieces of small stone (SU6, SU8); several small pits (SU9, SU12, SU14, SU20); two larger pits, most likely hearths (SU17, SU19); a mound of organic materials (SU18); and bedrock (SU7) (Figure 15).

Features 1 and 3 were circular pits cut in the bedrock, ca. 2.3 m and 2.7 m in diameter and 20-40 cm deep, respectively. They were encircled by rings of compacted sand and black pebbles, 15-20 cm wide and 20-25 cm high. A hearth, a post-hole, and a pit were cut in the bedrock outside F1 and were associated with it. Fragments of

[9] Excavation was conducted by A. Manzo.

pottery, wood, rope, textiles, and charcoal had accumulated near the hearth. Another post-hole was cut inside this feature (Figure 16).

The associated ceramics suggest an early 12th Dynasty date.

Western terrace, WG 7[10]

This excavation unit, 2 m x 2 m in area, was opened at the southwestern edge of the terrace in order to investigate an eroded circular concentration of small coral rocks (ca. 3 m in diameter) with a shallow depression inside (ca. 10 cm deep), covered with eolian sand, dark pebbles, shells, and a concentration of potsherds on the top.

Four stratigraphic units were distinguished. They included: strata of pebbles, very compact sand and soft eolian sand (SU1, SU2, SU3); and a stratum of small pebbles and rock in which there were two small, very shallow circular holes, ca. 40 cm in diameter (SU4).

Excavations demonstrated that this feature was partially cut in the bedrock and was associated with potsherds, shells, and lithics, as well as two shallow hearths with some charcoal at the northeastern side of the trench.

The associated ceramics date to the early 12th Dynasty and Second Intermediate Period – early 18th Dynasty (SU 1).

Western terrace, WG 8[11]

This excavation unit, 9 m x 11 m in area, was opened at the southwestern edge of the terrace to investigate a circular mound of coral blocks mixed with soft sand, wood, and branches, 4.5 m in diameter and 0.7-0.8 m high, which had apparently been excavated in the 1970s by A. M. Sayed.

Nine stratigraphic units were distinguished. They included: superficial strata of sand with pebbles and small pieces of fossil coral (SU1, SU2); an alignment of coral and other stone near the tumulus with a southwest-northeast orientation (SU3); a (possible) floor of

[10] Excavation was conducted by C. Zazzaro.

[11] Excavation was conducted by C. Perlingieri

compacted sand (SU4); a stratum of sand with many vegetal inclusions (SU5); a stratum of wood, branches, and leaves, beneath the superficial coral rocks of the tumulus (SU6); two strata of sand with many potsherds, lithics, charcoal, and burned soil outside the southern side of the tumulus (SU7, SU8); deteriorated bedrock (SU9) (Figure 17).

The excavated structure was a circular arrangement of large blocks of coral and limestone laid horizontally, with a great quantity of potsherds and a few lithics in the superficial strata of sand (SU1) and debris of rocks and pebbles (SU2) (Figure 18).

Two possible phases of use and/or reconstruction of the tumulus were recognized. The earlier phase of use (Phase 1) consisted of a bedrock base (SU9) on which the lower part of the tumulus was built, a deposit of sand mixed with leaves and small branches (SU5), and a thick layer of burned soil with many potsherds and charcoal (SU8).

The later phase of use (Phase 2) consisted of a possible floor (SU4) on which the later structure was built. The later structure, which consisted of the upper layers of coral blocks, was possibly a reconstruction of the tumulus.

The ceramics are early 12th Dynasty in date.

Western terrace, WG 9[12]

This excavation unit, 4 m x 4 m in area, was opened in the central sector of the fossil coral terrace, where a circle of black pebbles was visible on the surface. Another similar structure was located to the north of the excavation unit.

Four stratigraphic units were distinguished. They included: two superficial strata of eolian sand and gravel (SU1, SU2); a man-made feature of compacted sand and scattered small stone fragments (SU3); and the bedrock (SU4).

[12] Excavation was conducted by A. Manzo.

The excavated structure consisted of a shallow pit, ca. 0.05-0.1 m deep and ca. 2.8 m in diameter, encircled by a ring of compacted sand and black pebbles, ca. 40-70 cm wide and 12-15 cm high (Figure 19).

The ceramics date to the early 12th Dynasty.

3.2.c Excavations, southern slope

Southern slope, WG 10[13]

This excavation unit, 10 m x 6 m in area, was opened to investigate a roughly oval mound of almost sterile sand covered with many potsherds, ca. 9 m long, 3.5-4.0 m wide, and 0.6-0.7 m high, near a huge coral rock, which had collapsed in antiquity at the base of the southern slope of the terrace. After removing the mound, excavations were conducted beneath and around it to a depth of 20-30 cm in order to investigate the deposit at the base of the terrace.

Eleven stratigraphic units were distinguished. They included: two strata of superficial eolian sand mixed with a few pebbles, potsherds, and shells (SU1, SU2); some hearths covered with a very compact crust of salt (SU3, SU4, SU7, SU8, SU9); a badly preserved living floor of compacted sand (SU5); an alignment of short wooden poles and small planks near the hearth SU7 (SU10); a deposit of large potsherds with a compact crust of salt, mixed with small wooden planks (SU11).

The oval mound consisted of a dump of sand on top of which was an accumulation of discarded fragments of Middle Kingdom jars. Most of the potsherds were encrusted with salt, which suggests that they had been removed from another (unknown) deposit, as salt concretions cannot form on artifacts above a loose deposit of sand (A. M. Mahmoud personal communication). The age of this feature is uncertain, as it was already in place when A. M. Sayed investigated the site in the mid-1970s.

[13] Excavation was conducted by C. Perlingieri.

Beneath and around the mound there was evidence of human occupation, which consisted of wooden poles, pottery, hearths, charcoal, and small fossil coral rocks. This evidence included: a hearth with a roughly circular arrangement of charcoal, ash, and wood, and potsherds laid horizontally inside and around the hearth (SU7); a linear arrangement of wooden poles and small planks along the western edge of the hearth; small pieces of fossil coral partially covered by the hearth, where they were mixed with charcoal and potsherds; and two smaller hearths (SU8, SU9) with large rocks of coral, which had most likely been used as potstands. A well preserved floor of compacted sand (SU5) was found to the south of the small hearths (SU8, SU9) and to the east of the larger one (SU7). A huge deposit of large potsherds and small wooden planks in a compact crust of salt (SU11) was found nearby. The potsherds in this deposit had accumulated without any special order, suggesting that this was an area of discard rather than an activity area. This deposit was not excavated.

The ceramics of the deposit date to the late 12th – 13th Dynasties.

A stratigraphic test pit, 1.0 m x 1.0 m in area and 0.8 m deep, was opened under the preserved floor (SU5). Three or four alternating layers of eolian sand and fluvially deposited gravel were found. At the base of the pit were some potsherds of Middle Kingdom date, most likely from the early to middle 12th Dynasty.

Very few potsherds dating to the Old Kingdom / First Intermediate Period were also collected in this excavation unit.

Southern slope, WG 15[14]

This excavation unit, 4 m x 4 m in area, was opened to investigate the deposit at the base of the southwestern terrace. It was excavated to a depth of ca. 1.23 m.

Five stratigraphic units were distinguished. They included: two upper strata of eolian sand (SU1, SU2); a stratum of sand mixed with

[14] Excavation was conducted by R. Fattovich and A. M. Mahmoud.

pebbles and gravel (SU3); a salt crust, ca. 5-6 cm thick, with some traces of a hearth (SU4); and a stratum of very compacted sand (SU5), which covered another stratum of sand.

Only a few potsherds dating to the 12th Dynasty were collected in this trench.

Southern slope, WG 18[15]

This excavation unit, 6 m x 4 m in area, was opened at the base of the terrace slope, about 2.5 m above the bed of the present wadi and to the west of WG 10. The unit was excavated in order to investigate a roughly circular accumulation of sand, ca. 0.4 m high, with a central shallow depression and a great quantity of ceramics outside the depression, and to collect geoarchaeological information.

Sixteen stratigraphic units were distinguished. They included: three superficial strata of sand with small pieces of fossil coral, many potsherds, and a few shells (SU1, SU2, SU3)[16]; an upper layer of wadi deposit consisting of moderately compact soil with granular and gravel stones, many pieces of rounded coral, and lenses of fine to medium sand (SU4); a stratum of very fine eolian sand, with charcoal, some artifacts and organic material (SU5); a salt concretion between SU4 and SU5; a badly preserved hearth, 0.5-0.6 m in diameter, in the northwestern corner of the trench (SU6); a stratum of eolian sand with a few granular inclusions of charcoal, layers and lenses of red sand, small coral rocks, as well as a high quantity of artifacts, ca. 1.0-1.2 m thick (SU8); a well preserved hearth, 50 cm in diameter and ca. 15 cm thick (SU9); a well preserved living surface of compacted sand, ca. 30 cm thick, with a small concentration of small shells (SU10); another living surface of compacted sand with some charcoal and very few artifacts beneath SU10 (SU13); two hearths, 0.4 m and 1.0-1.3 m in diameter, and 25 cm thick (SU11, SU12); a stratum of wadi activity,

[15] Excavation was conducted by C. Perlingieri, in collaboration with T. Arpin.

[16] The occurrence of a modern basket in SU2 suggested that this area was already excavated and backfilled by A. M. Sayed.

ca. 20 cm thick, beneath SU13 (SU14). Bedrock was found at a depth of ca. 2.5 m below the present surface (Figure 20).

The stratigraphic and sedimentary evidence from WG 18 points to two major wet intervals during the period of occupation and use of the area. The latest one is represented by SU4 and the earliest by SU14. These strata consisted of alternate irregular layers of rough-grained deposits with gravel and pebbles, and finer-grained clastics of sandy beach deposits. They represent different phases of wadi activity under wet/moist climatic conditions with alternating episodes of abundant floods and dry oscillations.

Two main phases of occupation were identified. The earliest one (Phase 1) is represented by SU9, SU10, SU11, SU12 and SU13, and dates to the early 12th Dynasty. In this phase there were a few fragments of Egyptian wheel-made pottery, Middle Nubian Ware associated with a lithic industry, and a huge quantity of shells with some traces of working. The later one (Phase 2) corresponds to the upper strata from SU1 to SU8, and dates to late 12th Dynasty (Figure 21).

Southern slope, WG 36[17]

This excavation unit was opened at the base of the south slope of the fossil coral terrace in order to test some anomalies that were detected in the geophysical survey along the wadi bed. The trench was initially a north-south transect, 3 m x 1 m in area, and was later enlarged into a 5 m x 4 m area. The excavation was suspended at a depth of ca. 0.8 m below the present surface.

Four stratigraphic units were distinguished. They included a stratum of hard gypsum and salt encrustation with a few potsherds, ca. 0.1 m thick (SU1); two strata of soft playa sand (SU2, SU3); a recent shallow hearth, ca. 1.45 m x 0.45 m in area and 5 cm thick, beneath a thin layer (ca. 5 cm) of eolian sand on top of SU1 in the northwestern corner of the unit (SU4).

[17] Excavation was conducted by K. Bard and C. Zazzaro.

An anchor of conglomerate stone and four large sherds of a storage jar were found in SU2, over a layer of soft sand (SU2, l. 2) with many Middle Kingdom potsherds, a sherd of an imported pot, and many shells and fish bones (Figure 22). The lower stratum (SU3) consisted of soft sand with shells, but without any artifacts.

3.2.d Excavations, western slope

Excavation along the western slope was conducted in two main areas: 1) outside and inside several rock-cut caves at the top of the terrace slope (WG 16, WG 30, WG 24, WG 32, WG 33, Caves 2-5) and along the terrace slope (WG 17, WG 21) below; and 2) along the top of the terrace slope to the north (WG 28, Cave 1 and WG 31).

Western slope, WG 16[18]

This excavation unit, 10 m x 8 m in area, was opened on top of the western slope of the coral terrace in order to investigate possible rock shelters such as the one A. M. Sayed recorded on the southern slope (Sayed 1983: 28). The excavation was conducted to a depth of ca. 2.5 m without reaching the bedrock.

Thirty-two stratigraphic units were identified in this trench. They included: strata of eolian sand, sometimes with fragments of mud-brick (SU1, SU2, SU3, SU9, SU11, SU61, SU77, SU81); strata of sand with many fragments of wood, leaves, and charcoal flakes (SU6, SU7, SU19, SU49, SU60, SU66); strata of sand with concentrations of sea-grass leaves and leaves (SU5, SU74); strata of sand with a concentration of fragments of mud-bricks (SU4, SU12); salt encrustations (SU8, SU10); a stratum with many chunks of rock (SU13); strata of gravel (SU82, SU84, SU85, SU86); hearths and post-holes (SU14, SU15, SU16, SU83, SU88, SU89, SU90) (Figure 23).

Seven phases of use with evidence of at least five living floors were identified. The earliest phase (Phase 1) is represented by one potsherd at the top of SU86. Three almost sterile strata of sand,

[18] Excavation was conducted by K. Bard, R. Fattovich, A. Manzo, and C. Zazzaro.

deteriorated rock, and gravel (SU82, SU84, SU85) covered this SU, suggesting abandonment of the area (Figure 24).

Phase 2 is represented by a living floor with slabs of conglomerate stone laid horizontally and large potsherds on top of SU82. This floor was covered with a thick stratum of eolian sand (SU77), which probably represents another period of abandonment.

Phase 3 is represented by several timbers from ship building and a living floor with hearths above SU77. A thick stratum of rock debris (SU13) from the terrace wall where the man-made caves (Caves 2-6) were excavated covered the evidence of this phase, suggesting that the caves were excavated or enlarged after Phase 3 but before Phase 4.

Phases 4, 5 and 6 consisted of living floors (SU10, SU11, SU66) with hearths and artifacts lying horizontally, and grinding stones, fragments of mud-bricks, and post-holes. This evidence, as well as strata of sterile soil in the upper part of the sequence, suggest more intensive use of the area after the formation of the stratum with rock debris, i.e., after the enlargement of the caves. The occurrence of a granite stone anchor on the living floor of Phase 4 (SU10), near the opening to Cave 3, suggests that the cave entrance was constructed (or re-constructed) and used at this time.

The last phase of use (Phase 7) is represented by artifacts in the upper stratum of sand (SU1), but no evidence of a living floor was found. The thickness of the sand deposit (ca. 5-10 to 40 cm) suggests that the area was less intensively occupied at this time.

The phases of use in this excavation unit date to the 12th Dynasty. Only the last one dates to the late Second Intermediate Period – early New Kingdom.

Western slope, WG 24[19]

This excavation unit, 6 m x 10 m in area, was opened on top of the slope along the western edge of the terrace as an extension of WG 16 to the south, in order to better investigate the stratigraphic sequence in

[19] Excavation was conducted by K. Bard and C. Zazzaro.

this area of the site. Excavation was conducted to a depth of ca. 2.5 m without reaching bedrock.

Thirty-six stratigraphic units were distinguished during the excavation. They included: strata of soft sand (SU1, SU20, SU41); strata of sand with dense concentrations of fragments of wood, leaves, charcoal flakes, and artifacts, as well as some pebbles (SU19, SU24, SU28, SU11); layers of salt encrustation (SU8, SU10); a large slab of conglomerate stone (SU99); nine hearths (SU21, SU23, SU27, SU30, SU31, SU33, SU36, SU38, SU39); twelve carved niches in the wall of the coral terrace (SU93, SU95, SU97, SU101, SU103, SU104, SU105, SU106, SU109 and SU108); the wall of the coral terrace (SU109); six strata of sea-grass leaves over the niches, the stelae, and the entrance of Cave 2 (SU94, SU96, SU98, SU100, SU102, SU107) (see Figure 25).

Five phases of use with evidence of living floors were distinguished in the stratigraphic sequence. Periods of abandonment are represented by strata of sand with a few artifacts.

The earliest phase of use so far recorded in WG 24 (Phase 1) is represented by a (possible) living floor with evidence of two hearths and a small timber associated with a few artifacts, pebbles, fragments of gypsum and mud plaster, and organic materials (SU36, SU38, SU39, SU11). A concentration of sterile sand over this stratum in the southeast corner of the trench probably represents a period of abandonment.

Phase 2 is represented by another living floor with three hearths, potsherds, branches, fragments of timbers, mud plaster, ropes, and bones (SU28, SU33, SU27, SU36, SU41). This stratum was sealed by salt encrustation (SU10), suggesting that this phase corresponded to the fourth phase of use in WG 16 and WG 30.

Phase 3 is represented by a deposit with strata of sand containing potsherds, branches, fragments of timber, mud plaster, ropes, and bones (SU24, SU30, SU23, SU31). This deposit was also covered with a thin and irregular layer of salt encrustation (SU8).

Phase 4 is represented by an alignment of large stones and two stones which had been partially pierced (probably unfinished

anchors), along the eastern side of the entrance to Cave 2, and a living floor with a large hearth.

The last phase of use (Phase 5) is represented by a (possible) living floor with a rope, about 5 m long, some fragments of wood, and other artifacts. A layer of sea-grass leaves and leaves covered the entrance to Cave 2 at this time. A large, roughly rectangular block of conglomerate stone, 1.25 m x 1.2 m in size, was also associated with this phase of use.

The ceramics from WG 24 date mainly to the late 12th – 13th Dynasties. Potsherds dating to the Second Intermediate Period and/or early 18th Dynasty were collected near the entrance and in the fill of Cave 2.

Western slope, WG 30[20]

This excavation unit, 6 m x 3 m in area, was opened to the north of WG 16 in order to investigate the possible entrances to Caves 3-4 to the north of Cave 2. Excavations were conducted to a depth of 0.5 m, without reaching the bedrock.

Excavations demonstrated that the constructed entrance to Cave 3 consisted of two walls of stone anchors, wood fragments, and stone blocks with mud plaster sustaining the edge of the coral terrace as in Cave 2 (WG 24). The entrance is ca. 1.6 m wide and more than 1 m in height. Only the upper part of the entrance to Cave 4 was excavated. On either side of this entrance were marks in red ocher, perhaps so that members of a later expedition could locate the cave after the accumulation of windblown sand. Excavation of the entrances to Caves 3 and 4 was suspended, however, because of deep cracks in fossil coral terrace to the east of the excavation unit.

Twelve stratigraphic units were distinguished. They included: strata of eolian sand (SU1, SU2, SU3, SU11, SU65); a living floor with several planks of wood laid horizontally (SU62); a stratum of loose sand and mud-brick fragments (SU68); a stratum of compacted

[20] Excavation was conducted by A. Manzo and G. Plisson.

sand with mud-bricks fragments and large fragments of wood (SU71); a stratum of sand and sea-grass leaves (SU5); salt encrustations, the upper one of which had fragments of mud-bricks (SU8, SU10); a curvilinear stone structure, 1.57 m long, 1.2 m high, and 0.4 m thick (SU52) (see Figure 23).

Three phases of use and two possible phases of abandonment were identified. The earliest recorded phase of use (Phase 1) is represented by a living floor (SU69), corresponding to the last phase of construction of the entrance to Cave 3. This living floor was associated with timbers, stone anchors, and blocks from the walls of the cave entrance, which were covered with a stratum of sand (SU65), representing a phase of abandonment. Phase 1 corresponds to Phase 4 in WG 16.

Phase 2 is represented by another living floor on which several large- and medium-sized ship timbers were lying (SU62). This living floor was possibly related to the last phase of use of the entrances to Caves 3 and 4, as a thick stratum of sand and sea-grass leaves (SU51) covered it and the entrance to Caves 3 and 4. Phase 2 corresponds to Phases 5-6 in WG 16.

The latest phase of use in WG 30 (Phase 3) is represented by a rounded stone structure (SU52) on top of the deposit of sand and sea-grass leaves (SU51). This structure consisted of piled coral rocks abutting the coral terrace and forming a kind of shelter against the prevailing northern winds. Phase 3 corresponds to Phase 7 in WG 16.

The associated ceramics are 12th Dynasty in date.

Western slope, stela niches[21]

Twelve niches were cut in the wall of the fossil coral terrace to the south of the entrance to Cave 2 and above it. The coral wall had been artificially smoothed and modified. The niches had been carved in two groups, each with five niches (Figure 25). To the south of the entrance

[21] Excavation of the niches was conducted by C. Zazzaro. The niches were recorded by C. Perlingieri and R. Pirelli.

to Cave 2, Niches 1-5 formed the upper group and Niches 6-10 the lower one. Two more niches (11, 12) were cut above the cave entrance, ca. 4 m to the north of the other ones. The niches were covered with a deposit of sea-grass leaves. Four niches still contained limestone stelae. Other stelae had fallen out of their niches or may have been destroyed, as the rounded upper part of a stela was found in a sand deposit near the niches.

Niche 1: a rectangular niche, 46 cm x 30 cm and 25 cm deep. The niche contained Stela 1, a wooden wedge to fix the stela, and sea-grass leaves and sand.

Niche 2: a rectangular niche with a rounded top, 46 cm x 26 cm and 10 cm deep. The niche contained Stela 2, and sea-grass leaves and sand. Inside the niche were traces of white plaster near the stela.

Niches 3, 4, 5: a large, eroded and badly preserved niche, ca. 123 cm x 50-60 cm and 30 cm deep, which had originally been three separate niches. Niche 3, 50 cm 35 cm and 20 cm deep, was a rectangular niche with traces of white plaster inside. Niche 4, 50 cm x 30 cm and 22-30 cm deep, was a rectangular niche with a roughly rounded top and traces of white plaster inside. Niche 5, 58 cm x 52-53 cm and 43 cm deep, was a rectangular niche with traces of white plaster inside. These niches were filled with sea-grass leaves and sand.

Niche 6: a rectangular niche with a rounded top, 42 cm x 32 cm and 12 cm deep, filled with sea-grass leaves, sand, and very small fragments of vegetal mud plaster. Inside and outside the edge of the niche were mud plaster and some traces of white plaster.

Niche 7: a rectangular niche with a rounded top, 53 cm x 40 cm and 19 cm deep, with traces of plaster and copper inside. This niche was filled with sea-grass leaves and sand.

Niche 8: a rectangular niche, 37 cm x 25 cm, with Stela 3 still *in situ*. This niche was filled with leaves and sand.

Niche 9: a rectangular niche, 23 cm x 20 cm, with Stela 4 still *in situ*. The stela was fixed inside the niche with white plaster and was covered by leaves and sand.

Niche 10: a rectangular niche, 50 cm x 33 cm and 23 cm deep, with leaves and sand inside. Originally this niche probably contained Stela 5, which was found in a sand deposit below the niche.

Niche 11: the northern niche above the entrance of Cave 2. This rectangular niche, with a roughly rounded top, ca. 46 cm x 35 cm and 10 cm deep, was badly eroded.

Niche 12: the southern niche above the entrance of Cave 2. It was badly eroded.

These niches were probably cut at the same time that the stelae were made, i.e., during the 12th Dynasty.

Western slope, WG 32[22]

This excavation unit was opened to the south of the entrance to Cave 2. The area was covered by a thick stratum of eolian sand. Three inscribed stelae and a painted inscription on a wooden box were recovered in this sand stratum, which covered more than 21 piled wooden boxes and a large ship timber (Figure 26). This timber was associated with a living floor from the last phase of use of the area before abandonment, but it is not yet clear if the mound of wooden boxes was lying on this floor or on an earlier one. The sand stratum covering all these materials also sealed the entrance to Cave 5 and the entrance to another cave (Cave 6), which is located to the south of the entrance to Cave 5 along the fossil coral terrace. Only the upper part of the entrances to Caves 5 and 6 were uncovered, which were ca. 1.58 m and 1.61 m in length, respectively. Thus, the entrances to the two caves were already covered by sand when the large ship timber was abandoned there and the area was used for the last time.

In the northeastern sector of the excavation unit, near the coral terrace wall and the entrance to Cave 2, several layers of sea-grass leaves, alternating with layers of sand, were recorded, both mixed with artifacts. About 1 m (in depth) was excavated in this sector.

[22] Excavation of the niches was conducted by E. Mahfouz and R. Pirelli.

The first very disturbed layer consisted of dark sand, covering a compact layer of salt, beneath which was a thick stratum of sea-grass leaves with few artifacts, which in turn covered another layer of sand. Ca. 1 m from the coral terrace wall, a hearth was found associated with a mat fragment, one clay sealing with an impression, some pieces of wood, and potsherds. A second hearth was found to the south of the first one: it contained some potsherds and pieces of wood. Also found in the area were several thin ropes (one of which was very long), pieces of wood, pieces of partially baked clay, and several potsherds. The longest rope lay partially across a layer of salt, under which was a large amount of clay. Excavating down near the coral terrace wall, a remarkable quantity of artifacts was found: several sealings with impressions; pieces of cloth, one of which seems to be partially painted black; a large, moderately well preserved mat; many pieces of wood and small fragments of planks; bones; potsherds; and a thick rope. This occupation layer with two hearths is probably related to the latest phase of use of the area.

The associated ceramics date to the late 12th – 13th Dynasties.

Western slope, Caves 2-6[23]

Along the western edge of the fossil coral terrace entrances to five man-made caves (Caves 2, 3, 4, 5, 6) were discovered after removing a deposit of ca. 2 m of eolian sand and associated artifacts. Caves 2, 3, 4 and 5 were mapped and surveyed, and the entrance to Cave 6 was recorded. Cave 2 was partially excavated.

The five caves are all located near each other (Figure 27) and are oriented southwest-northeast. Caves 2, 3, and 4 were extended in size from a large natural rock shelter that represents an initial common area for Caves 3 and 4. Caves 5 and 6 were probably carved directly into the fossil coral rock from their entrances. Investigations in the

[23] Survey of Caves 3 and 4 was conducted by A. Manzo and C. Zazzaro. Caves 2 and 5 were surveyed by C. Perlingieri and C Zazzaro. Excavation of Cave 2, Room 1 was conducted by C. Zazzaro.

caves revealed a deep and complex interior (about 20-25 m in length), with collapsed coral rock and a large amount of sand deposited near the entrances.

Western slope, Cave 2

Access to Cave 2 was obstructed by a deposit of sand and leaves and excavation of the cave filling began after removing this deposit. For the investigations, the cave was divided into three sectors: 1) Entrance Corridor, 2) Room 1, and 3) Inner Part. Excavations were conducted in the Entrance Corridor and Room 1, and a survey of the Inner Part was also conducted.

The Entrance Corridor, which is 2.6 m x 1.4 m in area, is lined with two constructed walls (Figure 28). On the northwest side, the Entrance Corridor divides Cave 2 from Cave 3.

In Room 1 a cleft in the fossil coral to the northwest gives access to Caves 3 and 4. The ceiling of Room 1 is badly preserved because of a deep east-west fracture in the fossil coral. Collapsed rock from the ceiling covered the entire floor of Room 1, especially near the walls. Excavation was conducted only where there were no safety problems concerning the stability of the bedrock. After removing a central mound of rocks in Room 1, a large rock which had collapsed from the ceiling was exposed. This rock divided the area of Room 1 from the Inner Part, which reveals the entire extension of Cave 2, 24 m from the entrance.

The Inner Part is carved with an almost rectangular plan, ca. 17.5 m x 4-5 m in area. The ceiling is vaulted with traces of burning, and the present height is about 2 m in the center, but 1 m near the walls. On the southeastern wall of the Inner Part there is a natural opening, probably due to a collapsed wall, which gives access to Cave 5. A concentration of wood fragments and fragmentary coils of rope was found in the center of the floor of the Inner Part.

Excavation of the Entrance Corridor and Room 1 revealed 21 stratigraphic units. They included: strata of eolian sand with large (SU91) and small collapsed rocks (SU29, SU42, SU43); a stratum of

sterile sand (SU79); strata of sand with a concentration of organic materials (SU32, SU34, SU53, SU57, SU58, SU64, SU92); and salt encrustations (SU8, SU10); man-made features consisting of pebbles from a floor pavement (SU47, SU56, SU78, SU80); and mud-bricks (SU76) from a wall construction. A hearth, 20 cm x 50 cm in area and 7 cm deep, was also excavated in the southeast corner of the Entrance Corridor (SU37), and SU44 corresponds to the bedrock.

Based on the stratigraphic sequence and analysis of the associated ceramics, at least two phases in Cave 2 correspond to human occupation:

1) The first phase of human occupation is well attested in Room 1 and the Entrance Corridor. From this phase there is an arrangement of mud-bricks (SU76) associated with three timbers (T3, T4, T48) lying parallel to the entrance on the fossil coral bedrock (SU44), and a concentration/arrangement of pebbles (SU78). Mud-bricks, pebbles, and timbers were probably arranged to create a walkway and flat floor in an area where the bedrock is very irregular (see below). Associated with this floor were a few organic materials, such as poorly preserved wood and charcoal, and several fragments of small ceramic cups (SU64), some of which have been dated to the Second Intermediate Period or early New Kingdom.

Timber 16 and a concentration of pebbles below and near this timber (SU56, SU78), probably also date to this phase. Most likely this arrangement is an extension of the western part of the wall in the Entrance Corridor, which divides Cave 2 from Cave 3. Fragments of wood and rope and a few potsherds were also inserted in this wall structure, beneath and along T16.

From this occupation phase in the Entrance Corridor there was also evidence of fragments of mud plaster and pebbles (SU58), mostly concentrated in the northwestern sector next to the wall, and also a small shallow hearth with sandy red soil, 20 cm x 50 cm in area and 7 cm deep, and pieces of red ocher (SU37). The fragments of mud plaster most likely fell off the wall construction, while the pebbles were from a floor pavement and/or the foundations on which the walls

were built. A test trench in this area revealed that the walls were not erected on the bedrock, which is absent in this sector, but on a deposit of sterile sandy soil on which pebbles and small rocks had been arranged. This evidence also suggests that the first use of Cave 2 was originally as a rock shelter, with the bedrock beginning approximately between the Entrance Corridor and Room 1.

The constructed walls of the Entrance Corridor (ca. 2.6 m long and 1.5-1.2 m high) carefully reinforced both sides of the cave entrance. The southeastern wall was built with six large blocks of conglomerate stone and limestone, small rocks of coral, and mud plaster, sometimes mixed with organic materials. The northwestern wall was built with seven large blocks of conglomerate stone and limestone, two timbers in the upper part, small coral rocks, and mud plaster, sometimes mixed with organic materials. Gypsum and mud plaster were used to fix the wall components in place, and potsherds and textile fragments were also used in the wall construction. These two walls and the wall arrangement on the northwest side of Room 1 possibly underwent changes during the following phase of use.

A thick layer of salt encrustation (SU10), sloping from outside to inside the cave, covered the first phase of occupation. In the middle of the excavation unit in Room 1 the salt layer became more horizontal and contained some organic materials and potsherds from the lower level (SU64). In the inner part of the excavation unit the salt layer covered the bedrock. A test pit 10-15 cm deep excavated in the northwestern end of Room 1 contained sterile sand (SU79), demonstrating that the level of the bedrock inside the cave is very irregular.

2) The second phase of occupation was divided into two sub-phases. The earlier one (sub-phase 1) is represented by a floor of a ramp/walkway and associated materials found on this floor. The later sub-phase (sub-phase 2) consists of a thick deposit of ship timber fragments and ropes mixed with sand and collapsed rock. Most likely the later sub-phase represents the abandonment of the cave.

At the cave entrance two timbers (T18 and T19) laid horizontally were associated with sub-phase 1. They were oriented approximately

southeast-northwest along the main axis of the cave, ca. 50 cm from each other. At a depth of 15-20 cm two more timbers (T5 and T6) were found with the same orientation as the upper ones. Most likely these four timbers were part of the same ramp/walkway at the cave entrance.

A walkway composed of five reused ship timbers was also recorded in Room 1. The timbers were arranged parallel to each other, but on slightly different levels (T27, T28, T42, T39). Timber 29 was found perpendicular to this arrangement.

A rope bag, an ovoid wooden vessel, a grinding stone, and a potsherd with red ocher inside were found in the southern sector of Room 1. Three ship timbers (T8, T9, T10), which overlapped each other, were also found at the northwestern edge of the excavation unit in Room 1. In the northeastern sector were fragments of rope and wood, a few potsherds of small cups, and a granite grinding stone (50 cm x 30 cm) associated with a concentration (130 cm x 60 cm, and 25 cm thick) of organic materials, which consisted of seeds, leaves, and insect remains (SU92).

The evidence in Room 1 suggests that it was a living area where food production took place. The large quantity of reworked wood fragments and disassembled ship timbers also suggest an activity area for woodworking, mainly in the second sub-phase.

The second sub-phase (2) consisted of an accumulation of organic materials, such as branches, leaves, and a large concentration of reworked wood or fragmentary timbers from a dismantled ship(s). Two blades of a steering oar/rudder were also associated with this sub-phase; they were most likely left in the Entrance Corridor just before the final abandonment of the cave.

Following human occupation/use of Cave 2 in pharaonic times there is evidence of three sub-phases. During the first sub-phase rocks collapsed from the ceiling in Room 1 (SU42, SU91), and the cave was subsequently occupied by small mammals (SU43) before the entrance was completely obstructed by a deposit of sand, leaves, and branches during the third sub-phase (SU29), which is well represented in the

Entrance Corridor. It is difficult to determine when the cave entrance was completely obstructed and when the ceiling collapse occurred. Ceiling collapse probably did not occur in antiquity, and the bones of small mammals seem to be relatively recent.

Western slope, Cave 3 and Cave 4a/b

Cave 3 and Cave 4a/b share a common area near their entrances. In this area there are mounds of eolian sand and some collapsed rock, probably already *in situ* when the two caves were excavated. Most likely there were three entrances which gave access to the complex. These two entrances were discovered in excavation units WG 16 and WG 30. A thick unexcavated stratum of sand to the northwest of excavation unit WG 30 may cover the third one.

The two caves have a slightly different orientation. Cave 3 is oriented southwest-northeast and Cave 4a/b has a roughly south-north orientation.

Western slope, Cave 3

Cave 3 is 22 m long from the entrance. On the southeast side of the cave there is an opening into Cave 2, and on the northwest side there is an opening into Cave 4. The inner part of Cave 3 has an almost rectangular plan, ca. 13.5 m x 4 m. The walls are very straight and the roof is vaulted. The present height of the ceiling is 1.65 m in the middle of the cave and 1.35-1.45 m near the walls. Some collapsed rock from the walls and the ceiling are on the floor. Near the entrance of the cave there was a concentration of small mammals, which had been naturally preserved. In this area shallow hearths and scattered pieces of charcoal were also recorded.

In the inner part of the cave there was a concentration of shells (mostly *nerita*), fish bones, charcoal, and wood fragments. Some of the wood fragments could be identified as parts of ships (fragments of mortises, tenons, and dovetails). According to Cheryl Ward, marine shell mixed with wood fragments, many of which are sponge-like with gribble, testify to the trimming and reworking of ship planks there.

Western slope, Cave 4a/b

Cave 4 is divided into two distinct areas (Cave 4a/b) by several large rocks, which were probably already *in situ* when the cave was excavated. The cave is 22 m long from the entrance. The southeast side the cave gives access to Cave 3. The inner part of Cave 4 has a roughly rectangular plan, ca. 16 m x 6.5 m. The walls are straight despite the collapsed parts. Only in the center of the ceiling is the original vault still visible.

On the floor of the eastern part of the cave (Cave 4a) there were several concentrations of fish bones and naturally preserved fish, associated with hearths, charcoal, and large potsherds, including a bread mold. In the western part of the cave (Cave 4b), a hearth was associated with an area of ashy soil and large potsherds. The area near the entrance of Cave 4b was heavily disturbed by ceiling and wall collapse, which completely buried the original surface. Four carved limestone slabs forming part of the entrance, however, are still visible.

Western slope, Cave 5

Cave 5 is 19 m long from the entrance and is oriented southwest-northeast. At the rear of the cave, on the northwest wall, there is a natural opening into Cave 2, which is probably the result of collapse of the original wall. The cave has an almost rectangular plan with a width of 3.75-4.10 m. The walls are straight and the ceiling is vaulted, with a central groove 60 cm wide. The present height of the roof is 1.60 m in the middle of the cave and 1.50 m near the walls. Some collapsed rock from the walls and ceiling are seen on the floor. From the entrance a mound of eolian sand extends 5 m inside the cave, where some fragments of wooden boxes are visible on the surface. Numerous coils of rope, each about 1.0 m long and 0.6 m wide, are visible in the central and inner part of the cave. According to Cheryl Ward, these coils seem to maintain coherence all along the cave and are disposed perpendicular to the walls (Figure 29).

Western slope, Cave 6

In WG 32, near the complex of Caves 2-5 and 2.8 m southeast of the entrance to Cave 5, an entrance of another man-made cave was discovered. The arched entrance, ca. 1.5 m wide, is filled with eolian sand. The cave ceiling is very fragile and when excavations began pieces of rock fell from the ceiling. The northern side of the entrance appears to be well shaped and the ceiling there is better preserved. Only 30-40 cm of sand was removed from the entrance to this cave, and investigations were discontinued due to problems of stability.

Western slope, WG 33[24]

This excavation unit, 4 m x 4 m in area, was opened to the north of the entrances of Caves 3 and 4, down-slope from where two large niches are cut in the upper wall of the coral terrace. The larger niche (facing the terrace wall to the left) is 1.48 m high, 1.0 m wide, and 1.25 m deep, with a threshold at the base 0.9 m deep. The smaller niche (to the right) is 1.16 m high, 1.05 m wide, and 0.85 m deep. Most likely, these niches originally contained two large stelae, one in granite and the other now in limestone fragments, which were found in the deposit of gravel and sand washed down from the top of the coral terrace, and layers of compacted eolian sand next to the terrace wall.

The granite stela, with a disintegrating surface, is 114 cm high, 65 cm wide, and 27 cm thick. Seven pieces of limestone were excavated, two of which were clearly from stelae, but they were badly eroded on the surface and without any inscriptions. The two stela fragments are 31 cm high, 30 cm wide, and 9 cm thick; and 54 cm high, 15 cm wide, and 11 cm thick. Other limestone stela fragments and a whole limestone stela were found in the lower layers of the deposit. Unfortunately, they were completely eroded and any possible inscriptions are now gone. The one preserved limestone stela is 34 cm

[24] Excavation was conducted by K. Bard and R. Pirelli.

high, 21.5 cm wide, and 8.4 cm thick. The only artifacts associated with these layers were large sherds of storage jars.

The associated ceramics date to the late 12th – 13th Dynasties.

Western slope, WG 17[25]

This excavation unit, 8 m x 4 m in area, was opened on a small terrace along the western slope of the coral terrace, where burned soil and ash were visible on the surface. Several dark areas, probably concentrations of organic materials, were also visible in the western sector of the unit. Before the excavation, a whole ceramic dish was collected on the surface.

Seven stratigraphic units were distinguished. They included: strata of eolian sand with fragments of wood, leaves, and charcoal flakes (SU1, SU2); the terrace surface (SU3); concentrations of leaves and small branches with some charcoal, over the excavation unit (SU4, SU7); a well preserved oven (SU5); and a man-made floor (SU6).

One phase of use could be identified, consisting of a man-made clay-plastered floor with a small undisturbed rectangular oven and the remains of one or perhaps two other, badly damaged ovens (Figure 30).

The oven, 54 cm long, 45 cm wide, and 27 cm high, was made with three vertical fragments of reddish-brown circular ceramic platters with a central groove on the sides, open to the west. Clay was used to plaster the oven bottom and to fill the corners and joints between the ceramic fragments. The oven was well cleaned, and then filled and covered with branches with elongated, pointed leaves, to be used again. The branches were tied tightly together with rope. Several large branches and smaller pieces were also scattered between and around the ovens, perhaps intended to be used as fuel.

The associated pottery dates to the late 12th – 13th Dynasties.

[25] Excavation was conducted by A. Manzo.

Western slope, WG 21[26]

This excavation unit was located immediately to the west of WG 17 in order to understand the meaning of an accumulation of anthropogenic red soil in the area. No artifacts or other materials were found in this trench.

Most likely, this soil and other dark gray spots not far from it down-slope were due to the discard of materials from cleaning the ovens. This may suggest that its formation was at least partially contemporary to the use of the ovens on the upslope terrace where excavation unit WG 17 was investigated. Moreover, the thickness and extension of this soil suggest intensive use of this area.

The associated pottery dates to the Middle Kingdom.

Western slope, WG 28, Cave 1[27]

This excavation unit was opened on top of the slope along the edge of the coral terrace's western side, above WG 19. This area was selected for excavation because it was located at the apex of a fan of scattered potsherds covering the surface of the slope to the base.

A rectangular entrance, ca. 1.6 m wide and 1.4 m high, was found opening into a large man-made cave (ca. 6 m x 4 m in area), mainly filled with eolian sand (Figure 31). A wooden threshold was at the base of the entrance. The timber was 1.35 m long, 0.15 m wide, and 0.13 m thick. Mud-bricks had been placed against the threshold on the outside and inside. Sherds of storage pots, pieces of cedar planks, and five grinding stones were found inside the cave. A broken hieratic ostracon (inscription poorly preserved) was also found there.

A rough limestone block, ca. 21.5 cm x 17.3 cm, was also found on the surface of the eolian sand that filled the cave. The top of the block was 4.5 cm thick and the bottom was 11 cm thick. This was possibly an unused/unfinished stela. A (possibly imported) shell bead was also found inside the cave.

[26] Excavation was conducted by A. Manzo.

[27] Excavation was conducted by K. Bard and C. Sian Lim.

Five strata of windblown sand were distinguished. These included: the upper stratum of sand, which accumulated at the top of the slope and along the wall of the coral terrace, above the entry of the rock-cut cave, and a lower stratum of windblown sand, which covered and filled the entrance of the cave (SU1, SU2). SU3 consisted of 1) a stratum of eolian sand outside the cave entrance, beneath SU2, and 2) a deep stratum of eolian sand, ca. 45-50 cm deep, in a 2 m wide north-south transect inside the cave. SU4 was a stratum of eolian sand inside the cave, and SU5 was a stratum of sand directly covering the coral/conglomerate stone bedrock.

A large, fallen limestone block, 86 cm x 8 cm x 4 cm, was found at the entrance of the cave. Fragments of mud-bricks were also found at the base of SU2, and there was evidence of mud-brick/plaster construction on both sides of the cave entrance. Finds from SU2 included fragments of a marl ware bowl(?); large potsherds of storage jars with encrustations of salt; many fragments of wood, including cedar; a small piece of linen; and a large black stone (basalt?), heavily encrusted with salt, to the west of the limestone block. Finds inside the cave included a large conch shell and many fish bones, probably from later human use of the cave. Three well preserved mud-bricks were also found inside the cave to the east of the entrance. The mud-bricks were not mold-made, but had been formed roughly by hand. A thick lens of charcoal was excavated in SU3, with more fragments of mud-bricks, and many pieces of wood, linen, rope, and one large cedar plank outside the cave. Also in SU3 were two bread mold fragments, two inscribed potsherds, one large polished grinding stone, a flat rough stone (sandstone?) with green pigment (copper/malachite) ground on one surface, some copper, and sherds of storage jars inside the cave near the entrance. Finds from SU4 included four grinding stones, potsherds, four planks and other fragments of wood (cedar), some small animal bones, and mud-bricks. Two grinding stones were still *in situ* and were cemented together by an encrustation of salt. A blank limestone stela without any inscriptions was found on top of

SU4 in the deepest sector of the cave. Finds from SU5 included a shell bead, which is not Egyptian in style.

The ceramics date to the Old Kingdom / First Intermediate Period and early 12th Dynasty.

Western slope, WG 31[28]

This excavation unit was opened on top of the slope along the western wall of the coral terrace, midway between WG 24 and WG 28, Cave 1. The trench was originally 12 m x 3 m in area, but the southern half of the trench was enlarged 4 m to the west.

Three main strata (SU1, SU1b, SU2) were distinguished in the excavation, which was suspended at a depth of ca. 2 m because only sterile sand was found at the bottom of the trench. SU1 and SU2 were strata of loose eolian sand, which accumulated on the slope of the terrace. SU1b was a thick stratum of windblown leaves along the coral terrace wall. Many bird nests were also associated with this deposit. The nests were made of ancient rope fibers and occasionally linen strands from cloth.

In SU1 there was evidence of four lenses of ash from hearths associated with New Kingdom pottery. The hearths were located near the terrace wall, which showed traces of smoke. Finds from SU1 included: one large piece of plastered cedar, 36 cm x 24 cm, and 1.5 cm thick; a plastered wooden panel, ca. 28 cm x 28 cm, and 2.2 cm thick; at least three mud-bricks which had been made without chaff, and fragments of similar mud-bricks; one well preserved (papyrus) sandal; rope fragments; one small piece of white (linen) string; much wood from the western edge of the trench; a ram's horn; a large shell; a dom palm nut; and a cut piece of (modern) sugar cane. A small, badly eroded limestone stela was also found in SU1. The stela was roughly rectangular, 21-22 cm high, 16 cm in wide, and 6 cm thick, with a roughly rounded top and flat base.

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

Finds from SU2 included: a large storage jar with many sea shells inside; two wood timbers, one with an unusual design at the top; three very damaged pieces of cedar: 26 cm x 8 cm, 47 cm x 11 cm, and 37 cm x 16 cm; one rectangular, plastered piece of cedar, 32 cm x 21 cm, and 2 cm thick; a circular rope (pot stand?) and rope fragments; seeds of a nut(?); donkey(?) dung; three shells; and a rib and leg bones (of a sheep?).

The ceramics date to the late 12th – 13th Dynasties and possibly Second Intermediate Period – early 18th Dynasty.

Western slope, base, WG 19/25/26/27[29]

These excavations were opened at the base of the western slope of the coral terrace to the west of WG 17, where many potsherds and bread molds, as well as wide areas of charcoal and ash, were visible on surface. The purpose of the excavations was to better understand the activities which were practiced in this area. Excavations began in 2003-04, when an excavation unit, 8 m x 8 m in area, was opened (WG 19). In 2004-05 WG 19 was enlarged with three more excavation units (WG 25, WG 26, WG 27) to the west, northwest, and north of WG 19, respectively. Altogether, an area of 20 m x 20 m was systematically excavated over three field seasons.

On the whole, 87 stratigraphic units were distinguished. They included strata of sand, brown soil, gypsum and salt crust, with a great quantity of bread molds and pottery, and sometimes flakes of chert, tiny pieces of copper ore, a few pieces of copper, as well as charcoal and ash, and possible evidence of post-holes, 14 cm x 10 cm in diameter (SU1/topsoil, SU2, SU3, SU4, SU5, SU6, SU7, SU11, SU13, SU14, SU16, SU17, SU19, SU24, SU25, SU29, SU36, SU37, SU46. SU60, SU63, SU73); concentrations of bread molds and potsherds (WG 26, E5, Features 1 and 2, SU47); strata of eolian sand with fragments of bread molds and potsherds, and sometimes

[29] Excavation was conducted by T. Childs and C. Perlingieri.

vegetal materials, such as straw or dung (SU8, SU26, SU34); hearths and fire pits (Feature 3, SU9, SU20, SU21, SU22, SU23, SU27, SU42, SU48, SU49, SU50, SU51, SU52, SU53, SU54, SU55, SU57, SU58, SU59, SU61, SU62, SU64, SU65, SU66, SU67, SU70, SU72, SU75, SU76, SU77, SU78, SU80, SU81, SU82, SU83, SU84); pits (SU85, SU86); alignments of mud-bricks (SU10, SU15); (possible) living floors, sometimes with post-holes (SU12, SU18, SU30, SU79, SU87); post-holes (SU44, SU45, SU56); dumps of discarded material with many large fragments of bread molds, and vegetal materials (such as straw or dung) (SU28, SU32, SU38, SU39, SU43, SU68, SU69, SU71, SU74); and strata or lenses of ash with bread molds and potsherds (SU31, SU33, SU35, SU40, SU41, SU43) (Figure 32).

Five main structure types have been identified so far:

1. Small fire pits that are roughly circular, shallow depressions. They are often associated with food remains. Average dimensions are: diameter 25-30 cm, depth 4-5 cm. Fire pits of this type are: SU51, SU55, SU57, SU59, SU61, SU62, SU65, SU83, and SU84.

2. Medium-sized fire pits that are shallow, circular depressions. In one case, animal bones were found associated with the structure (SU81). In another case, a large fragment of an unfired platter was found in situ (SU49). Average dimensions are: diameter 55-70 cm, depth 10-20 cm. Fire pits of this type are: SU42, SU49, SU52, SU53, SU54, SU64, SU67, SU70, SU78, SU81, SU82, Feature 2, and Feature 3.

3. Medium-sized fire pits that are circular, shallow depressions with lines of large potsherds arranged around the base. There is no association with food remains. Average dimensions are: diameter 70 cm, depth 25 cm. Fire pits of this type are: SU50, SU58, and SU66.

4. Large, shallow fire pits that are roughly ovoid or quadrangular with rounded edges. There is no clear association with food remains. Two of these fire pits seem to have protective barriers at their edges. SU72 has a concentration of potsherds and SU75 has a line of brick and platter pieces. Average dimensions are: length 180 cm, width 160 cm, and depth 20 cm. Fire pits of this type are: SU72, SU75, SU76, and SU77.

5. Medium and small, but deep fire pits that are roughly ovoid in shape. No association with food remains has been noticed. Dimensions show great variability in length: 80-180 cm, width 40-100 cm, and depth 35-50 cm. They include SU80 and SU81.

Initially the bread molds were interpreted as wind pipes, which suggested metal working at this area. The excavations demonstrated that this was a functional area mainly related to pottery manufacture, as extremely scarce evidence of metal working was found.

In particular, many fragments of furnace/oven walls in a salt crust, charcoal flakes, and many gypsum nodules were collected in the southwestern corner of WG 26, E5. A mound of compacted debris, brownish/black in color, with many bread molds and large potsherds, as well as pieces of furnaces/ovens, occurred in the western sector of WG 25, E3. Many fragments of bread molds, especially tip ends, were found in a scattered array in the southwestern corner of the same square. A concentration of loose, grayish-brown sand mottled with ash and charcoal, and with tiny ashy lenses was recorded in the northwestern corner of WG 25, D1.

At least five phases of occupation and use with evidence of living floors, post-holes, fire pits, and possible clay structures were identified in the stratigraphic sequence (Figure 32).

Phase 1 (Figures 33 and 34) is represented by a cluster of three fire pits covered with potsherds and with a circular arrangement of large potsherds at the base in the eastern sector (SU50, SU58, SU66), and a concentration of medium sized fire pits (SU40, SU52, SU53, SU64, SU70)[30] and two dumps nearby (SU28 and SU29) at the center of the excavated area. Another concentration of five large fire pits (SU36, SU41, SU48, SU49, SU67) along the northern edge, two large dumps (SU34, SU37) in the southwestern corner, two very small fire pits

[30] SU40 and SU52 represent two different phases of use of the same fire pit rather than two different fire pits.

(SU83, SU84) and two small pits (SU85, SU86) in the northwest corner of the excavated area can also be ascribed to this phase of use.

Phase 2 (Figure 33) is represented by the living surfaces SU13/79 and a number of large fire pits cut into it (SU35, SU78, SU76, SU80, SU81, SU82). Several dumps of fragments of bread molds and other potsherds lay on this surface (SU17, SU38, SU39). Two dumps (SU38, SU39) are nearby and extend along the southern edge of a large fire pit (SU35). The evidence of Phase 4 is mostly located in the center and northwest corner of the excavated area.

Phase 3 (Figure 33) is represented by a few scattered, circular fire pits (SU9, SU51, SU64, SU42) and post-holes (SU25, SU44, SU45, SU69) without a clear pattern in the western sector and two alignments of mud-bricks (SU10, SU15) in the northwestern sector of the trench. The meaning of these features is uncertain because of their bad preservation and heavy erosion of the area. Evidence of this phase also includes a concentration of dumps with many fragments of bread molds (SU14, SU31, SU32), a semicircular alignment of four ovoid pits (SU20, SU21, SU22, SU23), a concentration of three large fire pits (SU72, SU75, SU77), and several ovoid dumps in the northwestern corner of the area.

Phase 4 (Figure 33) is represented by a living surface (SU46) and a number of man-made features, mainly small fire pits (SU27, SU56, SU57, SU59, SU61, SU62) sometimes associated with animal bones, and occasional post-holes and dumps, as well as a small concentration of fragments of bread molds (WG 26, E5, Feature 1) and two hearths (WG 26, E5, Feature 2; WG 25, E1, Feature 3).

Phase 5 (Figure 33), is represented by an archaeological deposit with spots of darker soil and slightly different concentrations of artifacts (SU2, SU43, and SU60), along with two fire pits (SU55, SU65).

The ceramics from WG 19/25/26/27 suggest a dating of Phases 5, 4, 3, and 2 to the to late 12th - 13th Dynasties. Phase 1 dates to the early 12th Dynasty.

Western slope, base, WG 22[31]

This excavation unit, 2 m x 2 m in area, was partially excavated to the north of WG 19 in order to assess the extension of the functional area, which was found in WG 19. The excavation was limited to removing superficial loose sand, and confirmed the occurrence of artifacts in the area.

The ceramics are late 12th – 13th Dynasties in date.

Western slope, base, WG 34[32]

This excavation unit was a test pit, 2 m x 2 m in area, in an area where a concentration of buried material was located with the magnetometer along the wadi shore at the base of the terrace slope, to the north of WG 19.

The stratigraphic sequence consisted of a topsoil with a thin stratum of eolian sand (SU1); a layer with ash pervasively throughout, a large lens of very hard (salt) ash and small bits of charcoal near the center of the square, and a lump of copper in the southwestern corner of the trench (SU2); a layer of soft sand beneath the layer with pervasive ash and mottled soil (SU3); and a layer of dense ash, some cemented with hard deposits of salt (SU4).

The ceramics date to the Middle Kingdom.

3.3 Geophysical survey

B. Vining

The 2005-06 field season at Mersa/Wadi Gawasis included a component of geophysical survey that ran concurrently with ongoing archaeological excavation. The geophysical survey employed two methods—gradient magnetometry and electromagnetic induction—and covered approximately 1.3 ha of the site between 1 – 13 January, 2006. This survey had three principal objectives: 1) to locate artificial

[31] Excavation was conducted by K. Bard.
[32] Excavation was conducted by K. Bard.

caves excavated into bedrock 2) to delimit the extent of the archaeological site and provide potential targets for future excavation, and 3) to use excavated and known archaeological features and materials to provisionally characterize geophysical anomalies in this environmental situation. This report discusses the methods used to address these objectives, provides results, and offers recommendations for future geophysical and archaeological field research at Mersa/Wadi Gawasis on the basis of this season's geophysical survey. The section, "Methods" describes the instruments used, geophysical principles, and the survey parameters. The second section, "Results" presents the data collected during the 2006 survey, and provisionally interprets them. Final comments and recommendations for future work are given in the last section.

3.3.a Methods

Two geophysical instruments were employed for the 2006 survey. A Geometrics G-858 cesium-vapor magnetometer was used to identify archaeological features based on thermal-remnant magnetism and a Geonics Limited EM-31 electromagnetic induction (or "conductivity") meter was used to try to identify caves and to map major geological substrates.

Magnetometry survey

Magnetometers measure the intensity of magnetic disturbances relative to the earth's original undisturbed total field (Breiner 1999: 4). These variations result from differing quantities and densities of magnetic iron oxide minerals, primarily haematite (Fe_2O_3). The densities and quantities of magnetite can be affected by both cultural and geological processes, which either reduce iron or concentrate magnetic minerals.

In archaeological applications, magnetic anomalies are principally caused by thermal-remnant magnetism, which is related to the effects of heating. When material is heated beyond its Curie point (approximately 584 °C for iron oxides), the magnetic domains within

are minerals reoriented, such that upon cooling they have a higher apparent magnetism due to the secondary organized structure. Thermal remnant magnetism is indicative of such archaeological materials as baked clay (and brick), fired ceramics, metal artifacts containing iron oxides, or rubified sediments. Remnant magnetism is also characteristic of geological materials (especially igneous rocks such as andesite, basalt, and granite) that can be introduced into archaeological sites as artifacts or as sources of noise. At Mersa/Wadi Gawasis, cultural materials observed to have remnant magnetism, and consequently were visible as localized anomalies, were fire pits and burned sediments, dense concentrations of ceramics, large blocks of granite and basalt on the surface of the site, and a few pieces of modern steel. It appears the magnetometer also detected geological anomalies where magnetic minerals were concentrated by alluvial deposition in abandoned channels.

To remove contributions from geological materials and to enhance the visibility of small, near surface anomalies that are typical of archaeological materials, the magnetometer was used in a gradiometer configuration. A gradiometer subtracts a total field measurement from a bottom sensor from a total field measurement determined by a top sensor; the difference, in nT/meter, is the gradient. The depth of detection is typically limited to near-surface objects (within <1.5 m) by using a gradiometer configuration. The cesium gradiometer is sensitive to variations of 0.1 nT/m. To measure gradients at Mersa/Wadi Gawasis, the bottom sensor was positioned approximately 40 cm above the ground surface with the top sensor at approximately 115 cm above the ground surface. The total magnetic field value for Mersa/Wadi Gawasis, estimated by IGRF models (MagPick software) is 41919.86 nT during 2006.

The magnetometer survey concentrated on the western component of Mersa/Wadi Gawasis, beneath the fossil coral terrace on the colluvial slope and playa basin. Data were collected and analyzed in 20 m × 20 m grids. A total of 20 grids were surveyed, covering approximately 1.32 ha of the site. Gradients were measured along transects spaced one meter

apart and oriented 15 ° E of N. The sensor cycling rate (i.e., the interval at which readings were taken) was 0.1 seconds, and the survey collected data at a rate of approximately 1 m/second. This results in a density of approximately one data point per 10 cm along the Y-axis (the survey direction) and 100 cm along the X-axis.

Electromagnetic induction (conductivity) survey

Electromagnetic induction (EM) employs an electric currently passing between a transmitter and a receiver to measure the conductivity of geological substrates. The transmitting coil generates time-varying magnetism, inducing an electromotive force (EMF) into the conductive substrate. The generated currents have a characteristic decay related to the conductivity, volume, and shape of the conductive substrate. Changes in conductivity have the most significant relationship to the propagation and decay of an EMF, which is measured by the receiving coils. The Geonics, Ltd. EM 31, the instrument used at Mersa/Wadi Gawasis, is sensitive to changes in terrain conductivity of ≥ 5%.

Since electromagnetic induction measures substrate conductivity, it is inversely related to resistivity which has well established archaeological applications (e.g. Clark 1990). Both measurements evaluate the facility with which an electrical current passes through a medium. There are several interrelated factors that effect terrain conductivity, which is a function of the prevalence of conductors within a resistive matrix. Moisture content (free and particle-surface) and the availability of free ions for electrolytic exchange are the strongest determinants of conductivity. These are in turn related to the porosity, organic material or clay content, mineral structure and composition, and grain size of a material (see Scollar *et al.* 1990). Electromagnetic induction at Mersa/Wadi Gawasis measured spatial variability in terrain conductivity related to available water, salinity, and grain size.

Two loci were targeted for EM survey; the surface of the fossil coral terrace above caves WG 3 – 6 and the wadi deposits beneath the

southeast face of the fossil corral terrace in the area of excavation unit WG 10. In all grid-based surveys, readings were taken along transects spaced two meters apart at along-transect intervals of two meters.

3.3.b Results

The site was divided into contiguous western and eastern grids due to the topography of the survey area. The grids referred to below are numbered as in Figure 35. To avoid heading error during magnetic survey, grids were oriented roughly north-south, but were twisted approximately N 15 ° E to follow the local topography. Grids were run up to the edge of the fossil coral terrace. No magnetometer survey was done above the terrace, but two 20 m × 20 m grids of EM data were collected here.

Gradiometer survey

Figures 36 and 37 show the results of the gradiometer survey as a mosaic of the individual grids plotted as grey scales. When plotted as grey scales, magnetic dipoles appear as areas of black and white immediately adjacent to one another, reflecting their positive and negative magnetic characteristics.

Both cultural and geological sources of magnetic anomalies are evident. Cultural anomalies appear to be largely limited to the western survey block, while anomalies in the eastern block likely are mostly geological. Cultural anomalies appear as either isolated clusters of dipoles or as artificially rectilinear arrangements of dipoles. In grids 1, 3, 5, 16, 19, and 20, cultural anomalies appear as clusters of dipoles. These anomalies are scattered across the middle portion of the slope and correspond to surface distributions of ceramic and lithic artifacts. A high density of hearths, burned sediment and ash lenses have been uncovered in units WG 19/25/26/27, which lie within grid 3 and are immediately adjacent to the six grids listed above. Although this area has already been excavated, it was included in the survey to record the magnetic response of these features and to see how this signal compared with other areas. A cluster of three exposed hearths,

indicated in Figure 36 by an arrow, appeared as a magnetic dipole of -78 – 19 nT/m. This is atypically strong, and indicates a large density of magnetic mineral most likely through burning and oxidation. Other features within WG 19/25/26/27 had low-magnitude dipoles on the order of ± 10 nT/m.

Table 1: Statistics for the magnetometer grids in the western portion of the survey area. Values in nT/m.

Number of values	Minimum	Maximum		Mean	Standard deviation
grid1	9285	-28.22	51.56	0.67	2.45
grid2	4628	-154.73	117.53	-8.30	36.35
grid3	4071	-86.07	41.49	1.37	6.50
grid4	4309	-139.77	181.31	2.78	12.84
grid5	6041	-156.40	140.30	0.61	7.22
grid16	6126	-132.10	146.86	3.34	7.05
grid19	11076	-74.42	30.07	1.81	2.04
grid20	6230	-12.36	19.15	2.12	1.28

Most anomalies in the other grids have similar sizes and arrangements, but are even lower magnitude. This can be seen in Table 1. When a gradiometer configuration is used, the mean value of all gradients in a grid (the bottom sensor value subtracted from the top sensor value) should be at or near 0 nT/m. The further a grid's mean is from nT/m, the more magnetic activity there is within that grid and the stronger the magnetic anomalies are. A better metric of the amount of magnetic activity there is within a grid is the standard deviation (σ) of the gradients. The higher σ is, the more magnetic activity there is within the grid, and a lower value for σ shows unity between the two sensors' readings and fewer magnetic anomalies.

In Table 1, grids 2 and 4 have the highest values for the mean and standard deviation. These are most likely due to the magnetic effects of bedrock in grid 2 and back-dirt piles riddled with ceramics in the

case of grid 4. Both are sources of noise, although magnetism in the bedrock may prove to be advantageous for detecting artificial cavities (discussed below). The backdirt is purely noise and problematic.

Grids 3, 5, and 16 have standard deviations between 6.50 - 7.22 nT/m, higher than most of the other grids. There are also large positive and negative nT/m values (see columns "maximum" and "minimum" gradient readings in Table 1). This suggests more magnetic activity. Both the plots and grid statistics suggest that the magnetism in grids 5 and 16, and to a lesser extent in grids 1 and 19, is similar to the magnetism in grid 3 where the fire pit features are excavated. It is likely that excavations in these areas will show that the pyrotechnic features found in WG 19/25/26/27 will continue to the west and also downslope. In grids 1 and 16, the magnetic anomalies are slightly more organized. This includes two rows of dipoles in grid 16 that trend NW – SE, or along the contour of the slope. Given that oven-like features were found in WG 17, just upslope from grid 16, it is possible that more of these will be found if this area is excavated. Most dipoles in these grids are low-magnitude and range between - 5 – 9 nT/m. The narrower range may be due to a dampening effect that overburden has on the magnetic signal. Overall, these grids show that diffuse, relatively unorganized cultural deposits are scattered over the lower portions of the slope to the west of WG 19/25/26/27.

The cultural activity in these grids contrasts with the lack of magnetism in the wadi deposits at the bottom of the slope. The channel that cuts through grid 5 is an exception. This near-surface channel is expressed at the surface as a shallow swale. It appears in the magnetic data most likely because it is infilled with geological materials with a different magnetic susceptibility than the surrounding matrix, although it is possible that it is infilled with deposits of cultural materials. Excavations in the wadi bottom on-contour with this channel show cultural materials to be much lower and more dispersed than are likely to create such a signal.

The magnetism in the eastern block of the survey area is organized differently. These anomalies are primarily linear, with none of the

dipole clusters seen in the western survey block (Figure 37). Further, while excavation is necessary to verify the anomalies, they appear to be primarily geological in origin and likely come from shallow channels that have infilled with magnetically susceptible clays or magnetized gravels, as was seen in grid 5. If the grid statistics are considered, it is clear that there is very little magnetic activity and mostly low-magnitude anomalies in these grids, suggesting their geological

Table 2: Statistics for the magnetometer grids in the eastern portion of the survey area. Values in nT/m.

Number of values	Minimum	Maximum		Mean	Standard deviation
Grid10	8928	-66.47	76.52	-0.07	4.97
Grid11	6240	-24.97	15.01	-0.24	3.40
Grid6	5987	-53.62	53.39	1.27	2.21
Grid7	6189	-104.90	30.48	0.92	3.12
Grid8	6105	-101.29	76.92	1.21	4.36
Grid9	6052	-111.95	35.07	1.13	3.91
Grid12	6167	-27.32	35.14	-0.14	1.57
Grid13	6189	-10.57	7.10	0.16	1.60
Grid14	5777	-92.06	97.55	1.73	3.86
Grid15	6159	-202.09	102.36	1.72	4.83
Grid17	8711	-223.33	238.18	0.06	13.25
Grid18	8727	-157.02	32.19	0.47	4.30

nature (Table 2). Mean nT/m values are very close to zero and even more importantly the standard deviations for each grid are very low (with the exception of grid 17 where a strong magnetic dipole was created by a modern iron bar). There are few concentrations of dense magnetic material in this area, in contrast to the scattered burned features in the other area. The low standard deviation indicates few

strong anomalies, and most readings were within or near a threshold of background magnetism that could be expected for a largely sterile (i.e., non-cultural) geological setting. Many of the stronger anomalies that do appear are caused by recent machinery disturbance linked with the construction of the railway bed. Machinery cuts left several scars on the northeast edge of the survey that exposed gravels with magnetism. Modern erosion has created several channels near these that also have magnetic signals. Isolated iron objects created anomalies in grids 12 and 17. Finally, as in the western portion of the survey area, there are some effects on the data from bedrock magnetism.

When these sources of noise are disregarded, there are several interesting but very faint linear anomalies in this area. These are expressed as two sets of parallel lines, one that runs southwest – northeast and the other north northwest – south southeast. The first set is limited to the southern portion of the survey area (grids 6, 7, 12, 13, and 18) and the latter set is limited to the northern portion (grids 8, 9, 14, and 15). The southern set is most likely a series of wadi channels. The largest of these corresponds to a slight swale on the surface that starts in the SW corner of grid 6, continues into grid 13, and terminates in a modern erosion channel. There are several additional linear anomalies parallel to this one in the SE corner of grid 18, but these are very faint.

The northern set of anomalies is similarly faint and occurs over the distal end of an alluvial fan. Barring excavation and evidence to the contrary, both sets of anomalies probably show a migrating series of deposits. As marine fauna were found in WG 34, this area may possibly have been coastal and the anomalies may reflect accretional phases. I say this, however, very cautiously and stress the need for further exploration.

Surface evidence and previous excavations show that cultural material is concentrated along the slope beneath the coral terrace, in areas that correspond to the northern portions of grids 10 and 11 and the western portions of grids 7 and 8. There is some magnetic activity

here, but it is largely suppressed (one strong dipole in grid 7 is from a mound of sediment and concentrated ceramics). There are two possible explanations for this. The first is that cultural materials present do not have magnetic qualities. Such would be the case for the limestone anchors on the surface. The second possibility is that cultural material is not concentrated well enough to create strong, discrete magnetic anomalies. Related to the second possibility are the magnetic effects of the bedrock and the dampening effect of the heavy overburden of eolian sand in this area. Particularly in grids 10 and 11, the bedrock magnetism appears to have an overpowering effect on smaller magnitude signals that extends 5 m from the bedrock itself. There are at least 4 isolated anomalies that could be investigated further. These are labeled as 1 – 4 in Figure 37. In each instance, these are low magnitude anomalies but there was nothing on the surface to reflect their source. Number 4 is interesting because it corresponds to an isolated low-point in the conductivity data (see below) and number 2 was selected to be excavated (WG 34) because two linear anomalies appeared to intersect there. It is difficult to predict what causes these anomalies.

Bedrock magnetism was problematic for detecting artifacts on the slope directly beneath the scarp, but it may be an asset for detecting large, artificial caves cut into the bedrock. While testing with the magnetometer, it was found that the bedrock at the level of known caves and above had non-directional magnetism, the strength of which decayed with distance (airspace) away from the bedrock. Assuming a relatively constant density of magnetic mineral throughout the bedrock, the strength of a magnetic signal should also be relatively constant. Voids (e.g. caves) would appear as a depletion of magnetic mineral, and hence a magnetic "anomaly" relative to the magnetism of the surrounding bedrock, and caves would theoretically be detectable.

Electromagnetic induction survey

Two areas were surveyed with a Geonics EM 31 electromagnetic induction meter. The first area surveyed the edge of the coral terrace

above Caves 2-6 as two contiguous 20 m × 30 m grids and the second area corresponds to/overlaps with magnetometer grids 6 – 9 in the wadi bottom (Figure 35). The first area was selected to detect caves as voids in the fossil coral terrace. The second area was surveyed to map the sedimentary deposits and detect possible modifications to the wadi channel. Electromagnetic induction measures the apparent conductivity of a geological substrate: more conductive or less conductive (resistive) anomalies reveal unconformities in the substrate that are due to either geological features or perhaps cultural behavior. The results of the EM survey are given in Figure 36 as apparent conductivity values. Both areas show strong contributions to apparent conductivity from near-surface geology, primarily the depth, grain size, and moisture content of sediments. In this regard, more resistive portions of the coral terrace correspond to local topographic highs where the bedrock is closer to the surface and covered with less sediment (Figure 38). Conversely, higher apparent conductivity values were recorded in areas of deeper surficial sediment.

Apparent conductivity—the value measured by electromagnetic induction at a given point on a surface—is a function of the cumulative contribution of subsurface values. The contribution of a substrate's conductivity to the overall apparent conductivity decreases with depth in a non-linear fashion. Apparent conductivity measured at any point, thus, is a function of the homogeneity of a substrate, the substrate's conductivity, and the depth to which the substrate is homogenous (and hence that conductivity is constant). The practical effect which is of concern here is that inhomogeneities at or near the surface will have a stronger contribution than deeper features (even when they are large in magnitude) and could possibly "over-shadow" deeper anomalies. Further, this model of signal decay with depth is based on the premise that the theoretical substrate is homogenous to the maximum depth of sensor penetration and has a constant conductivity. Detecting anomalies strictly on apparent conductivity assumes either a strongly conductive anomaly or detection within a homogenous substrate.

This is rarely the case geologically. Moreover, it is known not to be the case at Mersa/Wadi Gawasis, where four discrete sedimentary strata are exposed in the fossil coral terrace's scarp. These strata are, from top to bottom, a porous coral-dominated bedrock, more massive coral, a relatively fine-grained conglomerate with beach pebbles and shell fragments, and a coarse-grained conglomerate of small cobble-sized clasts deposited in a higher energy environment. These strata have different average conductivities and consequently differential contributions to the apparent conductivity measured at the surface of the terrace. Artificial caves are excavated into layers of conglomerate beneath the fossil coral. As these caves are largely air-filled (with some eolian sand deposited within them) they should be evident as more resistive anomalies within the more conductive bedrock. The caves are not obvious in the raw apparent conductivity data, however, because of the strong contribution to instrument response from near-surface conductivity, and apparent conductivity most closely reflects near-surface geomorphology (Figure 38).

Locally more conductive areas appear to correspond to the course of wadi channels, which are filled with higher moisture, finer sediments. It is interesting to note the correspondence between the apparent conductivity in the second area and the gradient magnetometer data from the same area (grids 6 – 9), displayed side-by-side in Figure 39. Three particular features are of interest (indicated by black numerals in Figure 39A). These are: 1) a recent wadi channel, with high conductivity values that also appears in the magnetic data, 2) a local plateau around 300 – 320 mmhos/m in an otherwise steady increase in conductivity. This also corresponds to faint linear positive magnetic anomalies and occurs where excavation unit WG 36 was opened. This plateau and the positive anomaly may relate to the finding of marine fauna in this excavation unit. Finally, 3) marks a highly localized, negative (i.e., resistant) peak in apparent conductivity. In this area, as there is also a significant magnetic dipole (see Figure 37, number 4 mentioned above). Without excavation it is not certain, but the strong anomalous response from both sensors could indicate a foreign intrusive object at this locus.

3.3.c Conclusions and recommendations

For an initial survey, the geophysical results from the 2006 season at Mersa/Wadi Gawasis can be considered overall to have been successful. Both gradient magnetometry and electromagnetic induction proved to be techniques well suited to the geological environments, archaeological materials, and modern conditions at the site. Fortunately, there were few noise inputs that complicated the application of these techniques. Finally, this season's geophysical survey identified several operational problems which can possibly be circumvented by modifying field techniques or post-acquisition data processing.

The survey had three objectives. The principal objective of this survey was to document the location of known caves and to use this to detect additional caves. Unfortunately, caves were not detected by either instrument in its standard operating mode. Initial tests with the magnetometer do suggest, however, that caves can be detected by increasing sensor spacing as would be appropriate for geological applications. Further, the multilayered Earth model may provide a data-processing technique for detecting anomalies in EM data which are not immediately apparent. This will be pursued.

The second and third objectives were to compile information on the spatial extent of cultural deposits and to provide geomorphological data. Additional areas of burning and cultural deposits were identified with the gradiometer survey, and both methods located channels and other features of interest for the geomorphological history of the wadi. Consequently, depending on project interests, these methods can be applied in other areas of the site. The terrace surface and the coastal shrine area might both be good candidates for additional gradiometer survey. Two factors affected the success of magnetic survey in the area of densest cultural deposits: strong ambient magnetism from the bedrock and a dampening effect on low-magnitude signals from the

deep overburden of eolian sediment nearest the scarp. As already discussed above, it may be possible to turn the bedrock magnetism into an advantageous environmental condition useful for detecting caves. It may also be possible to detect stronger-magnitude features within the sand with modified approaches.

Future research should be coordinated with the archaeologists engaged in excavation, the project geoarchaeologist and, if possible, a geomorphologist. The alluvial history of the wadi and near-coastal areas is of direct relevance for the site's ancient occupation, and geophysical instruments are uniquely suited to providing data relevant to these issues when used within the scope of a well-structured research design. Systematic transects with EM and ground penetrating radar antennae would both be applicable to such studies. A higher frequency electromagnetic induction meter, such as the Geonics EM 38 with an effective sensing depth of approximately 1.5 meters, is particularly suited for many archaeological applications and could be used in conjunction with the larger EM 31 for geological purposes.

Finally, methods not used at Mersa/Wadi Gawasis should be considered for future surveys. High frequency GPR would be applicable for near surface geological as well as archaeological data; a very low frequency antenna may be able to detect caves, either from the terrace surface or more probably through the upper deposits of eolian sand that have accumulated along the slope. With a very low dielectric constant, radar waves will be able to propagate efficiently through the dry eolian sand with minimal attenuation, permitting deep penetration and possibly cave detection. Alternatively, micro-gravimetric survey may be a viable option for detecting caves.

3.4 Geoarchaeology

T. Arpin

An understanding of the natural topography and the natural and anthropogenic site formation processes at Mersa/Wadi Gawasis is necessary to fully understand the site. To that end, geoarchaeological

observations have been undertaken at the site since the 2004-05 season. Much of the site is located on the slope of a Pleistocene marine terrace overlooking a large wadi, which empties into a large wave-cut embayment that forms the modern coastline. Numerous features of unclear dates are found on the terrace itself. The site contains a complicated mixture of eolian, colluvial and alluvial deposits, and a large playa lake formed in the wadi in the early 1990s. The location of the ancient shoreline in relation to the site is at present unclear.

A series of five geological test pits have been excavated at around the site and profiles drawings have been made of other excavation units. Below the field observations are described beginning with the terrace and moving downslope to the wadi bottom. Since this site was occupied intermittently for short durations, possibly from the late Old Kingdom to the early New Kingdom, most of the observations made here can only apply to the general span of occupation rather than to a particular episode of use.

3.4.a Geoarchaeology, terrace

The terrace associated with the site is comprised of limestone (derived from ancient coral). A desert pavement (including many pottery sherds) has formed on the surface, but has been removed by construction equipment near the modern north-south road. In areas unaffected by construction, there are numerous (at least 15 in the area closest to the site) circular features visible on the surface. These circles are 1-1.5 m in diameter; the edges are marked by very low mounds of stone. The desert pavement is much less dense and finer-grained within the features. Excavation units within these features have not been able to trace them to any depth, nor have substantial numbers of artifacts been found. As there is no natural process to account for these features, they appear to be anthropogenic. Given the lack of stratigraphy and artifactual content, it is difficult to interpret them. They may have been tent circles, but the lack of a clear pattern of post-holes is perplexing.

Excavations into the terrace surface revealed a layer of gypsum 10 cm below the present surface. Gypsum precipitates below a stable surface, but normally at depths greater than 10 cm (often 30–40 cm below the surface). Its presence at 10 cm below the surface on the terrace points to a period of landscape stability during which the gypsum precipitated at a greater depth below the surface, followed by a period of erosion. If these features date to the Middle Kingdom, as seems likely, then the formation of the gypsum and the erosion of the terrace surface would pre-date this period.

3.4.b Geoarchaeology, southern slope

Southern slope, WG 15

The deposits visible in both the WG 15 and the geological trench excavated to the west of it contain a sequence of eolian and alluvial deposits (Figure 40). The basal layer in WG 15 is an eolian deposit, over 1.5 m thick, containing occasional well preserved hearths. Excavations in the final days of the 2005-06 field season appeared to expose an earlier alluvial unit below this eolian deposit, but this identification is not certain.

Above the eolian deposit was a channel filled with sub-rounded granule to pebble sized stones. This channel deposit is visible in the western wall of WG 15 and the eastern wall of the geological trench. Both large (over 1 cm) charcoal fragments and pottery sherds are found throughout these layers, indicating that the wadi was actively depositing sediments during the use of the site. Visible in the geological trench, but less apparent in WG 15, is a 10-15 cm zone at the base of the channel deposit composed of well sorted sands with bedded organic material distributed throughout. This layer may represent organic material deposited in standing water and may reflect ponding at the site.

Also visible in WG 15 is a halite layer which occurs at the transition from the eolian to the channel deposit. This same pan also appears in the geological test trench where it is extremely well

developed. A second stratigraphically lower halite layer also appears in the geological trench. In WG 19, B1 gypsum layers occur at depths of close to 1.0 m below the surface. The salt layers that formed in this unit and elsewhere in the wadi bottom differ from those found on the slope in that no cubic halite crystals are visible. The formation of both the halite and the gypsum layers in the wadi bottom is most likely related to a *sabkha* (Butler 1969).

3.4.c Geoarchaeology, western slope

Western slope, WG 16

Excavation units WG 16 and WG 24 are located at the top of slope near the entrance to Cave 2. Both units contain horizontal layers that indicate the area in front of the caves was relatively flat and may have been a wave cut terrace that formed sometime after the terrace itself.

WG 16 reached a layer of loosely consolidated, rounded cobbles similar to that found in WG 17. Numerous post-holes had been dug into this layer. A salt crust also formed on the surface of this layer and impregnated the remains of the posts.

The layers that overlie this crust are a series of eolian and colluvial deposits that also contain common inclusions of preserved vegetal material and the remains of construction material (mud-bricks, mortar, etc.).

Western slope, WG 24

WG 24 is north of WG 16. WG 24 contained a series of interbedded layers of eolian sand and colluvial/anthropogenic sediments and indicates periods of occupation and abandonment at the site.

Most notable about WG 24 are two thick layers of the mineral halite (commonly called table or sea salt). The lower layer is thicker (up to 7 cm) and is more continuous across the unit; this layer also extends into Cave 2. These salt layers most likely formed at or only slightly below the surface, possibly as a result of a spring in the bedrock, and serve as time markers for the unit.

Cubic crystals of halite (its natural crystal habit) are visible across the upper surface of the lower salt layer and across the stone anchors and wooden beams in front of the cave entrance (Figure 41). The preservation of these crystals indicates that the salt layer was rapidly buried by the eolian deposit that overlies it (Figure 42). This eolian layer also contains some cubic salt crystals that probably eroded from the surface of the salt layer. The upper salt layer lacks the cubic crystals found on the lower layer. It is unclear whether these crystals never formed on this layer or whether the surface was exposed for a longer period of time and was eroded.

Western slope, Caves 1-6

There appears to have been a natural rock shelter on the western slope in WG 16, WG 30. Excavation within Caves 1-6 has so far been limited to Caves 1 and 2. While exploration and mapping of the caves is ongoing, a few initial observations regarding the caves can be made. The surface of the terrace is limestone overlying a pebble conglomerate and poorly consolidated sandstone. The caves are cut into the lower, pebble conglomerate and sandstone layers. At least three large (over 1 m) stone slabs have been found buried outside of the Caves 2, 3 and 4. These slabs appear to have been overhangs above the caves that collapsed. It seems unlikely that the inhabitants would have excavated these overhangs and more likely that they formed from the natural erosional processes. There has been considerable wall and ceiling collapse within Caves 2-6. Nevertheless, Cave 3 has vertical walls that have clearly been intentionally cut or at least straightened: the eastern wall of WG 28, Cave 1 is also quite vertical. One would expect to find the several hundred cubic meters of stone that would have been removed during excavation of the caves, on the slopes or the base of the wadi below. To date, such these deposits have not yet been found.

To date only a very limited amount of excavation has been conducted in the entrance to Cave 2. The sediment that has been removed is fine grained silt that appears to be mainly derived from

spalling from the roof walls and ceiling. The entrance also contains a thin (less than 1 cm) layer of halite that is continuous with the layer found in WG 24.

Western slope, WG 17

This unit was excavated downslope from WG 16 and WG 24. The surface of the slope is covered by loose sand and abundant large, usually rounded cobbles of basalt, other volcanic rocks, and chert are visible on the surface. The unit reached a layer of loosely consolidated, rounded cobbles that may be the upper surface of the bedrock and are the source of the cobbles visible on the surface. Some of the cobbles were most likely used as pounding or grinding tools. The oven structures (described elsewhere) were found on top of this layer.

Deposits visible on the surface of the slope, below WG 17, show very noticeable color contrasts. Immediately below WG 17, there is a zone of reddened sand (Figure 43). This sand is similar in appearance to that which was found immediately adjacent to the oven identified in WG 17. This red sand could have been produced by heating which caused oxidation of the quartz sand. A test pit showed that this red sand deposit was at least 30 cm deep. In a 1 m x 1 m unit excavated into this deposit, the sand had been strongly consolidated by halite. This deposit contains no charcoal and very few artifacts.

Below the reddened sediments (reaching to the foot of the slope) was a zone of very dark, charcoal-rich deposits. A test pit excavated into these deposits indicated that they extended to a depth of 45 cm before a layer of reddened sand was reached. These charcoal rich deposits contained more bedding than the reddened sand (which tended to be more massive), and contained varying percentages of reddened sand with some layers having a reddish cast to them. These charcoal rich layers contained very few artifacts.

The presence of such a large volume of sediments that are the product of heating is surprising, since there is no evidence of any large-scale burning activity. The processes that produced the distinct

zonation (reddened sand higher on the slope, charcoal rich sediment on the toe slope) are unclear.

Western slope, base, WG 19/25/26/27

The excavation units excavated at the base of the slope (WG 19/25/26/27) are composed predominantly of anthropogenic deposits with occasional eolian layers (often limited in their areal extent). The anthropogenic layers appear to be the remains of both local activities (primarily involving burning) and debris that was brought (or thrown) from farther upslope. In some layers there are nodules of very soft powdery gypsum (Figure 44). These nodules vary in size from a few mm to several cm across. They also vary in abundance. Given the variations in size and abundance across such a small area (as well as the large size of some nodules), it is very unlikely that they formed naturally within the anthropogenic deposits. It is more likely that the nodules were brought there (similar deposits exist within the wadi). It is unclear what this gypsum was used for, but it could have been used to make gypsum plaster.

Some of the layers within these units also contain reprecipitated crystals of both halite and gypsum. These crystals can be up to 7 cm in length. The appearance of these precipitates is highly variable between layers and even within the same layer. The units are above the base of the wadi and precipitates do not appear to be related to the presence of playas. It seems more likely that the halite crystals formed by processes similar to those that formed the halite layers farther upslope, probably a spring. The gypsum crystals may have formed from the precipitation of the gypsum nodules (already present).

Western slope, base, WG 30

Southeast of WG 19/25/26/27 a 1.0 x 10.0 m trench was excavated to just over one meter in depth. The trench was not excavated stratigraphically although artifacts (pottery and occasional bronze fragments) were collected. The deposits within the trench consisted of colluvial deposits (often including reworked anthropogenic material from further upslope) and thin eolian layers (Figure 45). Below this were a series of layers that were largely anthropogenic in origin (although again they include some thin eolian layers). All pottery found was Middle Kingdom.

Deposits from the upper 0.8 m consisted of largely colluvially anthropogenic material, colluvium from the top of the terrace, and eolian deposits. Below this the deposits are a mixture of midden-like anthropogenic material that was likely dumped debris that originated in WG19/25/26/27 and *in situ* anthropogenic material. The *in situ* material included intact hearths and one largely intact large pottery vessel.

The deposits at the base of WG 30 consisted of bedded fine to coarse alluvial sand. Pottery was found in the upper 10 cm of these sandy deposits. There were two discontinuous layers of clay that most likely formed as the result of standing water, but as both layers are less that 1 cm thick, these ponding events probably lasted only a few weeks. Both occur below the lowest pottery fragments. Occasional shells were found in the southern, deepest part of the trench, but again below the level of the pottery.

The trench was also marked by the presence of gypsum deposits. These varied in thickness and depth (from less than 10 cm thick and 0.6 m below the surface at the northern end of the trench to almost 25 cm thick and 10 cm below the surface at the southern end). These accumulations are secondary and may be attributed in whole or in part to the *sabkha* which exists in the wadi.

3.4.d Geoarchaeology, Wadi Gawasis

Wadi Gawasis, T1, A5

Three 1.0 x 1.0 m trenches were excavated at 10 m intervals from the edge of the playa deposits towards the center of the wadi channel. Each was dug to a depth of just over 1.0 m. In the two test pits in the main wadi channel the water table was reached. The upper 18–20 cm of these units were strongly impregnated with gypsum (Figure 46).

The underlying units were medium sand with occasional lenses of coarse sand. These units were consistent with alluvium. Occasional pottery fragments were found to a depth of about 80 cm. Rare shells were found, but these appeared below the pottery fragments.

Wadi Gawasis, WG 35

This was a 1.0 x 2.0 test pit that was opened to explore anomalous readings that were found during the magnetometry survey. When the readings were found to have been produced by a small wadi cut channel some 30 cm below the surface, the pit was reduced to 1.0 x 1.0 and excavation continued to a depth of 0.8 m. The fill throughout this test pit consisted of bedded fine-sand through granule size particles, consistent with deposition by flowing streams (Figure 47). Occasional pottery fragments were found in the upper 40 cm. Below 50 cm, occasional algae and rare shells were found. These may be from a marine or brackish water environment, although the sediments in which they were found appear to be alluvial.

3.4.e Geoarchaeological observations

Much of the geomorphology of Mersa/Wadi Gawasis has been shaped by the Red Sea. The limestone terrace and the activity areas in front of the caves and at the base of the modern wadi were all likely shaped by waves long before the site was occupied. It is not yet clear where the coastline was at the time of occupation, but it may have been much closer than it currently is.

The deposits at the site were formed primarily through anthropogenic, eolian, and (to a lesser extent) colluvial processes. On the slopes, these layers are very distinctive. The anthropogenic and eolian deposits at the slope base were both reworked by the site occupants as they used the area and were later disturbed by the formation of halite and gypsum crystals, making it difficult to identify the original depositional episodes.

The formation of gypsum and halite crystals and layers at the site were postdepositional processes. The processes responsible for these

layers require further research, but it seems clear that different processes were responsible for the formation processes on the upper slope and at the slope base. The halite on the upper slope may have formed from spring action, while that at the slope base may be related to a *sabkha*. These deposits could serve as important time markers at the site.

Chapter 4
Finds: Pottery

ANDREA MANZO AND CINZIA PERLINGIERI

4.1 Egyptian ceramics

C. Perlingieri

To date about 20,000 fragments of pottery have been excavated at Mersa/Wadi Gawasis, as well as two complete pots from WG 8 and WG 31. The ceramic evidence demonstrates long-term use of the site, from the late Old Kingdom and early First Intermediate period to the early New Kingdom.

Most of the pottery consists of well-known forms from pharaonic sites. A huge amount of Marl C potsherds was widely spread along the slope and at the base of the western terrace, and concentrations of bread molds were found at the base of the western terrace. Two examples of imitation foreign wares(?) were also found.

Analysis of the ceramic assemblage also demonstrates the presence of a locally manufactured pottery. This pottery (a coarse, vegetal tempered ware) is mostly concentrated in WG 19/25/26/27, but was also found in strata in WG 24. The existence of a clay deposit a few km to the south of the site was already known (Bard *et al.* 2004), and unworked clay was found in the production area (WG 19/25/26/27), providing evidence of local ceramic production.

The pottery from Mersa/Wadi Gawasis was described and classified in a detailed list of morphological attributes based on a macroscopic analysis of the fabric, temper, and surface treatment, with the aid of a 10 x hand-lens. *Munsell Soil Color Charts* were used for color identification. The high degree of compatibility between visual and laboratory analyses has been demonstrated in the identification of ancient Egyptian wares, confirming the basic validity of macroscopic observation of the fabrics (see Hope, Blauer and Riederer 1982; Nicholson and Rose 1985).

The fabrics were described according to the "Vienna System," as they basically correspond to ware groups in this system of classification (see Nordström and Bourriau 1993). Some variability was observed on samples from Mersa/Wadi Gawasis, mainly in the surface color and at the section (see Nicholson and Rose 1985; Nicholson and Patterson 1985, 1989).

4.1.a Fabrics

Fabrics of both Nile alluvium clay and marl clay occur at the site, with a much higher percentage of marl fabrics.

Nile alluvium clay fabrics include:

1. Nile B1: levigated Nile silt clay well mixed with sand and a small amount of fine chaff; weak red (2.5 YR 5/2, 5YR 3/1) outside surface; red/weak red (2.5 YR 4/4, 10R 5/4) inside surface; brown/reddish brown (5 YR 2.5/1, 5 YR 4/2) section; thin walled vessels (ca. 0.5-0.6 cm thick). Dates: Old Kingdom to the beginning of the 18th Dynasty. This fabric is typical of Middle Kingdom fine wares from the Delta and Memphis-Faiyum regions (Nordström and Bourriau 1993: 171).

2. Nile B2: Nile silt clay with many large organic inclusions (fibrous vegetal impressions); red (10 R 6/6) outside surface; red (2.5 YR 6/6) inside surface; red (10 R 5/6) core zone, reddish/light brown (7.5 YR 7/4) outer zone of the section; thin- and medium-sized thin-walled vessels (ca. 0.5-0.7 cm thick). Dates: early 12th Dynasty to 18th Dynasty (Nordström and Bourriau 1993: 173).

3. Nile C: Nile silt clay with sand and much chopped straw, resulting in a poorly mixed paste with an extremely porous texture; light brown (7.5 YR 6/2, 10 YR 4/3) outside surface; brown (5 YR 6/4, 5 YR 4/2) inside surface; light brown (7.5 YR 3/0, 7.5 YR 3/2) core zone, reddish/light brown (7.5 YR 4/6, 10 R 5/6) outer zone of the section; uncoated surfaces or with a red slip over the outside surface; large thick-walled vessels (ca. 0.9-1.4 cm), mostly large dishes and large- and medium-sized jars. Dates: Middle Kingdom to the 18th Dynasty (Nordström and Bourriau 1993: 174).

Some vessels were manufactured locally, as can be inferred from a number of unfired bread molds from WG 30, D5, SU70; WG 16, Transect 2, Square 2; and WG 32, SU18. Locally manufactured pottery probably consisted of utilitarian ware for cooking/baking, such as bread molds, platters, and wide, open dishes.

Marl fabrics include:

1. Marl A3: very dense, "exceptionally fine and homogeneous" fabric with tiny ovoid elongated pores (see Nordström and Bourriau 1993: 177); both surfaces and section are fired to a homogeneous pale greyish green color (5 Y 7/3, 5 Y 7/4).

This fabric occurs frequently in early Middle Kingdom and New Kingdom assemblages in Upper Egypt. According to Bourriau (1981: 55), "there is a clear evolution in the fine Marl A clay from an exceptionally fine paste in use in Dynasties XI-XII . . . through coarser variants . . . to a sand-tempered marl clay . . . of the Second Intermediate period."

2. Marl C and variants: overall, this fabric at Mersa/Wadi Gawasis is very similar to Marl C in the Vienna System, especially Marl C1 and Marl C compact (Nordström and Bourriau 1993: 179-81). Diagnostic features are abundant limestone particles, more or less decomposed; fine to medium sand particles; and particles of mudstone or unmixed marl clay. Colors of the Mersa/Wadi Gawasis samples are: red (7.5 YR 8/2, 5 YR 8/2) external surface; reddish brown (10 R 5/6, 10 R 5/6, 5 YR 8/4) internal surface; light reddish brown (5 YR 5/1, 5 YR 4/1) core zone; red (2.5 YR 6/8, 2.5 YR 5/6, 10 R 5/8) edges of the section.

Marl C is the most common and distinctive fabric in the WG 10 assemblage (about 80%). A consistent difference between the Mersa/Wadi Gawasis samples and Marl C compact samples is the large grey/dark grey core, with occasional traces of the first stages of vitrification in the Mersa/Wadi Gawasis samples.

Marl C probably originated in the Memphis-Faiyum region and became dominant in the northern part of the country throughout the entire Middle Kingdom and later (Arnold 1988: 146).

4.1.b Shapes

The majority of the known ceramic shapes from Mersa/Wadi Gawasis consist of large-mouthed storage jars (about 70 % of the whole samples). Other common shapes at the site include medium-sized jars, bottles, plates, and medium- and small-sized unrestricted bowls. The general characteristics of the shapes are summarized in two categories below:

Dishes and unrestricted shapes

Dishes are usually made of Nile C fabric, in simple open forms with a direct rim and rounded lip; diameters are 26 cm or more. Other unrestricted shapes consist mostly of fine Nile B1-B2 small/medium cups with a direct or slightly everted rim and a rounded bottom, ca. 10 cm to 17-18 cm in diameter. A few unrestricted bowls consist of fine Marl A3 small/medium cups with a rounded bottom, ca. 12 cm to 18 cm in diameter and ca. 0.5/0.7 cm thick. Fine Marl A3 medium-sized, carinated bowls with incised wavy decoration, ca. 24 cm in diameter and 0.5 cm thick at the lip, also occur at the site. Some of these round bottomed bowls belong to the class of "drinking bowls" studied in detail by Dorothea Arnold (1988: 140-1).

Restricted shapes

About 90% of the restricted shapes are medium- and large-sized jars. Marl C fabrics occur in about 85% of the jars from the site; the others are made with variants of Marl A, particularly Marl A3. Most Marl C jars are of well known Middle Kingdom types, including: 1) "bag-shaped" *zirs*, large mouthed and flat bottomed; and 2) egg-shaped jars with a narrow corrugated neck. Some rim type variability of the "bag-shaped" *zirs* was recorded at Mersa/Wadi Gawasis; the same variability was also found in other assemblages: Tell el-Dab'a, Dahshur (Ceramic Complex 7), Abu Ghâlib, and at Lisht in the south wall deposits (1 and 2). In all these contexts the Marl C vessels dated to the early 12th Dynasty (see Bader 2001: Figure 45a, 267; Arnold 1977: Figures 11, 3; Arnold 1988: Figure 59, # 1, 2, 3, and Figure 62; Bagh 2002: Figures 10b, 10c). Potsherds with the same type of rim, shape, and fabric, but with a more rounded section (not common at Mersa/Wadi Gawasis), were found in assemblages dated to the early 12th Dynasty: at Lisht in the southwest foundation deposit of the main pyramid, at Ezbet Rushdi, and in the lowest levels at Tell el-Dab'a (Arnold 1988: Figures 55b and 59, 4; Czerny 1999: 45, Figure 19b; Bader 2001: 265, Figure 44d). Egg-shaped jars are common in the earlier levels at Tell el-Dab'a dated to the late 12th to early 13th Dynasties (Bader 2001: 129-31, 13 and 16; see also Bourriau 1996: Figure 2, type 10; Figure 4, types 11, 12).

4.1.c Pot marks

Most of the pot marks found at Mersa/Wadi Gawasis are associated with Marl C *zir*s. A few are incised on fine Marl A3 drinking bowls, and very few were found on Nile B1 drinking bowls. At present, a precise taxonomy of pot marks and associated wares and vessels cannot be done because of the fragmentary evidence of vessels with pot marks.

Most pot marks were incised before firing and some are graffiti. The pre-fired ones consist of vertical or horizontal "commas" (2 cm long on the average), a single "comma", or a pair incised on the interior or exterior of the rim (Figure 48). Less frequently they are located on the exterior, on the upper shoulder. On one rim-sherd (from WG 10) two different rim-marks had been incised on the same vessel.

Graffiti marks are usually bigger (ca. 5 to 7-8 cm) than the incised marks and are located in the middle to upper part of the vessel. Two sherds (from WG 10) and one from WG 15 have a graffito of a stylized boat, and other graffiti on sherds from the site are of hieroglyphic signs (*nfr*, *ntr*, and *mn*). The association of pre-fired incised "rim-marks" and graffiti is common on sherds (see Figure 49).

The values of pot marks used as numbers and fractions in the writing system are not agreed on by all Egyptologists, and these

values also changed through time. Traditionally rim-marks have been associated with a vessel's capacity, but a study to prove this hypothesis has never been conducted. Since most pot marks at archaeological sites are only found on pot fragments, it is often difficult to reconstruct them in terms of their capacity.

Pre-fired incised rim-marks and graffiti represent two different acts made at different times, and should be understood as containing different information. Rim-marks were made during the manufacturing process, and once the vessel was filled and sealed rim-marks were no longer visible. Graffiti marks were made later in the vessel's life: they were made to be seen on the exterior. Rim-marks may have contained "primary" information, requested when the vessels were made, possibly by an official in charge of organizing storage and redistribution, or expeditions. Graffiti represent "secondary" information not necessarily linked to the original incised mark; they may represent an official message or something simpler.

Concerning the boat graffito found on three sherds at Mersa/Wadi Gawasis, it is reasonable to suggest that this sign was somehow linked to the destination of the vessels for a seafaring expedition.

4.1.d Other ceramic artifacts

Many pottery scrapers were found during the 2005-06 field season. More than 70% of the total was from the WG 19 area. These tools were classified into four main categories based on shape: 1) triangles with rounded top (Figure 50a); 2) blade-shaped with flat bottom and rounded top, frequently with S-shaped edges (Figure 50b); 3) half circle (Figure 50c); and 4) squares (Figure 50d).

These ceramic tools were produced with the same technology used for lithic artifacts. They were first roughly shaped and then "retouched" to make a more suitable shape. Many of these scrapers had smooth and sharpened edges from use. These tools, which are not uncommon at other ancient Egyptian sites (Janine Bourriau personal communication), may have had a variety of functions, such as to smooth the clay surface in pottery making, and domestic activities involved in food preparation. It is possible that these scrapers were also used in wood working (Cheryl Ward personal communication), but no archaeological evidence supports this interpretation.

4.1.e Painted ostracon[1]

A Marl C body sherd with a representation of a dog painted in black ink on the external surface was discovered in WG 16, transect 2, SU19 (Figure 51).

The body sherd is 16.3 cm x 16 cm x 1.8 cm. The dog has a thin body, elongated legs, high neck, and a pointed head with prick-ears. It can be identified as a *tsm* dog of the greyhound variety (Osborn and Osbornova 1998: 64).

4.1.f Evidence of pottery production

Specialized pottery-making areas, other than kilns or firing areas, are rarely recognized at archaeological sites. The criteria most frequently used to recognize pottery workshops are the presence of: 1) raw materials - clays, availability of water, tempers, and pigments; 2) pottery-making tools; 3) areas and structures to prepare materials; 4) evidence of firing structures; and 5) unfired vessels. In remote, temporary sites such as Mersa/Wadi Gawasis, however, evidence of unsophisticated firing technology should be expected.

Excavations at WG 19/25/26/27 (see 3.2.d), together with data from other units (especially WG 16), provide evidence of most of the above mentioned criteria for pottery making.

4.1.f.1 Raw materials

Water from the wadi and the presence of local sources of clay (clay deposits have been found a few kilometers from the site) may have played a role in the selection of the area as the harbor for seafaring

[1] Studied by A. Manzo.

expeditions. The location of the production area at WG19/25/26/27 helps to explain its intensive use. This area was situated to take advantage of the prevailing northerly winds that were funneled down the gullies, most likely to facilitate hotter kiln temperatures.

In WG 19 a mound of compact, organic-textured clay silt was found, and small lumps of clay were also found in a nearby concentration of fire pits. It is likely that the clay found in WG 19 was used to make bread molds and other types of ceramics. Petrographic and chemical analysis of this clay should be done to determine its inclusions and elemental composition, and then these data should be compared to those of the clay deposits near the site.

4.1.f.2 Unfired vessels

One fire pit in WG 19 (SU49) contained a partially fired platter. Unfired vessels were also found in WG 32, SU18 (dried, unfired bread mold) and WG 16, Tr. 2, Sq. 2 (dried, unfired bread mold).

Bread molds and platters were manufactured at the site, but, based on fabric parallels, open wide dishes were probably also made at Mersa/Wadi Gawasis. The local fabric is a light tan/brown-greyish, medium-grained clay rich in coarse straw temper that fires to a light brown/orange. Vessels made with such a light and friable fabric are primarily a coarse utilitarian ware, mainly used for cooking. Macroscopic analysis of the fabrics indicates that organic matter, mostly coarse straw, had been added to the paste. This type of fabric is favored for cooking pots because the pores that are created after the organic matter has been burned away help to arrest cracks created by thermal shock during the firing.

Most of these utilitarian pot types (except the bread molds) were formed using a slow wheel and then fired in open-air fires. Open firing was a satisfactory economic solution, as it did not require any investment in constructing and maintaining a kiln, and was sufficient to provide useful, low-fired wares for cooking and storage at the camp. The majority of pottery found at this "outpost," such as large storage jars and open bowls in marl ware, was imported from

workshops connected to the centralized organization of the expeditions. Some of this pottery may have traveled with the trade goods to the final destination in the southern Red Sea region, while some of it was used, broken, and re-used in craft activities at Mersa/Wadi Gawasis.

4.1.g Bread mold production[2]

Based on present evidence, the following reconstruction of the manufacture of tapered bread molds and their use in bread-making is suggested:

1. Local clays were used to make the molds and to produce the fine-grained slip lining the interior shaft.
2. The clay for the molds was tempered with organic materials and shaped around a tapered dowel.
3. The exterior wall of the narrow end was slightly flared, perhaps to create more surface area for the mold base to stand upright, either during firing of the mold and/or during bread baking.
4. The narrow end surface was probably solid with no air hole.
5. The clay was dried to a leather hard state during which it shrank sufficiently to remove the dowel.
6. A fluid suspension of clay was poured into the mold up to the top of the wide end and carefully and quickly rotated to maximize the even distribution of the slip as it was quickly absorbed into and adhered to the vessel wall (Rice 1987:150).
7. Once a slip coat of ca. 1 mm was created, the remainder of the clay suspension was poured out of the vessel.
8. Very soon thereafter, a small air hole was poked through at the narrow end from inside the mold, often leaving a slight ridge around the rim of the hole.
9. After the interior slipped bread mold was completely dried, it was fired at a low temperature. This probably occurred in an open fire

[2] The technique to make bread molds was outlined by S. T. Childs.

covered with local woods and bush as fuel. The same wood used for ship parts has been identified in some of the fire pits at WG 19.

4.1.h Ceramic chronology

Seventy-five percent of the ceramics from Mersa/Wadi Gawasis date to the Middle Kingdom, but the pottery evidence suggests that the site was used from the late Old Kingdom to the early New Kingdom. Old Kingdom/First Intermediate Period evidence, however, is scarce. The chronological sequence of diagnostic types is as follows:

Old Kingdom / First Intermediate Period (Figure 52)

In general terms the types dated to this period are finer compared to later types, and very fine rilling lines reveal the use of the wheel on most of them. The fabric and manufacture of Marl A3 samples are particularly fine. The occurrence of Marl C ware, which is also common in later periods, and the lack of typical early and mid-Old Kingdom fine orange-burnished ware, point to a late Old Kingdom and First Intermediate Period date. These wares include:

1. Nile C: open medium- to small-sized bowls, flattened inflected rim, sharp profile (Kemp 1985: Figure 9, C-12).

2. Nile B1-2: medium-sized collared jars, restricted orifice, and thickened rim (see Kelley 1976: Plate 37.2, 22; Bourriau 2004: Figure 1, 5).

3. Nile B1: collared medium-sized jar, a variant of the previous one with slightly projecting direct rim (see Kelley 1976: Plate 40.6, jar 460/3 from a Middle Kingdom tomb at Lahun; Plate 34.3, type 47L from Qaw and Badari, 9th-11th Dynasties).

4. Nile B1: high-necked jar, slightly projecting high neck with thickened rim (Soukassian, Wuttmann, Pantalacci, Ballet and Picon 1990: 156, Figure 32).

Early 12th Dynasty (Figure 52)

5. Nile B1: open small-sized bowls, "drinking bowl" type, small/medium-sized round bottomed bowls with direct rim (Arnold 1988: 140-141).

6. Nile B1: open small-sized bowls, "drinking bowl" type, small/medium-sized round bottomed bowls with slightly everted rim (Arnold 1988: 140-141).

7. Marl A3: open small-sized bowls, "drinking bowl" type, small/medium-sized round bottomed bowls with direct rim (Arnold 1988: 140 – 141).

These three types of bowls fall within the class of "drinking bowls" studied by Dorothea Arnold (1988: 140 – 141). According to Arnold, the bowls with a short and flat profile belong to the beginning of the 12th Dynasty. This dating is also supported by the very fine fabric of Marl A3 and the low vessel index of all bowls from Mersa/Wadi Gawasis.

8. Marl A3: medium-sized carinated bowl, direct rim, with incised wavy decoration below the rim (Arnold 1982, Abb. 8, 4).

9. Nile B1: dishes with flat oblique lip (Arnold 1988: Figure 63, 189; see also Bourriau 1996: Figure 2, 1.)

10. Nile B2: dishes with direct rim, decorated with impressions of rope, common during the Middle Kingdom to the end of the 12th Dynasty (Arnold 1982: Figure 3, 1; Figure 6, 3; Arnold 1988: Figure 63, 190, 109, 191; Bagh 2002: Figure 4, g-h; Aufrère and Ballet 1990: 7; Bourriau 1996: Figure 3, 1).

11. Nile B2: dishes with a slightly everted lip, common during the Middle Kingdom to the late 12th Dynasty, (Arnold 1988: Figure 63, 189; see also Bourriau 1996: Figure 2, 1).

12. Nile B2: dishes with a slightly everted and thickened lip (Arnold 1982: Figure 3, 1; Figure 6, 3; Arnold 1988: Figure 63, 190, 109, 191; Bagh 2002: Figure 4, g-h; see also Aufrère and Ballet 1990: 7; and Bourriau 1996: Figure 3, 1).

13. Marl C: storage jars, *zir* type, "classic" bag-shaped jars (with a maximum diameter below the middle body. The shape is slender in the upper part. Rims have a triangular section (see all the complete "bag-shaped" jars in Arnold 1988).

14. Marl C: storage jars, *zir* type, sub-globular shape (shoulder orientation is less vertical than the previous group). Rims have a triangular section. Orientation varies from everted to almost vertical.

The rim on the interior is direct to slightly grooved (see Bader 2001: 160-163; also Bader 2002: 42-43).

15. Marl C: storage jars, *zir* type, larger upper body (with maximum diameter in the middle). No similar samples were found for such a large form. The orientation of the shoulder suggests a globular wide-bodied form. Rims have a triangular section. Rim orientation is everted to almost vertical; the rim on the interior is direct to slightly grooved (for the general shape see Arnold 1988).

16. Marl A4: medium-sized jar with wide cylindrical neck. Possible parallels are a Marl A3 medium-sized water jar and a Nile B flask with a broad body in the Fitzwilliam Museum, dated to the early 12th Dynasty and First Intermediate Period, respectively (Bourriau 1981: 70-71, type 131, and 54, type 92). Jars of the early 12th Dynasty usually have a more direct and cylindrical neck (e.g. jars from assemblages dating to Senusret I at Lisht, Arnold 1988, Figure 68 and related tables).

17. Marl A3: bottles, with a vertical or everted neck, thickened rim, and rounded lip. Parallel incised wavy lines frequently decorate the upper part of the body or shoulder. This type is also decorated with incised lozenges (Bourriau 2004: Figure 5, 1), but such decoration does not occur at Mersa/Wadi Gawasis.

18. Local ware: cylindrical bread molds. All bread molds from Mersa/Wadi Gawasis correspond to Jacquet-Gordon's type C9 from Kuban (Jacquet-Gordon 1981: Figure 4).

Three different sizes of bread molds have been identified at Mersa/Wadi Gawasis. Most bread molds are approximately 27-30 cm long. A few smaller bread molds are ca. 24-25 cm long. A few larger bread molds are at least 30 cm long, with a much thicker profile. All of these bread molds are tempered with vegetal material to make the clay body porous. All variants date to the Middle Kingdom and there is no chronological distinction between these types.

Late 12th – 13th Dynasties (Figure 52)

19. Nile B1: open small-sized bowls, "drinking bowl" type, small/medium-sized, round bottomed bowls with a direct rim (Arnold 1988: 140-141).

20. Nile B1: open small-sized bowls, "drinking bowl" type, small/medium-sized, round bottomed bowls with a slightly everted rim (Arnold 1988: 140-141).

21. Marl A3: open small sized bowls, "drinking bowl" type, small/medium-sized, round bottomed bowls with a direct rim (Arnold 1988: 140-141).

According Dorothea Arnold (1988: 140-141), these bowls date to the late 12th Dynasty. This dating is also supported by the coarser quality of Marl A3 bowls.

22. Marl C: medium-sized short-necked bowl. Very fine fabric with a thick white surface layer. This type, which is only represented by a rim-sherd, is very similar to bowls with a spout dating from the late 12th Dynasty to the end of 13th Dynasty (e.g. examples from Dahshur dated to the time of Amenemhat III, and assemblages from Tell el-Dab'a dated to the late 12th to 13th Dynastics; Arnold 1977: 50, Figure 2, 5 and 6; Bader 2002: 43, rim type 54; Aston 2002: 102, pottery group 69, fabric II-c-2).

23. Marl C: restricted bowl. Very fine Marl C, with a thick white surface layer (e.g. examples from Serabit el-Khadim and Dahshur, Ceramic Complex 4, dated to the late 12th Dynasty; Bourriau 1996: 22, Figure 2, 3; Arnold 1982: Figure 9, 9).

24. Marl A2 (or A3, uncertain): bottle (see Aston 2002: 82; Arnold 1988: Figure 70 and related tables).[3]

25. Marl C: medium-sized bottle (see examples from Dahshur, Ceramic Complex 6, and from Serabit el-Khadim, Pottery Group 2; Arnold 1982: Figure 7, 4; Bourriau 1996: Figure 2, 6).[4]

26. Marl C: storage jars with thickened rounded rim, with a groove around the rim interior. This type of grooved rim has parallels with

[3] Aston (2002: 82) remarks that "Type 6 is a transitional type, which retains the inwardly sloping neck form of type 5, but has a distinctly rolled rim, which has not yet developed into the distinct kettle form of the succeeding type 7."

[4] In both cases the rim and profile of the bottles are very similar, but the neck is higher and narrower than in the Mersa/Wadi Gawasis sample.

pottery from the earlier levels at Tell el-Dab'a (Bader 2001: 129-131, 13 and 16; Bourriau 1996: Figure 2, type 10; Figure 4, types 11, 12).

27. Marl C: large necked storage jars with a flattened lip. A typical feature of this type is a direct rim with a flat termination (see examples from Tell el-Dab'a dated to the late 12th to 13th Dynasties; Bader 2001: 160-163).

28. Marl C: ovoid/globular jar with a corrugated neck. This type is characterized by a high everted rim with parallel corrugations (Arnold 1982: Figure 11, 7; Bourriau 2004: Figure 9).

29. Local ware: cylindrical bread molds. This type corresponds to Jacquet-Gordon's Type C9, (Jacquet-Gordon 1981: Figure 4). All variants of this type, based mainly on dimensions, date to the Middle Kingdom, and have no chronological distinction.

Second Intermediate Period – early 18th Dynasty (Figure 52)

30. Nile B1: small unrestricted hemispherical bowls, with a direct rim decorated with red paint at the top. These bowls frequently occur in the Second Intermediate Period and early 18th Dynasty (see Kelley 1976: Plate 50.1, types 7, 8, 12, 14, 15, 16; Holthoer 1977: Plates 23, 24, 30, 31).

31. Nile B1: medium-sized, restricted bowls decorated with alternating red and black painted lines, which presumably covered the upper part of the vessel. This type of decoration frequently occurs in the late Second Intermediate Period and early 18th Dynasty (see Holthoer 1977: Plates 23, 24, 30, 31; Williams 1993: Figure 117).

32. Nile B1: small flat-based bowls. This type occurs frequently at early New Kingdom sites in a brown uncoated ware, and less commonly in a red coated ware (Holthoer 1977: Plates 24, 25, types CU2 and CU3; 26, CU3, CU4 and GO2, goblet with a flat base). Some bases from Mersa/Wadi Gawasis are from deep bowls with vertical walls.[5]

[5] Small unrestricted bowls with a flat base dating to the early New Kingdom from Serra East are also described as "Votive Miniature Cups"; see Williams 1993: 164-165, Figure 101, g, h, k, l.

33. Nile B1: small round-based unrestricted bowls, usually of a brown uncoated ware or sometimes of fine marl yellowish-greenish clay.

Holthoer (1977: Plate 26) describes this type as "miniature dishes with round base, shallow" and "miniature dishes with round base, deep - very deep," and states that these types appear in the Middle Kingdom, but the "very deep" type dates mainly to the New Kingdom.

34. Marl A3: slightly restricted bowl, with a discontinuous profile and a slightly everted rim (Kelley 1976: Plate 47.2, 9K, 9M and 9N, from Qaw and Badari dated to the Second Intermediate Period).

35. Marl A3: medium-sized jars with a short cylindrical neck and rounded everted rim (Kelley 1976: Plate 53.1, type 43 from Diospolis Parva dated to the 18th – 19th Dynasties; Plate 66.2, 3, 4 from Thebes dated to the 18th Dynasty; and Plate 66.4, type 14 from Thebes/Memphis dated to the 18th Dynasty).

36. Marl A2: medium-sized bottle, with a very everted neck, and exterior thickened rim. These bottles occur frequently in early New Kingdom assemblages (Holthoer 1977: types BO1, group IIR/O/e-f, especially BR1 IIR/O/e-f and IIR/4D/a-b; see also the carinated forms in Plates 30 and 31; Williams 1993: Figure 108, b, d, e, g, i, j).

37. Marl A3: large-sized jar with a rounded everted rim (see Kelley 1976: Plate 67.7 from Tell el-Amarna dated to the 18th Dynasty).

38. Marl A3: medium-sized restricted bowl with vertical handles (see Holthoer 1977: 50, 97-101).

4.1.i Chronological sequence of the excavation units

The following chronological sequence of the excavation units at Mersa/Wadi Gawasis is based on the occurrence of diagnostic types of pottery found in the stratigraphic units (SU) in different localities. Numbers below refer to the types of vessels, as listed above. For the complete list of the chronology of stratigraphic units see Table 3.

Table 3: Chronology of stratigraphic units based on ceramic assemblages.

Old Kingdom / First Intermediate Period	WG 10, Corr. 4 (intrusive?) WG 28, Cave 1, SU4
Early 12th Dynasty	WG 2, all SU's WG 3-6, Surf. Coll., SU1, 2, 5 WG 4-5, SU1, 5, 15, 16 WG 7, SU2 WG 8, SU8 WG 9, SU1 WG 10, all SU's WG 12, SU3, 4 WG 13, Surf. Coll. WG 15, all SU's WG 16, SU73 WG 16 tr.1, SU11, 13 WG 18, all SU's WG 19/25/26/27, SU18 (?), 47/87 WG 24, SU40 (?) WG 28, Cave 1, SU1, 2, 3 WG 30, SU1, 51 WG 32, SU10, 16 (?) WG 36, SU2
Late 12th – 13th Dynasties	WG 7, Surf., SU1 WG 8, SU2, 3, 7 WG 10, intrusive on surface of sectors 6, 7, 9, 10 WG 12, SU1 (?) WG 15, SU1 WG 16, SU1, 2, 3, 3-5, 3-4, 4-6, 5, 7-9, 8, 9, 11, 14, 17, 19, 27, 45, 48, 49, 60 WG 17, SU1, 7 WG 18, SU1, 2 (a few intrusive sherds) WG 19/25/26/27, SU1, Feat.1, Feat. 2, Feat. 3, 2, 9, 10, 12/16, 13/79, 15, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 29, 30, 31, 32, 33, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47/87, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 80, 81, 82, 83, 84, 85, 86 WG 22 WG 23, SU1, cleaning south side

Late 12th – 13th Dynasties	WG 24 and WG 24, Cave 2, SU1, 17, 19, 24, 25, 32, 34, 36, 40, 64, 73, 76, 78, 79, 83, 88, 90, 92 WG 30, SU1, 45, 51, 67 WG 31, SU1, 1 bis WG 32, SU19, 20, 24, 26, 28, 30, 32, 34, 35, 37, 39, 40, 60, 61, 70 WG 33, SU1 WG 34, SU1, 2, 3, 4 WG 35 WG 36 SU1
Second Intermediate Period – early 18th Dynasty	WG 7, SU1 WG 24 and Cave 2, SU26, 43 WG 31, SU2
Middle Kingdom (in this group chronologically undefined sherds have been included)	WG 1, all SU's WG 9, SU1, 2 WG 16 tr. 1, SU1, 61, 63, 66, 77 WG 19/25/26/27, SU1, 2 WG 20, all SU's WG 21, all SU's WG 24 and WG 24, Cave 2, SU47, 53, 56, 57, 58 WG 29, all SU's WG 30, SU50, 62, 65 WG 32, SU1, 17, 65, WG 34, 37, 44 WG 36, uncertain

WG 1
Middle Kingdom
13, 14, 15. Marl C: storage jars, *zir* type
26. Marl C: storage jars with thickened rounded rim

WG 2
early 12th Dynasty
13, 14, 15. Marl C: storage jars, *zir* type
WG 3-6

early 12th Dynasty (mostly from SU1 and SU2)
5. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type

WG 4-5
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
6. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
9. Nile B1 and B2: dishes
13, 14, 15. Marl C: storage jars, *zir* type
17. Marl A3: bottles

WG 7
Second Intermediate Period – early 18th Dynasty (SU 1)
26. Marl C: storage jars with thickened rounded rim
38. Marl A3: medium-sized restricted bowls with vertical handles
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type
17. Marl A3: bottles
18. Local ware: cylindrical bread molds

WG 8
early 12th Dynasty
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type
17. Marl A3: bottles
18. Local ware: cylindrical bread molds

WG 9
early 12th Dynasty

13, 14, 15. Marl C: storage jars, *zir* type

WG 10
late 12th – 13th Dynasties (only a few potsherds)
19. Nile B1: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowls
early 12th Dynasty
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type
17. Marl A3: bottles
Old Kingdom / First Intermediate Period (only a few potsherds)
2. Nile B1-2: medium-sized collared jars

WG 12
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowls
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
17. Marl A3: bottles
18. Local ware: cylindrical bread molds

WG 15 (geological test pit)
The ceramic assemblage from this unit, not clearly divided into archaeological stratigraphic units, had a number of sherds with pot marks, both incised and graffiti, mainly with the signs *ir* and *ntr*.
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
26. Marl C: storage jars with thickened rounded rim
early 12th Dynasty
13, 14, 15. Marl C: storage jars, *zir* type
17. Marl A3: bottles

WG 16

Second Intermediate Period – early 18th Dynasty
26. Marl C: storage jars with thickened rounded rim
(two sherds decorated with painted black parallel lines)
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
26. Marl C: storage jars with thickened rounded rim
27. Marl C: large storage necked jars with flattened lip
early 12th Dynasty
17. Marl A3: bottles
18. Local ware: cylindrical bread molds
13, 14, 15. Marl C: storage jars, *zir* type

WG 17
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
26. Marl C: storage jars with thickened rounded rim

WG 18
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
26. Marl C: storage jars with thickened rounded rim
27. Marl C: large necked storage jar with flattened lip
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type

WG 19/25/26/27
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowls
24. Marl A2 (or A3, uncertain): bottles

26. Marl C: storage jars with thickened rounded rim
27. Marl C: large-necked storage jars with flattened lip
28. Marl C: ovoid/globular jars with corrugated neck
29. Local ware: cylindrical bread molds
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
6. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
9. Nile B1 and B2: dishes
10. Nile B2: dishes, open dishes with direct rim
11. Nile B2: dishes, open dishes with slightly everted lips
13, 14, 15. Marl C: storage jars, *zir* type
16. Marl A4: medium-sized jars with wide cylindrical neck
18. Local ware: cylindrical bread molds

WG 20
Middle Kingdom
13, 14, 15. Marl C: storage jars, *zir* type
26. Marl C: storage jars with thickened rounded rim

WG 21
Middle Kingdom
Body sherds of Marl C storage jars and Nile B1 small- and medium-sized open bowls

WG 22
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowl
24. Marl A2 (or A3, uncertain): bottles
26. Marl C: storage jars with thickened rounded rim
28. Marl C: ovoid/globular jars with corrugated neck

WG 23
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
28. Marl C: ovoid/globular jars with corrugated neck

WG 24 and WG 24, Cave 2
Second Intermediate Period – early 18th Dynasty
30. Nile B1: small-sized unrestricted hemispherical bowls
31. Nile B1: medium-sized restricted bowls
32. Nile B1: small-sized flat based bowls
33. Nile B1: small-sized round based unrestricted bowls
36. Marl A2: medium-sized bottles
37. Marl A3: large-sized jars with a rounded everted rim
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
28. Marl C: ovoid/globular jars with corrugated neck

WG 28, Cave 1
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
6. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
13, 14, 15. Marl C: storage jars, *zir* type
16. Marl A4: medium-sized jars with wide cylindrical neck
Old Kingdom / First Intermediate Period
1. Nile C: open medium- to small-sized bowls
2. Nile B1-2: medium-sized collared jars
3. Nile B1: medium-sized collared jars
4. Nile B1: high-necked jars

WG 29
Middle Kingdom

Body sherds of Marl C storage jars and Nile B1 small- and medium-sized open bowls.

WG 30 (geological test pit)
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
26. Marl C: storage jars with thickened rounded rim
28. Marl C: ovoid/globular jars with corrugated neck
29. Local ware: cylindrical bread molds
early 12th Dynasty
5. Nile B1: open small-sized bowls, "drinking bowl" type
6. Nile B1: open small-sized bowls, "drinking bowl" type
7. Marl A3: open small-sized bowls, "drinking bowl" type
10. Nile B2: dishes, open dishes with direct rim
11. Nile B2: dishes, open dishes with slightly everted lips
13, 14, 15. Marl C: storage jars, *zir* type
18. Local ware: cylindrical bread molds

WG 31
The pottery assemblage from this unit is of special interest. In general, it is much finer compared to the contemporary pottery from other units at the site. Marl fabrics, both Marl A and C, are much finer and better fired; particularly abundant are body fragments of Marl A2 and A4.
Two atypical fragments were found in WG 31: 1) a high- and narrow-necked rim with flaring flat top (about 4 cm in diameter), and 2) an open direct rim with a flat top, painted on the exterior with large black bands. The fabric seems to be an extremely fine yellowish Marl A3/4 (this fabric looks slightly different from typical Marl A3 and A4; its identification was based on macroscopic analysis, and thus must be taken as a provisional one). The painted decoration and fabric of these potsherds might be similar to those of a Late Bronze Age Cypriot wheel-made ware, which is contemporary with the early 18th

Dynasty.[6] Further analysis will confirm if these potsherds are from imitations of foreign pottery or imported vessels.
Second Intermediate Period – early 18th Dynasty (?)
32. Nile B1: small flat-based bowls
late 12th – 13th Dynasties
27. Marl C: large necked storage jars with flattened lip.

WG 32
late 12th - 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
20. Nile B1: open small-sized bowls, "drinking bowl" type
21. Marl A3: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowl
26. Marl C: storage jars with thickened rounded rim
28. Marl C: ovoid/globular jar with corrugated neck

WG 33
late 12th – 13th Dynasties
19. Nile B1: open small-sized bowls, "drinking bowl" type
21. Marl A3: open small-sized bowls, "drinking bowl" type
22. Marl C: medium-sized short-necked bowls
26. Marl C: storage jars with thickened rounded rim
28. Marl C: ovoid/globular jars with corrugated neck

WG 34
Middle Kingdom
Body sherds of Marl C storage jars and Nile B1 small- and medium-sized open bowls

WG 36
Middle Kingdom (?)

[6] This remark is based indirectly on comparisons between early New Kingdom pottery and Cypriot pottery. See Hein 1998: 547-554.

Very few body fragments of Marl C storage jars and Nile B1 open bowls

To date, the diagnostic potsherds from the excavated units suggest that the site was used in 1) Old Kingdom / First Intermediate Period (WG 10, WG 28, Cave 1); 2) early 12th Dynasty (WG 2, WG 3-6, WG 4-5, WG 7, WG 8, WG 9, WG 10, WG 12, WG 16, WG 18, WG 19/25/26/27, WG 28, Cave 1, WG 30); 3) late 12th – 13th Dynasties (WG 10, WG 12, WG 15, WG 16, WG 17, WG 18, WG 19/25/26/27, WG 22, WG 23, WG 24, WG 30, WG 31, WG 32, WG 33); and 4) Second Intermediate Period – early 18th Dynasty (WG 7, WG 16, WG 24, Cave 2, WG 31).

4.1.j Egyptian pottery: general remarks

A great quantity of Marl C large storage jars is characteristic of the Egyptian pottery at Mersa/Wadi Gawasis in all phases of occupation. A huge amount of Marl C jar fragments is widely spread across the surface, along the lower slope and base of the western terrace, while bread molds are mainly concentrated at the base of the western terrace. Of particular note is the great quantity of flat-bottomed jars, as these jars are rare at other Middle Kingdom sites. Many flat-bottomed jars were recently discovered at a Middle Kingdom village of miners to the west of the fort at Toshka in Lower Nubia, and at the early Middle Kingdom pyramid complex of Senusret I at Lisht, where they were interpreted as containers from the Memphis-Faiyum region intended for grain storage (see Shaw and Bloxam 1999: 17; Arnold 1988: 113). Marl C ware probably originated in the Memphis-Faiyum region and became dominant in the northern part of the country during the Middle Kingdom and later (Arnold 1988: 146). It is likely that this fabric was an innovation of the potters of the Lisht region, as suggested by Dorothea Arnold (1988: 146), but it has also been suggested that a source of Marl C clay existed in Middle Egypt and "served" the south of the country (Bader 2002: 31). The latter hypothesis, that a source of Marl C clay existed in Middle Egypt, is

reasonable given the intensive economic development during the Middle Kingdom, but the problem cannot be resolved until there are comparative petrographic analyses of pottery from different sites. As remarked elsewhere (Perlingieri n.d.), it is very difficult to understand the significance of all variations in the Marl C fabric. At present it is impossible to state whether the morphological differences between the Marl C ware and variants as described in the Vienna System, and the Marl C ware found at Mersa/Wadi Gawasis, are due to different clay sources used or to the manufacturing process, and if the Mersa/Wadi Gawasis evidence belongs to a different (new?) fabric group.

Concerning other ceramic imports from the Nile Valley, such as the Marl A2 / A3 / A4 small jars and Nile B1 open bowls, these are commonly known as originating in Upper Egypt. This evidence suggests that for some provisions places in Upper Egypt were to some extent involved in the Mersa/Wadi Gawasis expeditions.

4.2 Exotic ceramics

A. Manzo

To date, 29 exotic potsherds have been recovered at Mersa/Wadi Gawasis. They can be placed in two main groups: 1) Nubian potsherds, and 2) potsherds from regions in the southern Red Sea. A few other potsherds which cannot be identified were also collected.

4.2.a Nubian potsherds (Figure 53)

Nubian potsherds were recorded in the following units:

1. Four slightly everted rim-sherds of small closed bowls, with incised horizontal lines on the body and small impressed notches on the rim; dark brown, reddish brown or grey ware. From WG 9, SU1; WG 10, SU1; WG 19 general surface; WG 25, SU2 (Figure 53a).

These vessels occur in: a) assemblages dated to the second half of the 3rd millennium BC near the Western Deffufa at Kerma (Privati 2004: 174, 178, Figures 137.15, 139.8); b) Site D5 in the Wadi Allaqi (Sudanese Eastern Desert), where they are dated to ca. 2500-1500 BC

(Sadr, Castiglioni and Castiglioni 1993: 32, Figure 4.2); c) C-Group and Pan-grave settlements and cemeteries in Lower Nubia, where they are associated with Egyptian materials dating from the Middle Kingdom to the first half of the 18th Dynasty (Bietak 1968: Plate 16, type P 13; Gratien 1985: 52-53, type NT 8, Figure 12; Säve-Söderbergh 1989: 200-205, 261-262, Plate 37, 8, Site 76/76:0; Plate 163, 6, Sites 176 and 18C); d) Egyptian settlements of the late Second Intermediate Period (Smith 1992: 33, Figure 2c).

2. Three body-sherds covered with incised lozenges or triangular bands filled with an incised criss-cross pattern from closed bowls; dark brown or grey ware. From WG 10, SU1; WG 10, SU1, Level 2; WG 18, SU2 (Figure 53b).

These vessels occur in: a) Pan-grave cemeteries and domestic C-Group assemblages dating to the Second Intermediate Period and early New Kingdom (Bietak 1968: Plate 16, P 10; Gratien 1985: 51, type NT 7, Figures 11, 314; Säve-Söderbergh 1989: Plate 20, PI b2, 47/B and 47/1:2); b) assemblages dated to the late Second Intermediate Period at the Second Cataract fort at Aksut, where they are considered typical of the Pan-grave assemblage (Smith 1992: 33, Figure 3, d).

3. Ten body-sherds from open or slightly closed bowls with incised criss-cross bands covering the upper part of the vessel; dark brown or grey organic and/or mineral tempered ware. From WG 10, W dump, surface collection; WG 10, SU1; WG 10, SU1, Level 1; WG 10, SU1, Level 1; WG 15, SU1; WG 15, SU2; WG 16, SU1; WG 16, SU48; WG 18, SU14; WG 27, SU1 (Figure 53c).

These vessels occur in: a) Lower Nubian Pan-grave cemeteries and Egyptian domestic assemblages dating from the late Middle Kingdom to early New Kingdom (Bietak 1966: Plates 25-26, Grab B/1, 76001, 76002, and 76003/a; Plate 27, Grab B/3, 76020, 76015/b; Plate 30 Grab B/10, 76046/b; Plate 31, Grab B/12, 76052/a; Bietak 1968: Plate 16, type P 8/9; Säve-Söderbergh 1989: 166-174, 218-219, Plate 20, type PI c2, 47/A, PI b4, 47/1:1, 47/121:1, 47/51:1 and 193/3:1; Bourriau 1991: 131, Figure 1, 2; Giuliani 2001: 41-43, Figure 11, a-c,

i, Figure 12, a-b, e); b) Askut, were they are dated to the late Middle Kingdom (late 12th-13th Dynasties) and late Second Intermediate Period to early New Kingdom assemblages (Smith 1992: 28, 33, Figures 1 b, 3 a-b; Smith 1995: Figures 3.16 B, 4.10 A-B); c) Upper Nubian Kerma culture cemeteries and settlements dating from the late 3rd to mid-2nd millennia BC (Vila 1987: 262, 264, Figures 42, 4; 94, 5; 170, 1; 173, 3; Privati 2004: 163, 166, 170, 178, 180, Figures 128, 12-13; 129, 9; 130, 12-13; 133, 8; 139, 10, 12; 140, 11).

4. One rim and one upper body-sherd from bowls with a rim band of very irregular triangles of criss-cross incisions; dark grey or brown organic and mineral tempered ware. From WG 18, SU14; WG 16, SU1 (Figure 53d).

These vessels occur in: a) Nubian cemeteries with Egyptian pottery dating to the late Middle Kingdom and/or beginning of the Second Intermediate Period (Giuliani 2001: 41-43, Figure 11 c); b) 13th Dynasty assemblages at Askut (Smith 1992: 28-33, Figure 1 a; Smith 1995: Figure 3.16 A); c) Kerma culture domestic assemblages dating to first half of the 2nd millennium BC (Gratien 1982: 30, Figure 3 c; Gratien and Olive 1981: 77, Figure 3 d).

5. Two body-sherds from vessels with an incised herringbone pattern on the outside; mineral tempered, reddish brown ware. From WG 17, SU1; WG 27, SU46 (Figure 53e).

These vessels occur in: a) Lower Nubian cemeteries dating to the 13th Dynasty, Pan-grave cemeteries, and C-Group domestic assemblages dating to the late Middle Kingdom to early New Kingdom, e.g. at Wadi es Seboua (Bietak 1968: Plate 16, P 12, P 14; Gratien 1985: Figure 13, 245; Säve-Söderbergh 1989: 166-174, Plate 20, Pl b2 47/51:2; Giuliani 2001: 40, Figure 11 g); b) Askut, where they are dated to the 13th Dynasty (Smith 1992: 28-33, Figure 1, e-f; Smith 1995: Figure 3.16, e-f); c) Kerma culture cemeteries and settlements dating from the late 3rd to mid-2nd millennia BC (Vila 1987: 262, 264, Figure 184, 2; Privati 2004: 170, 178, Figure 133, 2; Figure 139, 2).

6. One body-sherd decorated with incised parallel lines, brown ware. From WG 18, SU1 (Figure 53f).

Similar potsherds occur in Lower Nubian C-Group settlements together with Egyptian ceramics dating to the Middle Kingdom and New Kingdom (Säve-Söderbergh 1989: 261-262, Plate 163, 11).

7. One upper body-sherd reused as a scraper with evidence of an incised zig-zag band at the rim; black-topped ware, with smooth reddish brown exterior surface and burnished black interior surface. From WG 28, Cave 1, SU4 East (Figure 53g).

This rim band decoration is rare on black-topped vessels in Lower Nubia, but more frequently occurs on black-topped vessels dating to the mid-3rd to mid-2nd millennia BC in Upper Nubia (Gratien 1978: 148, Figure 41 n; Privati 1999: 46-47, Figures 9, 3, 6; 12, 12; 14, 4; Privati 2000: Figure 129, 4; Privati 2004: 166, 170, 172, Figures 129, 13; 132, 8; 134, 11; Smith 2003: Figures 6-22).

8. Two body-sherds from vessels with an exterior burnished surface and an interior wiped surface. From WG 24, SU24; WG 16, SU48.

Wiping the interior surface is a frequent feature of Nubian pottery (see Williams 1983, Plate 5 A-B, 7 B, 11 E, 12 E, 14 A, 17 A-C; Williams 1993: Figures 16 a, 49 f, 106 d; Vila 1987: Figure 148, 5; Privati 2004: Figure 139, 7; Giuliani 2004: Figure 5 a).

9. One body-sherd, most likely from a bowl or cup, with wiped interior and exterior surfaces and four roughly parallel, oblique incised lines; grey mineral tempered ware. From WG 36, SU1 (Figure 53h).

Bowls with this surface treatment occur in Nubian assemblages from Egypt dating to the 13th Dynasty (e.g. Giuliani 2001: 40, Figure 11 f, Figure 12 c).

10. One black-topped potsherd decorated with burnished perpendicular lines on the exterior and polished crossing lines on the interior; fine mineral tempered ware. From WG, general surface (Figure 53i).

Black-topped vessels with the same interior polishing pattern occur in Nubian graves recorded in Egypt dating to the Middle Kingdom (Giuliani 2004, Figure 4 e). Stick-burnished patterns on black vessels dating to the late 3rd-2nd millennia BC also occur in the Kassala region[7] and at Shaqadud (Butana) (Robertson 1991: 138-139).

4.2.b Potsherds from the southern Arabian coast (Figure 54a-e)

Potsherds from the southern Red Sea region were recorded in the following units:

1. One fragmentary shoulder from a jar with burnished surfaces, decorated with two molded parallel horizontal lines and five vertical parallel lines under them; brown mineral tempered ware. From WG 16, backfill (Figure 54a).

Jars with an everted rim and a similar molded decoration on the shoulder occur at the site of Ma'layba, to the northwest of Aden, where they are dated to Phase 1 of the Sabir culture (ca. 2000-1500 BC) (Vogt and Buffa 2005: 439, Figure 2, 8).

2. Five sherds of closed bowls with a thick rim, roughly smooth outside surface and burnished inside surface; mineral tempered brown ware. From WG 24, Cave 2, Room 1, SU26; WG 24, Cave 2, Room 1, SU43 (Figure 54b).

Similar bowls occur in the northern Yemeni Tihama, where they are dated to the late 3rd to 2nd millennia BC.[8]

3. Rim- and body-sherd with a broken handle decorated on the top with three lines of small impressed circles from a closed bowl with an outside burnished brown slip and inside light wiping; mineral tempered brown ware. From WG 36, SU2 (Figure 54c).

Fabric, shape, and decoration of this bowl are similar to vessels from the Aden region dating to the 2nd millennium BC (Vittoria Buffa personal communication; Lamya Khalili personal communication; Vogt and Buffa 2005: 440-441, Figure 6, 6).

[7] R. Fattovich personal communication.

[8] M. Cattani and M. Tosi, unpublished drawings of materials from Wadi Urq'.

4. One rim-sherd from a thickened rim decorated on the outside with horizontal burnished lines under the rim and parallel burnished oblique lines on the body; dark grey mineral tempered ware. From WG 16, transect 1, SU1 (Figure 54d).

Vessels with the same shape and decoration occur at the site of Sabir in the region of Aden, where they are dated to the second half of the 2nd millennium to early 1st millennium BC.[9]

5. Two rim-sherds from small open dishes with a flattened oblique rim and smooth surface; dark grey/black mineral tempered ware. From WG 10, W dump (Figure 54e).

This shape is similar to bowls or dishes from the site of Ma'layba dating to Phase 1 of the Sabir culture, but the paste and surface treatment of the samples from Mersa/Wadi Gawasis seem different from the Yemeni ones (Vittoria Buffa personal communication).

4.2.c Atypical potsherds (Figure 54f-h)

Two atypical potsherds were recorded:

1. One body-sherd from a vessel decorated with comb impressed lozenges on the exterior; reddish brown mineral tempered ware. From WG 17, SU1 (Figure 54f).

2. One rim-sherd from a cup with a slightly everted rim, roughly smooth exterior surface, decorated with rectangular incised patterns inside of which are horizontally incised lines, and a wiped interior surface. Mineral tempered brown ware. From WG 18, SU9 (Figure 54g).

4.2.d Egyptian imitations of Nubian types

One rim-sherd with a painted black band on the exterior from a small cup; Marl A3 ware. From WG 16, SU48. This potsherd is similar to Egyptian painted bowls reproducing black-topped Nubian bowls, which were made for Nubians living in Egypt, dating to the

[9] B. Vogt, unpublished drawings of materials from Sabir.

late 12th to mid-13th Dynasties (Giuliani 2001: 40, Figure 9a, Plate 2) (Figure 54h).

4.2.e Exotic ceramics: general remarks

The dating of the Nubian pottery to the late 3rd to mid-2nd millennia BC and South Arabian ceramics to the late 3rd to late 2nd millennia BC is consistent with the chronology of Egyptian ceramics at Mersa/Wadi Gawasis. The evidence of Nubian and Yemeni Tihama ceramics, however, shows a different pattern of spatial distribution according to the chronological sequence at the site, as can be inferred from Table 4 with the occurrence of exotic ceramics in different excavation units:

Table 4: Occurrence of exotic ceramics in different excavation units.

Excavation Unit	SU	Nubian	S. Arabian	Egyptian ceramic chronology
WG 28, Cave 1	4	7		Late Old Kingdom -First Intermediate Period
WG 36	2		3	First half of the Middle Kingdom
WG 10	1	1		First half of the Middle Kingdom
WG 36	1	11		First half of the Middle Kingdom
WG 10	1	2		First half of the Middle Kingdom
WG 18	2	2		First half of the Middle Kingdom
WG 10	1	3		First half of the Middle Kingdom
WG 15	2	3		First half of the Middle Kingdom
WG 15	1	3		First half of the Middle Kingdom
WG 18	14	3		First half of the Middle Kingdom
WG 18	14	4		First half of the Middle Kingdom
WG 18	1	6		First half of the Middle Kingdom
WG 16 tr. 1	1		4	Second half of the Middle Kingdom
WG 16 tr. 2	48	10		Second half of the Middle Kingdom
WG 16 tr. 2	1	3		Second half of the Middle Kingdom
WG 16 tr. 2	48	3		Second half of the Middle Kingdom
WG 16 tr. 2	1	4		Second half of the Middle Kingdom
WG 16 tr. 2	48	9		Second half of the Middle Kingdom
WG 27	1	3		Late Middle Kingdom
WG 17	1	5		Late Middle Kingdom
WG 27	46	5		Late Middle Kingdom
WG 24	24	9		Late Middle Kingdom (13th Dynasty)
WG 25	2	1		Middle Kingdom
WG 9	1	1		Middle Kingdom
WG 24, Cave 2	26		2	Late Second Intermediate Period-early New Kingdom
WG 24, Cave 2	43		2	New Kingdom

Nubian potsherds are widely distributed over the western sector of the site and occur in stratigraphic units dated to the late Old Kingdom/First Intermediate Period to late Middle Kingdom. South Arabian ceramics were collected near the cave entrances at the western edge of the terrace and in the wadi bed at the base of the southern slope (Figure 55), and are associated with evidence of ships, such as anchors and large planks of cedar. These ceramics occur in stratigraphic units dated to the early Middle Kingdom to New Kingdom.

At present, the meaning of this spatial patterning is not clear, as the data may be biased by the low number of South Arabian potsherds and possible disturbance of materials in the sand deposits.

Most Nubian potsherds can be ascribed to cooking vessels (Smith 1995: 79). Only the Egyptian painted bowl imitating a black-topped Nubian bowl (Egyptian imitations of Nubian Type 1), and two Nubian black-topped vessels (Nubian Types 7-8) could have been used as tableware or funerary offerings. The South Arabian potsherds can be ascribed to vessels with a direct rim, most likely for domestic use. Only a fragment of a closed jar similar to vessels from Ma'layba (South Arabian Type 1) was possibly a container, as it could be easily closed and used for carrying goods. The fact that most of the exotic ceramics from Mersa/Wadi Gawasis can be ascribed to cooking vessels or tableware suggests the presence of Nubians and South Arabs at Mersa/Wadi Gawasis.

Nubians may have participated in Egyptian expeditions as soldiers. This hypothesis is supported by the similarity between the Nubian

ceramics from Mersa/Wadi Gawasis and those from other Egyptian sites in Egypt and Nubia, as well as the Egyptian painted bowl imitating Nubian black-topped bowls, as this kind of vessel may have been used by Nubian residents in the Egyptian Nile Valley. The presence of Eastern Desert peoples with ceramics similar to Middle Nubian ones, interacting with the Egyptians at Mersa/Wadi Gawasis, is also a possibility.

The possible presence of South Arabs at Mersa/Wadi Gawasis is difficult to explain. They may have joined Egyptian expeditions at some point returning from the southern Red Sea. South Arabs may also have reached Mersa/Wadi Gawasis by themselves, as is suggested by a scene of Puntite boats arriving at an unspecified location on the sea coast under Egyptian control, found in a Theban tomb (TT 143) dated to the time of Amenhotep II (Davies 1935).

Finally, the two atypical potsherds with wiped interior surface and comb impressed decoration may be African in origin. They may be ascribed either to local coastal peoples interacting with Egyptians, or to other peoples living on the African coast of the Red Sea, which is still largely unexplored archaeologically.

Chapter 5
Finds: Ship evidence

CHERYL WARD AND CHIARA ZAZZARO

5.1 Ship timbers: description and preliminary analysis

C. Ward

Excavations at Mersa/Wadi Gawasis in 2005-06 continued to recover the world's oldest remains of seafaring ships. In addition to the presence of hull timbers at an archaeological site once located on the fringes of a lagoon probably linked to the sea, extensive damage to planks and fastenings by the shipworm, or marine borer, provides irrefutable evidence of seafaring.

Twenty-two other ancient Egyptian watercraft built for use on the Nile date from about 3000 to about 500 BC (Ward 2006). Because Egyptian construction techniques used to build these riverine vessels differ significantly from those of later Mediterranean seagoing craft, many scholars assumed that Egyptian ships would more closely reflect Mediterranean-type construction. Discoveries at Mersa/Wadi Gawasis prove that Egyptian design and construction techniques were successful both on the Nile and at sea. This report provides a preliminary review of the timbers excavated in 2004-06 and offers comparisons to other Egyptian watercraft.

Most timbers found at Mersa/Wadi Gawasis in 2004-05 and those excavated in 2005-06 were in contexts that indicate either discard or reuse and recycling in ramps, entrances, and walkways. Many planks were significantly reduced in size or reworked. In addition to 53 individually documented ship components, archaeologists also recovered at least a thousand wood debris fragments related to the dismantling of ships in concert with an aggressive hull cleaning and rot-removal process. Much of the wood debitage shows damage from shipworm infestation (Figure 56).

In 2004-05, Chiara Zazzaro excavated and described, with the assistance of Cinzia Perlingieri, wood objects recovered in WG 24, Cave 2 and WG 28, Cave 1 (see Fattovich and Bard 2005: 21-23). Zazzaro's study of the steering oar/rudder blades (T1, T2) follows in 5.2. Planks available for study in 2005-06 were intensively documented and assigned numbers in a sequential series that incorporated all finds through January 2006. Planks, plank fragments, and other wood finds with features identifying them as hull components or maritime equipment were assigned numbers T1-T60, not inclusive. Wood debris collected from excavation squares by archaeologists received brief scrutiny and recording. Lot numbers (W1-W166, not inclusive) represent associated fragments from a particular area brought to the laboratory on a given day. Wood debris was recorded according to the Stratigraphic Unit (SU) and square. While each lot was photographed, only a few examples could be thoroughly evaluated in the time available, so it is likely that much additional information about ship-breaking activities could be acquired by a thorough study of wood debris and its distribution.

On site, as archaeologists encountered substantial planks or timbers during excavation, the extent of the plank was defined and then cleaned as quickly as possible for mapping into the site plan while reducing exposure to sun and wind. When possible, the plank was then moved to a sheltered location (such as a cave) where it was measured, drawn and recorded in detail, and recorded with digital photographs. The condition of some planks required *in situ* recording, and moving these planks resulted in disarticulation. Most planks are stored on site, but representative examples (plank T34, steering oar/rudder blades T1 and T2, and plank T12, among others) were packed into wooden crates and transferred to Supreme Council of Antiquities storage facilities at Qift.

Archaeologists noted that wood objects tended to be either soft, powdery and weak, or strong and resilient. Preliminary wood identification of ship timbers by Rainer Gerisch (see 6.2.b) suggests that the softer timbers are mostly Nile acacia (*Acacia nilotica*) type

and the much better preserved timbers are cedar, *Cedrus libani*, obtained from sources beyond Egypt's borders, or sycomore, a wood found in the Nile Valley (*Ficus sycomorus*). Whatever wood species was used, the quality was high, typically with fine grain. For example, the Mersa/Wadi Gawasis examples have far fewer knots than the tamarisk Lisht timbers from the pyramid of Senusret I (Ward Haldane 1992), and are comparable in quality to cedar used in the ceremonial cedar boats excavated outside the pyramid of Senusret III at Dahshur.

Analysis of the hull components revealed strong similarities to Middle Kingdom boat construction technology as illustrated in the Dahshur boats and the recycled working boat planks from Lisht, but new or slightly different patterns and priorities are visible in the Mersa/Wadi Gawasis timbers. In addition, thinner, less rigidly fastened planks with waterproofed seams permit speculation about deck-level structures designed to protect precious cargo and crew from the wind and waves of the Red Sea. As expected from analysis of all other ancient Egyptian watercraft, Egyptian shipwrights used mortise-and-tenon fastenings without locking them in place with pegs like later Mediterranean Bronze Age and Classical shipbuilders.

5.1.a Timber types and fastenings

After documentation, excavated wood finds were classified into five types that reflect original function. Planks and wood fragments of unidentified function are classified as "other." Identifiable components of other artifacts such as boxes or furniture included in wood debris from excavation units were considered small finds and are not discussed here.

Distribution of timber types

Transverse timbers (Type 1)	1
Hull planks (Type 2)	16, possibly 17
Deck planks, chamfered (Type 3)	7, possibly 9
Planks with ligatures (Type 4)	5
Auxiliary equipment	6
Other planks, undetermined	12
Fastenings and debitage	T38, T40 and lots W1-W166

A single transverse structural member (Type 1) has been found. Beam T32 is a complete deck-level beam (Figure 57) discovered with its rounded surface uppermost, parallel to the wall of the fossil coral terrace between the entrances to Caves 2 and 3. Its position probably reflects its re-use as an architectural element to stabilize sediments around the cave entrances. Rounded on its lower surface, the beam has ledges to receive deck planking on its upper face to either side of a central pedestal. Its ends, adzed into precise shapes that reflect hull curvature, could be fastened to other planks through square holes in each end.

A plank shape similar to plank shapes from other Egyptian watercraft, comparable dimensions, and damage from marine mollusks, determined whether a timber was classified as a hull plank (Type 2). Sixteen planks are assigned to this category, and all sampled Type 2 planks are cedar. The most straightforward identification in this category is T34 from WG 32, a knife-shaped plank (293 cm long, 46 cm wide, 15 cm thick) like some in the Dahshur and Lisht assemblages (see Figure 26). Other timbers are identified as hull planks on the basis of their size (6.5 cm thick or thicker) in combination with fastening size and pattern (deep mortise-and-tenon joints), and evidence of shipworm damage, usually on one wide face and adjacent edges.

The third timber type consists of short lengths of planking (75 to 90 cm) with chamfered ends on one wide face, widths up to 35 cm, and thickness of less than 5 cm (Figure 58). Type 3 planks are identified as deck planks because of their similarity in proportion and shape to deck planks from the Dahshur boats. Mersa/Wadi Gawasis deck planks are better finished, slightly larger in scale than most Dahshur deck planks (52-68 cm long, up to 29 cm wide and 3.5 cm thick), and at 10 cm the angled portion of the lower face is longer than most chamfered ends of the Dahshur deck planks (4-9 cm).

Most Type 3 examples that were identified are cedar; some are sycomore. Many of these planks have traces of white plaster on at least one wide face; several showed signs of marine borer infestation.

Numerous and deep adze marks and red paint over the damaged areas suggest these areas had been marked out for rot removal but turned out to be more damaged than expected and the planks were recycled as walkway components or wedged beneath larger planks on entrance walls to compensate for plank curvature. One example (T13, of sycomore) has a series of incised marks in the center of its lower face; another (T25) was originally a hull plank (Type 2) and was reshaped with chamfered ends before being recycled in a ramp leading to Cave 3's entrance.

Each Type 4 plank was reused in ramps leading into the entrances to Cave 3 and Cave 4. These planks (2.5-3.5 cm thick) are thinner than planks in the hull of any pharaonic watercraft. They are joined to one another with both mortise-and-tenon fastenings and ligatures (Figure 59). Mortises are about 7 cm deep with a maximum tenon length of 14 cm. Ligatures consist of 1-1.5 cm-diameter holes that pass through the plank's wide faces and are associated with shallow grooves about 4-5 cm long and 4 mm deep that extend to the plank edge on the inner surface only. No lashing was visible in any of the grooves or holes. In addition, excavators found twisted copper strips 2 cm wide in association with the outer face of several planks of this type (Figure 60). No evidence for marine mollusks is recorded for any Type 4 plank although at least three have a black coating along plank edges that probably represents a waterproofing agent on the inner face. All identified members of this class are of Egyptian wood types (acacia and sycomore) and are in good to incoherent condition.

The auxiliary group (Type 5) is comprised of maritime equipment that was not part of a ship's hull, that is, a single blade from each of two steering oars/rudders recovered in 2004-05 (T1 and T2), a 1.89-meter-long crutch or stanchion (*Acacia nilotica*) (Figure 61), and some small pieces including three from projecting knobs that may be oarlocks or pins. Half-round and round-sectioned fragments were also recorded and may represent the remains of oar looms, poles, spars, or battens.

Wood debris and discarded fastenings were separated from bits of branches, twigs, charcoal, boxes, and furniture remains. While many

fragments were so eroded that features were indistinguishable, others retained tool marks, fasteners, and properties that provide at least an outline of their use history. For example, a 4-cm-thick acacia plank fragment with a faceted dowel (T50) and faceted dowel W67 (14.2 x 1.2 cm) were not part of the hull itself, but illustrate the use of common carpentry techniques to join wood. Similarly, pegs in fragments of thin planks and wooden boxes resemble loose pegs found in association with ship debitage, but are not seen in the remains of hull planks. Fastenings incorporate useful information about construction techniques, even without an entire vessel to study. In the case of the Mersa/Wadi Gawasis planks, this category includes free tenons of several sizes in planks and in upper levels of sediments both inside and outside caves; mortises and holes cut into planks for wood-to-wood fastenings; holes drilled for ligatures and lashing channels; pegs and dowels; and copper strips.

Type 2 and Type 4 planks were joined by mortise-and-tenon fastenings in standard sizes and patterns. All identified tenons are *Acacia nilotica*. Mortises (8-9.5 cm wide and 1.5-1.8 cm thick) were cut with chisels into plank edges, extending about 12-15 cm into each plank. Some tenons (Size I) found in archaeological sediments are 22-28 cm long, 4-6 cm wide and 1.2-2 cm thick, but those still in the planks were sawn and chiseled at their midpoints so as to break planks away from neighboring planks along plank seams. Most tenons filled the entire width of the mortise; some occupied only half the mortise when excavated. No pegged (locked) mortise-and-tenon joints are present today, but two loose tenon fragments and one mortise on plank T18 have drilled holes 1.2 cm in diameter, probably for fixing a loose tenon in place as seen on isolated joints in other Egyptian craft. As seen in the Lisht timbers, some mortise-and-tenon fastenings were 'stacked' one above the other, providing strong internal framing for the hull. In most planks, fastening spacing is between 40 and 60 cm.

Mortise-and-tenon fastenings in Type 4 planks were spaced more widely than those in Type 2 planks (60-75 cm), half the depth, and only 5.5-6 cm wide and 1-1.3 cm thick. Tenons (size II) measured 14-15 cm in length, 3.5-5.5 cm at maximum width, and 1-1.2 cm thick. They do not occur in pairs, but about half of those recorded on these planks are directly associated with a ligature fastening. On Egyptian river craft, lashing channels and ligatures have an ancient pedigree. At Mersa/Wadi Gawasis, on the inner face of a Type 4 plank, usually to either side of the tenon, a shallow (4 mm) groove leads from the plank edge to a 1.2-cm-diameter hole through the plank. The holes are offset and one of the channels is usually slightly curved. No trace of the cordage or lashing that passed through these ligatures was found. T8, a Type 3 deck plank, has two sets of opposing ligatures in the same pattern, but lacks mortise-and-tenon fastenings. Two size III tenons (11 cm x 3.5-4 cm x 1 cm) were recovered from sediments, but none of comparable size was documented in place.

Another form of fastening is visible in Type 2 plank T18 and Type 1 beam T32. About 17 cm from each end and 100 cm apart, diagonal holes pass from one edge of the plank to the inner face. Similar holes passing from beams through the sheer strake were recorded by Reisner (1913: 84) for one of the Dahshur boats in the Cairo Egyptian Museum (4925) and are present on the Dahshur boats at the Field Museum of Natural History and the Carnegie Museum of Natural History in the U.S. The hole on T18 is 5 cm x 3 cm on its outboard edge and 3 cm x 2.5 cm where it exits the plank on the outer face. Holes in each end of beam T32 probably fit over sheer strake holes like these. Lashing may also have helped secure beams to planking; two of the beams from the Carnegie Dahshur boat had crushed cordage between the bottom of the beam and the notch cut into the sheer strake.

Copper is rare on extant vessels, but present in limited quantities in the superstructure of the Khufu ships. At Mersa/Wadi Gawasis, twisted and bent remnants of copper strips of a constant width are relatively common (see 7.3). A twisted copper strip fragment (3.4 cm x 1.8 cm) was found with a potsherd beneath ligature holes at End 1 on T13. It resembles a fragment from WG 24, Cave 2, Room 1, C4, SU53 that is 4 cm x 2 cm; an individual strip (10 cm x 2 cm) that was

associated with a thin dovetail-ended plank T60 (10 cm x 2 cm); and, most definitively, four strips (ca. 15 cm x 2 cm) threaded through a single mortise in hull plank T34. The strips are wedged into a mortise through the plank and exit in an 8.5-cm-wide recess on the plank's outer face. Copper strips overlapped one another slightly, but were not fastened to each other; they originally linked T34 to the plank below it much like ligatures visible low on the hull of the Khufu ship (Ward 2000: 49-50). Although there are indications that the other copper strip finds were used as fastenings, no other *in situ* examples were recovered in 2005-06.

Archaeologists also recovered a number of dovetail tenons, all cut in half at their narrowest point, but originally 20 to 34 cm long, 3.5 to 3.8 cm thick, and about 6.5-7 cm at their widest point, narrowing to 3-3.5 cm. Such fasteners were commonly used to secure seams between stone architectural elements in ancient Egypt. Late 19th-century reconstructors of the Dahshur boats cut dovetail fastenings into its planks to replace decayed lashing mortises (Ward 2004), but their use is not otherwise recorded on ancient Egyptian ships or boats. Although some dovetail tenons were present in the general shell and wood debris from plank cleaning activities in Cave 3, no planks or plank fragments excavated in 2004-06 retained any trace of mortises to hold these tenons; only stone anchors or blanks had dovetail mortises. As a result, their function is unknown although pry marks made by chisels suggest that wherever they were used, they fit tightly.

5.1.b Tools, surface treatments, and incised marks

In addition to recording dimensions, wood characteristics and fastening patterns for each timber, all wood fragments were also examined for tool marks and other features to try to understand patterns of activity at the site. Evaluation of tool marks showed that the expected saws, adzes, chisels, and probably polishers were in use both during the construction and recycling process. A few drilled holes imply use of the bow drill, and axes may have been used in a few cases to reduce plank length (T33).

Two categories of tool marks were readily identified and associated with original shaping or reworking of planks (Figure 62). The original shaping of timbers included careful finishing of most examples so that few tool marks are preserved. A few score marks, shallow dubbing marks of an adze with a blade only a few centimeters wide or even smaller, and crushing caused by a chisel handle on one edge of mortises, and, only on Type 4 planks, abundant saw marks on wide faces fall into this category.

Tool marks associated with reworking of planks include saw marks at plank ends, deep and wide gouges made by adzes, chisel marks and pry marks. Another tool of the shipwright stands out, and that is the presence of red paint on finished surfaces that also bear evidence of shipworms. Red paint is present on many of the timbers evaluated in 2005-06, and also on perhaps 5% of the wood debitage. I believe that the paint was used to mark areas that needed to be removed, perhaps in accordance with the Old Kingdom word *šd-(m-)dšr*, translated by John Darnell (1984) as "remove the red." Red paint is present only in areas of extensive re-working or damage.

Some Mersa/Wadi Gawasis planks also bear incised marks that probably relate to hull construction methodology (Figure 63). Two hull planks (T18, T34) and at least one Type 3 deck plank (T15, possibly T11) bear panels of chiseled marks that include at least one multi-dimensional sign and what seem to be notational marks, some of which extend to the plank's edge and suggest they might have been matched with marks on an adjacent plank. Such a system is logical in considering how ships built at a Nile shipyard could be easily reassembled on the Red Sea shore, and has a precedent in the marking system on Khufu hull planks and battens (Nour *et al.* 1960: 8).

5.1.c Preliminary analysis of ship timbers

Ship timbers at Mersa/Wadi Gawasis provide the most ancient direct evidence for seafaring in complex watercraft anywhere in the world. Although the vessels associated with Khufu's Giza pyramid (ca. 2589-2566 BC) and those to the east of Khasekhemy's funerary

enclosure at Abydos (end of the 2nd Dynasty, ca. 2700 BC) are substantially older, they were designed and built for use on the Nile like the Middle Kingdom craft buried at Dahshur and Lisht (ca. 1870-1831 and 1956-1911 BC, respectively) (Ward 2004, 2000). Abdel Moneim Sayed's (1978, 1980, 1983) initial discovery of stone anchors and a few plank fragments revealed hints at what might be preserved at the site, but underwater archaeological survey there was unproductive (Ward 1996).

It is no exaggeration to state no one imagined the abandonment of complete timbers outside the cave system or the coils of rope in Cave 5 at Mersa/Wadi Gawasis, and so the results of this expedition's work are truly groundbreaking. Marine encrustations, destruction by shipworms, ship timbers recycled as architectural elements, and debris left by ship-breaking activity are common both inside and outside the caves on the western slope of the coral terrace. Documentation of wood remains shows that the technology and dimensions of hull components are consistent with what might be expected of seagoing ships in the Middle Kingdom. They are similar to, but sturdier than, Dahshur and Lisht planks, and bear marked similarities to boatbuilding techniques seen in those river craft.

For example, T32 resembles beams from the Dahshur boats, but at 3.29 m long and 0.28 m wide is more massive in scale. The midships beam in the Carnegie Museum of Natural History, for example, was 2.22 m long and was a maximum of 0.18 m wide, with ledges 0.035 m wide and 0.025 m deep. Deck planks are similar in shape and proportion, but about 15 percent larger at Mersa/Wadi Gawasis than on the Dahshur hulls.

Hull planks up to 22 cm thick provide ample evidence of a characteristic Egyptian construction practice, overbuilding. In this case, because shipworm damage extends up to 5 cm into the plank edge, overbuilding does not seem to be an appropriate term. Some plank fragments resembled sponges with a thin layer of finished surface; it is difficult to imagine how they provided any protection from the sea. No exterior coating was recorded for any Type 2 plans,

suggesting that the resinous nature of cedar acted as a moderately effective repellent. Type 4 planks probably functioned in deck-level structures as they are not robust, have small mortise-and-tenon joints, and have no damage from shipworm.

Auxiliary components and maritime equipment such as the crutch, steering oar/rudder blades, and possible oar pins help to elaborate aspects of actual voyaging and also provide insight into the dispersal and disposal of wood elements. Cordage recovered in Cave 2 and stored in coils in Cave 5 (see 7.2) also contribute to understanding more about standing and running rigging for seagoing ships.

The primary activity that may be documented outside Caves 2, 3, and 4 at Wadi Gawasis is ship breaking. In the entrance areas of Caves 2 and 3, work areas identifiable by extensive deposits of chipped and shipworm-infested wood fragments, and fastenings cut and broken with tools, testify to the trimming and reworking of planks. Examination of wood debitage indicates large-scale removal of damaged wood from ships built of planks like those recorded in 2005-06.

It is likely that once ships returned from their voyage, shipwrights inspected the hulls, perhaps marking unsatisfactory timbers with red paint. Workers then began to remove planks from the hulls by prying seams apart and sawing or chiseling through the tenons, and others most likely followed behind them and pulled the planks off the ship from the outside. Once timbers were broken off the ships outside the caves, men carried them into the cave. They walked over ramps reinforced with mud-bricks and planks and across walkways made of short and cut-up planks about 80-100 cm long from the entrance across the lower levels of Cave 2, Room 1 into the 19 m x 4 m working space. There, workers cleaned and prepared individual planks, some of which may have been returned to shipyards on the Nile, while others were recycled in architectural features on the site. Some planks were stored or discarded in the cave rooms, and some were even used as fuel, as charcoal samples identified by Rainer Gerisch as non-native species *Cedrus libani, Pinus* sp., *Quercus* sp., and even ebony, indicate.

Like other unique artifacts discovered by archaeologists working at Mersa/Wadi Gawasis, the ship timbers and remains contribute to a broader understanding not only of the role of shipbuilding technology and achievement, but also of the vast administrative and bureaucratic nature of ancient Egyptian contacts with the world beyond Egypt's borders.

5.1.d Partial catalog of timbers[1]

T32: Type 1 beam, *Cedrus libani*
WG 30/WG 16, between Caves 3 and 4, SU50
MaxL: 329 cm MaxW: 28 cm MaxTh: 18 cm

In very good condition, beam T32 was excavated with its lower, rounded face uppermost. Mud plaster and salt, mixed with wood and broken ceramics, covered the sides of the beam. Heartwood is central in the beam, and a few knots are visible. On the upper face, carved ledges define a central pedestal. On one edge, the ledge is about 8 cm wide and 4 cm deep; the opposite ledge is only 6 cm wide. A similar pattern is present on Carnegie Museum Dahshur boat beams. The central pedestal (12-14 cm wide) is almost entirely worn away in the middle third of the beam and has major concentrations of hatch and chopping marks 70-100 cm from each end. A 4 cm x 5 cm hole extends 7 cm into the beam from the upper surface, and a 4 cm x 4 cm hole is present at each end of the beam. The 4 cm x 4 cm hole is nearly vertical, and central in the thinned and shaped ends that fit into notches cut into the sheer strake. Shallow grooves connect the holes to the beam ends on the lower surface.

[1] Abbreviations used here are as follows: OF Outer Face, exterior planking surface; IF Inner Face, interior planking surface; MaxL Maximum Length; MaxW Maximum Width; MaxTh Maximum Thickness; rem Remaining. Timbers have two edges, two ends, and outer and inner faces. All wood identifications to species level were made by Rainer Gerisch. Where wood type is described as having gross morphological characteristics similar to a particular species, this indicates a similarity of color, grain pattern, density, and general evaluation of pore presence and distribution rather than a scientific identification to species level.

T34: Type 2 plank, *Cedrus libani*
MaxL: 293 cm MaxW: 43 cm MaxTh: 15 cm
WG 32, SU9

In very good condition, knife-shaped hull plank T34 has some wood rot and insect damage on its wide end. Several large knots (10-15 cm) are present on the IF and Edge A, but grain runs parallel to the long Edge B. The OF is wider than the IF, and the IF is slightly concave. Plank T34 was fastened to other timbers by deep mortise-and-tenon joints (8-9.5 cm wide, 1.2-1.5 cm thick, and 13 cm deep) and secured by a band of copper composed of four strips threaded through a mortise near the tip of the plank's wide faces. Wood tenons were originally about 21-26 cm long. All remaining tenons are about half that length today because they were sawn and chiseled to break this plank away from its neighboring planks along the former plank seam. No pegged (locked) mortise-and-tenon joints are present. No lashing channels are present; 22 of 25 fastenings are paired mortise-and-tenon joints, much like those in the Lisht timbers. Two series of incised marks are present on the plank's inner face.

T18: Type 2 plank
MaxL: 134 cm MaxW: 16 cm MaxTh: 11 cm
WG 24, Cave 2, entrance corridor, SU32 [2004-05]

In poor condition due to its relatively exposed position high in the sand outside the cave and heavy salt encrustation, little original surface remains on this plank. Light insect damage is present for about 50 cm along the IB edge/OF margin near End 1. T18 is cracked along Edge A; near End 1 is a partial mortise (8.5 cm wide, 1.2 cm thick, and 5.5 cm deep). Heavy salt encrustation obscures about half of the IF and End 1 on the inboard edge, but 13 mortise-and-tenon joints, one with a 1.2 cm peg hole to the OF, are present on the outboard edge (Edge A). The remains of two diagonal holes are visible on the OF (3.5 cm x 3.5 cm) and outboard Edge A (5 cm x 5 cm). Some tenons remain in mortises; no fastenings are visible on the IF. Mortise-and-tenon fastenings are extremely close-set and are

separated by only a millimeter or two, if that, in some cases. The wood shares gross morphological characteristics with cedar type wood.

T25: Type 2 plank fragment converted to a Type 3 plank, *Cedrus libani*
MaxL rem: 77 cm MaxW rem: 15 cm MaxTh: 7 cm
WG 30, D5 (north), SU62

Despite extensive shipworm infestation on both edges and OF, T25 is in overall good condition. Shipworm channels, with shells, run along grain lines on OF and extends up to 4.5 cm into thickness of plank. Wood grain runs parallel to plank edges and only one small knot (3 cm diameter) was recorded. The remains of three mortises (7.5, 8.5 and 9.5 cm wide and 1.2 cm thick) are visible on IF and the edges. Heavy dubbing with an adze blade 4.3 cm long with bites up to 1.5 cm deep and lines of red paint centrally located and near End 2 cover much of the IF. Chisel marks are visible in mortise 2.

This plank fragment originally was a Type 2 hull plank, but has been reworked as a Type 3 chamfered deck plank, as the plank ends each show a ca. 10-cm-long angle on the original OF.

T13: Type 4 plank, *Acacia nilotica*
MaxL rem: 122 cm MaxW: 19 cm MaxTh: 3.4 cm

T14: Type 4 plank, *Acacia nilotica*
MaxL: 203 cm MaxW: 25 cm MaxTh: 3.8 cm
WG 30, C4/C5, SU62

In good condition when exposed, but soft and entirely disaggregated when removed, T13 and T14 were still joined by two mortise-and-tenon fastenings when uncovered outside Cave 4. The seam was open by 0.7-3.5 cm when first exposed. The IF was uppermost, and the OF was not observed closely, but seems heavily eroded. No damage from marine borers was identified, but some insect damage was visible on the IF of both pieces. Neither timber was complete, but End 1 of T13 and End 2 of T14 are original. A black coating up to 3.3 cm wide is present on the IF along the original edges of both planks. Edge B of T14 was bright red and very smoothly worked when exposed.

On T14, four mortise-and-tenon fastenings (6 cm wide, 1 cm thick and 5-6 cm deep) retained tenons 5 cm wide at the plank seam on Edge B, and traces of a pair of ligatures remain on Edge A near End 1, but this part of the plank had crumbled before it could be completely recorded. Edge B of T13 had a single pair of ligature holes and one 12-cm-long tenon preserved in a mortise 6 x 1 x 5 cm. A single hole (1.2 cm diameter) was centrally located between the two pairs of ligature holes and grooves at End 1 of T13. A twisted copper strip fragment was found under the ligature holes near End 1 when T13 was removed.

An attempt to consolidate the timbers using Paralloid B-72 prior to removal was unsuccessful.

T1: Type 5, steering oar/rudder blade, *Acacia nilotica*
WG 24, Cave 2 entrance, SU26 [2004-05]
Steering oar/rudder blades are described in 5.2.

T2: Type 5, steering oar/rudder blade in 2 pieces, *Acacia nilotica: Faldherbia albida*
WG 24, Cave 2 entrance, SU26 [2004-05]
Steering oar/rudder blades are described in 5.2.

T44: Type 5, crutch, *Acacia nilotica*
MaxL rem: 189 cm MaxW: 18 cm MaxTh: 6.9 cm loom
Cave 4, leaning against north wall

Bowed, with a friable and dry surface that is cracked and checked, this crutch is nearly complete. Carved from a branch with a bifurcated end, T44 has few small knots, is fine grained, and has centrally located heartwood. The crutch opening (13 cm x 8.5 cm x 7 cm x 8.5 cm) is flattened along its narrowest surface and slightly concave on its sides.

T45: Type 5 fragment, carved pin or peg, *Ficus sycomorus*
MaxL rem: 9.5 cm MaxH rem: 10.2 cm MaxTh: 6 cm Max peg circumference 19 cm
WG 24, Cave 2, Room 1 just north of T16

A peg carved from compass timber rises from a flat base with one original rounded edge and two roughly hacked edges remaining. T45 was found with the peg oriented vertically with its flat lower face uppermost in a position that "squared off" the re-shaped tip of T16. It is in very good condition and has no damage from insects or marine life.

W147: wedge-shaped fragment that resembles the base of T45
MaxL rem: 13.5 cm MaxW rem: 10.5 cm MaxTh: 2.5 cm
WG 24, Cave 2, Room 1, E5, SU43

W63: from a peg fragment of similar proportions to W147
MaxH rem: 6.8 cm MaxW: 5.5 cm
WG 24, Cave 2, Room 1, C2, SU53

All three pegs/peg fragments (T45, W147, W63) share gross morphological characteristics of the same wood type, but only T45 was identified.

5.2 Ship blades

C. Zazzaro

During the 2004-05 field season, two steering oar/rudder blades were found covered by windblown sand, in the upper level of the Cave 2 entrance corridor, WG 24 (Figure 64). Associated with them were branches, algae and leaves, some rope fragments, and potsherds dating to the early New Kingdom (see 4.1.h). Found on top of a deposit of windblown sand, the two blades represent the remains of the last seafaring expedition at Mersa/Wadi Gawasis.

Blade 1 / T1 (Figure 65a)
MaxL: 200 cm MaxW: 40 cm, MinW: 15 cm MaxTh: 12 cm

T1 consists of two parts joined by a scarf junction. It is triangular in shape, with a rounded corner and an indented cut near the top. The upper part is of *Acacia Nilotica* (see 6.2.b): it has a fragile consistency, with insect damage on the surface. The lower, better preserved part is of *Faidherbia albida* (see 6.2.b), which grows in the Nile Valley as well as in sub-Saharan regions. Its surface is thickly encrusted with salt and shows insect damage, which occurred after abandonment at the site.

On T1 the fastening consists of five mortises with four partially preserved tenons still *in situ* (tenon dimensions: MaxL: 20 cm, MaxW: 9 cm, MaxTh: 2.4 cm). Mortises 3, 4 and 5 are fixed with perpendicular pegs 1.5 cm in diameter. Mortises 4 and 5 are broken by two trapezoidal cuts containing copper remains. A hole, 6 cm in diameter, through which rope would have passed, is carved into the upper part of the blade.

Blade 2 / T2 (Figure 65b)
MaxL: 175 cm MaxW: 35 cm MaxTh: 12 cm

T2 is identified as *Acacia Nilotica* (see 6.2.b); it is poorly preserved, and the lower part is damaged by shipworms, which demonstrates that the blade was used in the sea. Small remains of copper are seen in the damaged lower part. The blade is triangular in shape with a rounded corner and a groove on the top.

On T2 the fastening consists of four fragmentary mortises with two partially preserved tenons (tenon dimensions: MaxL 22.5 cm MaxW 9 cm). A hole, 7.5 cm in diameter, through which rope would have passed, is carved into the upper part of the blade.

The two blades are probably part of the same steering oar/rudder, in spite of differences in length and top shape. They seem to have been modified and/or re-adapted. The lower part of T1, which is of a different species of wood, might have been a later addition, as this part

is much better preserved than the upper part. Mortises and tenons alternate on the two blades, and they originally connected each blade to a central loom, which is missing.[2] After the last use, the original steering oar/rudder was most likely dismantled cutting the tenons connecting the blades to the loom. Where and how the original steering oar/rudder was positioned on the stern, and if it was employed as steering oar or as quarter rudder, cannot be determined.

The original fastening also included the use of copper strips, since copper traces are still visible in the two cuts along the edge of T1 and in the lower part of T2. The copper strips may have been used to protect or reinforce the mortise-and-tenon junctions and to fasten the blades to each other and to the loom. The strips were probably removed with part of the timber during the dismantling of the ship (see the two trapezoidal cuts on Blade 1 in Figure 65a). In representations of ancient Egyptian ships, Reisner and Boureaux have interpreted dark bands on steering oars and quarter rudders as evidence of metal bands (see Boureaux 1925: 341-45; Reisner 1913: Plates 12-13, 4801, 4820, 4825, 4844), and the Mersa/Wadi Gawasis evidence is the first of copper used in the fastening of an ancient Egyptian boat.

The two circular holes are carved almost in the same place on each blade. These functional holes provided a channel for rope to secure the blades to the hull, as with the steering oars from the Dahshur boats (Ward, 2000: 96) and in several representations of ancient Egyptian ships and boats (see also Faulkner, 1940: 7).

The triangular shape of the Mersa/Wadi Gawasis steering oar/rudder is similar to those in ship representations of the Second Intermediate Period to early New Kingdom, which also have a triangularly-shaped steering oar and quarter rudder.[3] The representational evidence thus fits well with the pottery associated with the Mersa/Wadi Gawasis steering oar/rudder blades, which have been dated to the early New Kingdom (see 4.1.h).

The length of the two Mersa/Wadi Gawasis blades also provides data for estimating the dimensions of the original ship. In representations of ancient Egyptian ships, and in the Dahshur boats, the proportion between the quarter rudder and the hull is frequently 1:8 to 1:10. Therefore, the dimensions of the Mersa/Wadi Gawasis blades suggest a ship 14.4-20 m long, which seem appropriate for a seafaring vessel in the Red Sea. The expedition fleet probably included ships of different sizes, as is attested by the reliefs of Hatshepsut's expedition to Punt (Naville 1907-1913, Plates 72-75) and by the Papyrus Harris, which records Ramses III's expedition to Punt (Bongrani 1997: 46).

The Hatshepsut expedition is the only known one that coincides with the probable date of the Mersa/Wadi Gawasis blades. There may have been other seafaring expeditions to Punt in the early New Kingdom, however, that are unknown because no records of them have survived.

[2] A similar fastening is also attested in the steering oars from the Dahshur boats (Creasman 2005:109, Figure 51; Ward 2000: 96).

[3] See, for example, the triangular quarter rudders of the gold model boat from the Theban tomb of Ahhotep now in the Cairo Museum (JE 4681, JE 4669), in model boats from Tutankhamen's tomb (see Jones 1990), and in reliefs at Ramses III's Medinet Habu temple illustrating the naval battle with the Sea Peoples.

5.3 Stone anchors and pierced stones[4]

C. Zazzaro

To date, twenty-six whole or fragmentary stone anchors have been found at Mersa/Wadi Gawasis, which are the main evidence for the study of the ancient Egyptian stone anchors. Six anchors were recorded by Sayed in the mid-1970s (Sayed 1980: 154-156; see also Frost 1979; Nibbi 1975, 1984, 1992, 1993). Twenty anchors (and three pierced stones of uncertain function) were recorded by the UNO/BU expedition.

[4] Mohamed Mustafa Abdel Maguid helped record anchors in 2005-06.

Anchors and pierced stones from the UNO/BU expedition were recorded describing their shape, material, dimensions, and (possibly) weight, as well as the context in which they were found (Table 5).

5.3.a Stone anchors

Anchors were found in many localities at Mersa/Wadi Gawasis, mainly on the surface and in strata of sand.[5] Providing a better construction material than the local conglomerate stone, some anchors had also been used for construction, in ceremonial structures or to build the two walls at the entrance to Cave 2. The absence of evidence of use on their surfaces suggests that most anchors were never in the sea, or were used only for a short time during one expedition (Mohamed Mustafa Abdel Maguid personal communication). Only one anchor (A11), excavated in the wadi along the southern slope of the terrace may actually have been used in the sea.

One well preserved anchor (A2) and fragments of six limestone anchors (A13, A14, A15, A16, A17, A18) were associated with the ceremonial structures and/or landmarks for ships on the eastern terrace at Mersa/Wadi Gawasis (see also Sayed 1980: 154-157; Frost 1996: 876). Most of the anchors from this area are small and not well preserved due to exposure to the sun and wind. As in the case of anchor A2, still *in situ* (Figure 66), the other anchors had probably been placed horizontally at the entrance of the structures.

Several small fragments of a limestone anchor(?), ca. 10.8 kg in total weight, were found on the surface of the western terrace, near WG 3-6. They were probably fragments from the pedestal anchor of

[5] All examples of ancient Egyptian stone anchors and pierced stones have been found on land, frequently in mortuary structures such as the mastaba of Kahotep at Abusir, the mastabas of Mereruka and Ptahhotep at Saqqara, and the mortuary temple of Userkaf at Abusir (Frost 1979: 142). Egyptian stone anchors have also been found in the Late Bronze Age temples of Baal at Ugarit (Frost 1996: 2 b, 17) and at Byblos (Frost 1969b: 425-429). Only six anchors have been recorded in a non-ceremonial context: the Middle Kingdom fortress at Mirgissa, and Tell Basta, where three New Kingdom anchors were found (Bakr and Nibbi 1991:3).

the Antefoker stela that Sayed recorded in 1976 (Sayed 1977: Plate 15, Figures d, e, f).

One anchor (A1) was also found on the western slope of the terrace at the entrance of Cave 3 and another one (A12) was found near the entrance of Cave 4. Some anchor fragments (A20) were also collected near Cave 1. Six limestone anchors (A3, A4, A5, A6, A7 and A8) were used to build the walls at the entrance of Cave 2: two anchors were in the northwest wall and four were in the southeast wall. These anchors did not show clear signs of use in water and seem to have been used only in the wall structures. Some of the anchors also show evidence of alteration for building: A7 and A8 were cut off to fit in the constructed wall. Three anchors (A3, A4, A6) have lateral cuts of a dovetail shape, one of which still contained remains of the wood joint.[6]

Two large limestone anchors (A9, A10) recorded by Sayed (1980: 156) and Frost (1996: 882-883) were found on the surface along the southern slope of the coral terrace. Both anchors were unfinished, suggesting that some anchors were made locally.

Lastly, one anchor (A11) was found at the base of the southern slope of the terrace along the wadi bed, in WG 36. This anchor was not associated with any structure and was probably lying on the original shore of the harbor, about 70 cm below the present surface. Associated with this anchor were fragments of a large Middle Kingdom jar, animal and fish bones, shells, and charcoal.

The Mersa/Wadi Gawasis anchors provide much information about the characteristics of Egyptian stone anchors in the Middle Kingdom - and perhaps also in the early New Kingdom. The anchors are triangular or more asymmetrical in shape, with a rounded top. There is

[6] Wooden dovetails were used in ancient Egyptian stone architecture (eg. a New Kingdom example from Deir el-Medina excavated by Ernesto Schiaparelli and now in the Egyptian Museum, Turin, 9973). The use of anchors as a construction material has also been recorded in the temple of Baal at Ugarit (Frost 1991: 356-357). The anchors from the walls of Cave 2 at Mersa/Wadi Gawasis, however, were not used in a cultic context.

a pierced hole in the upper part of the anchor, with a groove for rope between the hole and the top. Some anchors have an additional L-shaped hole in a lower corner for another rope, to help remove them from the sea floor.

Most anchors were made of fine limestone. Only two anchors were made of other materials: A1 (granite) and A11 (coral rock).[7] Limestone sources are widespread throughout the Nile Valley and on the desert plateaux to the east and west (Aston, Harrell and Shaw 2000: 40), and probably also in the Mersa/Wadi Gawasis region (Trina Arpin personal communication). Coral rock is found at Mersa/Wadi Gawasis in layers in the fossil coral terrace.

The anchors vary in size. The largest one (A5) is 105 cm long, 62 cm wide, and 16-25 cm thick. The smallest one (recorded by Sayed) is ca. 40-45 cm long, 20-25 cm wide, and ca. 15-20 cm thick.[8]

Some anchors have clear tool marks on the surface, in the carved dovetails, and in the upper holes and L-shaped holes. Chisel marks ca. 1-2 cm wide, made in an oblique direction, have been observed. According to Mohamed Mustafa Abdel Maguid, a simple technique was used to pierce the upper holes. Upper holes that are bi-conically shaped in cross-section were most likely pierced with a chisel in a diagonal direction from right to left, on both sides. Upper holes that are tubular shaped were pierced using a chisel in a diagonal direction from right to left and piercing the stone from one side to the other.

Based on the associated ceramics, most anchors at Mersa/Wadi Gawasis can be dated to the Middle Kingdom. The asymmetrical shapes and dimensions of A1 and A9 are similar to the anchors used in the 'Ankhow and Antefoker monuments, dated to the 12th Dynasty (Sayed 1977: Plate 14, Figures a, b, c, d; Plate 15, Figures d, e, f), as well as the Middle Kingdom ones from Mirgissa (Nibbi 1993: 11-13).

[7] Other ancient Egyptian anchors are also in limestone except for three anchors from Mirgissa that are made of sandstone (Nibbi 1992: 265).

[8] The smallest anchor was recorded by Sayed, and these dimensions were calculated based on his illustration (Sayed 1980: Plate 12, 3)

The anchors from the walls in Cave 2 (A3, A4, A5, A6, A7, A8), however, are typologically different from the ones that Sayed recorded, and thus may be later in date. The dating of a few anchors found on the surface is uncertain.

5.3.b Catalog of anchors (see Figure 67 and Table 5)

A1: Fine textured granite anchor from the eastern corner of WG 16 east-west transect, at the entrance of Cave 3. The anchor, 82 cm long, 40-54 cm wide, and 16-26 cm thick, is of an irregular triangle shape with a rounded top, and is similar to those at the base of the 'Ankhow monument (Sayed 1977: 163-164, Figures 5-6; Sayed 1980: Plate 22, Figures 1-2), but the L-shaped hole at the base is trimmed off or absent.

A2: Intact anchor inside the structure (Feature 6, WG 23). This anchor, 62 cm long and 35-50 cm wide (thickness not possible to record), is triangular in shape with a rounded top. The upper (apical) hole is circular with a groove for a rope above it. There is a square hole (12 cm x 12.5 cm) near the center (Figure 66) that had no useful purpose for maritime activity (Mohamed Mustafa Abdel Maguid personal communication), and the anchor may have been modified for some functional use on land, for example, to support a flag-pole.[9]

A3: Limestone anchor in the southeast wall of Cave 2, 102 cm long, 45-62 cm wide, and 16-25 cm thick. The anchor is triangular in shape with a rounded top and a groove above the apical hole, and an L-shaped hole through a corner at the base. Dovetail-shaped grooves are found on both sides of the anchor (Figure 68).

A4: Limestone anchor partially covered with a thick salt encrustation, in the northwest wall of Cave 2. The anchor, 98 cm long, 44-64 cm wide, and ca. 21 cm thick, is triangular in shape with a rounded top, a groove above the apical hole, and an L-shaped hole

[9] Frost (1996: 876) suggests that the structures on the coast, interpreted as landmarks, were probably enhanced by erecting flag-poles on them.

through a corner of the base. Dovetail-shaped grooves are visible on both sides.

A5: Limestone anchor in the northwest wall of Cave 2. The anchor, 105 cm long, ca. 40 cm wide, and 19-23 cm thick, is triangular in shape with a rounded top, a groove above the apical hole, and an L-shaped hole through a corner of the base.

A6: Limestone anchor in the southeast wall of Cave 2. The anchor could not be completely examined because of its location at the base of the wall. The anchor has an L-shaped hole through a corner at the base and a dovetail cut still containing the remains of wood (*Acacia nilotica*) in the joint.

A7: Limestone anchor in the southeast wall of Cave 2. The anchor could not be completely examined because of its location at the top of the wall. This anchor has chisel marks on the surface, and gypsum plaster was used as mortar between this stone and the one below it.

A8: Limestone anchor in the southeast wall of Cave 2. The anchor could not be completely examined because of its location at the base of the wall. This anchor has an L-shaped hole. The top was probably cut off.

A9: One of two unfinished anchors found on the southern terrace slope. This anchor, 76 long, 41-53.2 cm wide, and 16-20 cm thick, is of an irregular triangle shape. The apical hole is unfinished, with chisel marks still visible.

A10: One of two unfinished anchors found on the southern slope. The top, which was probably rounded, is broken off at the straight apical hole. The base is flatter than the other faces of the anchor.

A11: Anchor of coral rock from the wadi bed (WG 36). The anchor is 86 cm long, 51-61 cm wide, and 17-19 cm thick, of an irregular triangle shape, with a rounded top and an upper bi-conical hole, with a shallow groove for the rope. One side of the anchor is flatter than the other. An orange-yellow sediment covered the lower and the upper parts of the exposed side; the reverse side was encrusted with salt. The pitted, irregular surface and a fracture in one of the lower corners suggest that it had been used in the sea.

A12: Fragment of a limestone anchor from a deposit of sand in front of two large niches in WG 34. The preserved part corresponds to the upper part of an anchor, with a rounded top and an apical hole. A deep break between the upper hole and the rounded top was visible on one side. The surface is very irregular and probably eroded. Chisel marks are still visible on one side. This fragmentary anchor is similar in size to A3 and A5 from Cave 2, and was probably part of a structure connected with the two large carved niches.

A13: Four limestone fragments of an anchor, without chisel marks, found near structure WG 12, Feature 8. Most likely, several other limestone fragments on the surface were from the same small anchor.

A14: Five fragments of a limestone anchor with an apical hole, a groove for rope, and possibly a lower square hole. From WG 20, Feature 4 (see also Sayed 1980: Plate 21, Figure 1).

A15: Many limestone fragments of anchors associated with WG 23, Feature 6, including two fragments possibly with an apical hole and groove for rope. One fragment has a square hole, and a few fragments have chisel marks. Several limestone fragments without chisel marks were scattered inside and outside the structure, and were probably part of an anchor placed symmetrically to the one still *in situ* (A2), near the entrance of the eastern chamber.

A16/1, A16/2 and A17: Fragments of two or three anchors from a pit in the internal chamber in WG 12, Feature 8. Some fragments have chisel marks. Most likely, A16/1 and A16/2 are fragments of one anchor, as they were found close to each other in a niche. A16/1 is the top of a limestone anchor with a groove for rope on one side and a flat surface on the other side. A16/2 is a well dressed, limestone slab that probably is the squared bottom of an anchor, with several chisel marks on the surface. A17 is a fragment of the top of a limestone anchor with a groove for rope.

A18: Fragmentary anchor at the base of the platform WG 29, Feature 1.

A19: Three limestone fragments, including a rounded top, possibly from the same anchor near a circular mound (Feature 2) on the eastern terrace. These fragments all have chisel marks.

A20: Two fragments probably from the same anchor near the entrance of Cave 1. One fragment has a rounded top; the other has chisel marks on the surface.

5.3.c Pierced stones

Three pierced stones were recorded at Mersa/Wadi Gawasis. Two pierced stones of conglomerate stone (P/S1, P/S2), with irregular surfaces, were found outside the entrance of Cave 2 in alignment with the northeastern wall. The third one (P/S3) was found on top of the northeastern wall inside Cave 2, where it was attached with mud plaster to a lower limestone block in the wall.

These pierced stones are rectangular-trapezoidal or oblong in shape with circular or square holes. The identification of these pierced stones as anchors is problematic because they are found on land and are very different from ancient Egyptian stone anchors. The Mersa/Wadi Gawasis pierced stones are more similar to contemporary Mediterranean stone anchors (see Wachsmann 1997: 255; 274, Figure 12.33; 279, Figure 12.41; 280, Figure 12.52).

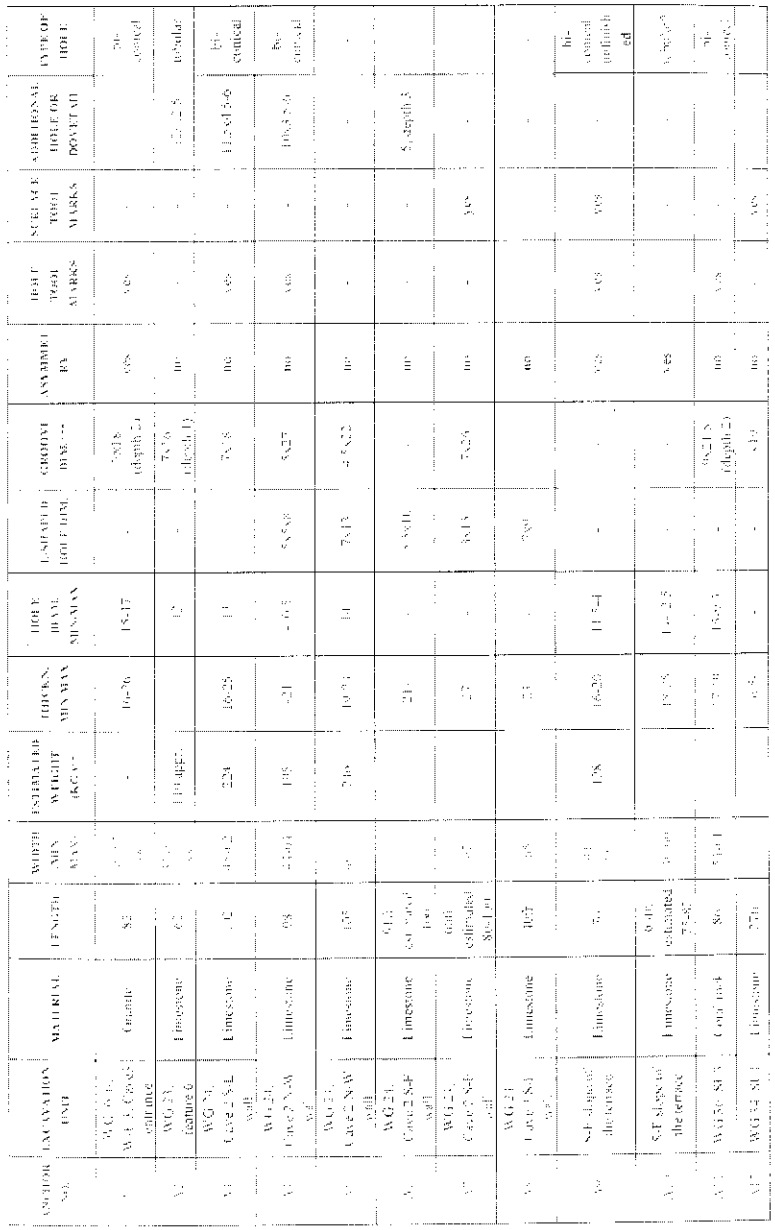
5.3.d Catalog of pierced stones (see Figure 69 and Table 5)

P/S1: Pierced stone of conglomerate stone, trapezoidal in shape with unfinished half-circle holes on each side, 60 cm long, 44 cm wide, and 15 cm thick.

P/S2: Pierced stone of conglomerate stone, rectangular in shape with two rounded corners and an almost rectangular hole in the center, 72 cm long, 52 cm wide, and 15 cm thick. The stone has two fractures running from the center hole encrusted with salt.

P/S3: Pierced stone of conglomerate stone, oblong in shape with a pierced square hole in the center; irregular surface, 60 cm long, 30 cm wide, and 10-27 cm thick.

Table 5: List of stone anchors and pierced stones



A/S	WG 2 feature 4 surface	Limestone	-	-			-	-	-	no	-	-	-	-	-
A/S4	WG 2 feature 4 surface	Limestone	67(?) at E	38 wd (?)	55		-	-	-	no		-			
A/S	WG 23 feature 3 surface	Limestone	-	-	90		-	-	-	no		-	-	-	
A/Se 1	WG 2 feature 3 niche	Limestone	35 fr	28 fr			7	-	5x11 ca	no	-	yes	-		
A/Se 2	WG 2 feature 3 niche	Limestone	45 fr	55 fr	-		-		-	no	-	yes			-
A/S	WG 1 feature 3/6 surface	Limestone	68 fr	50 fr			7.8	-	5x(?) 15 ca.	no	yes	yes	-		
A/S	Feature 6 surface	Limestone		-	-	-			-	no	-	-	-	-	-
A/S9	Feature 6 surface	Limestone	-		140	-	-	-		no	-	-	-		
A20	WG 28, Cave 1	Limestone	24 fr	11 fr	-			-	-	-	-	yes	-	-	
A/S 10	Ankhow shape pedestal	Limestone	82	56	250	-	-14	7x7	-	yes	-	-	-	-	

A/S1	Ankhow shape pedestal	Limestone	84	52-54	250	-26	-13	7x3 basal		yes	-	-	-	-	
A/S2	Ankhow shape pedestal	Limestone	82-84	52-54	250	24-26	13-14	-		yes	-	-	-	-	
A/S3	Ankhow shape pedestal	Limestone	82-84	52-54	250	24-26	13-14	-	-	yes	-	-	-	-	
A/S4	Antefoker stela pedestal	Limestone	-	50	-	-	-15	-	-	yes	-	-	four grooves	-	
A/S5	Pierced stones	Limestone	-	20 ca	-	-	-	-	-	yes	-	-	-	-	
P/S1	WG 24	Conglomerate	60	44	-	15	8x8-7x7	-	-	no	-	-	-	-	
P/S2	WG 24	Conglomerate	72	52	-	15	ovl/O	-	-	no	-	-	-	-	
P/S3	WG 24, Cave 2, Room 1	Conglomerate	60	30	-	18-27	6x7	-	-	no	-	-	-	-	

The dimensions are given in centimeters; fr. = fragmentary; estimated = estimated length based on comparison with others anchors; thickn. = thickness; diam. = diameter; dim. = dimension. A/S no. = anchors described only by Abdel Moneim Sayed. P/S no. = pierced stones.

** The specific gravity of the limestone was calculated based on a roughly rectangular stela found on the site and cut in the same kind of limestone as the anchors.

*** The dimensions given are: width, length and depth.

Chapter 6
Finds: Other wood and wood identification

RAINER GERISCH, ANDREA MANZO AND CHIARA ZAZZARO

6.1 Wooden artifacts

C. Zazzaro and A. Manzo

Concentrations of wooden artifacts were found mainly on the western slope of the fossil coral terrace, in WG 16, WG 24, Cave 2, WG 30, and WG 32, and inside the caves. Most of the wooden artifacts seem to have been abandoned there because they were broken or damaged, or were no longer needed. A large concentration of ca. 30 boxes was found in WG 32, near the entrances to Cave 5 and Cave 6. The boxes were probably left at the site after a ship voyage when their contents were emptied into other containers more portable by caravan into the Nile Valley.

Preservation of the wood depended on the species of the wood and its archaeological context. Wood has been better preserved in the lower levels, in deposits of wet sand.

6.1.a Cargo boxes[1]

Of the ca. 30 or more boxes in WG 32, which were excavated in a Middle Kingdom context, the remains of 21 wooden boxes were recorded. The boxes were covered and filled by a deposit of sand and they had been damaged by termite activity. The boxes seem to have been constructed in standardized sizes: they were all constructed in the same way and they are very similar in appearance and dimensions.

The boxes consist of the following components (Figure 70):

1) Four sides
2) A base

[1] R. Pirelli, G. Plisson and E. Mahfouz excavated and recorded the cargo boxes in WG 32.

3) Two furring strips
4) A lid
5) Dowels of different dimensions

Usually two or more wooden planks, matched and connected by dowels, formed the sides, base, and lid. Plaster, which covered all the external and internal surfaces of the box planks, was not always well preserved. Beneath the plaster coating there is often a light red color, or, less frequently, light blue. Frequently, a thick layer of white plaster, different from the plaster coating, was found on plank joints. This plaster was probably intended as a sealing between the planks.

The dimensions of all the boxes are similar, as was recorded on the best preserved samples. The height of the sides was difficult to establish, however, because the upper parts of the boxes are not well preserved:

1) Long sides: ca. 50-52 cm long, 1.4-1.7 cm thick.
2) Short sides: ca. 32-34 cm long, 1.2-1.8 cm thick.
3) Base: ca. 45-50 cm long, 30-31 cm wide, 1.2-2.0 cm thick.
4) One well preserved lid: ca. 52.5 cm long, uncertain width, 1.4-1.5 cm thick.
5) Rectangular furring strips: average length of 35-40 cm, 3.5-4 cm wide, 3.5-3.8 cm thick.

Most of the dowels, which in cross-section were roughly round, were broken, but among the preserved ones, two different types were found:

1) Smaller dowels: 1.0-2.5 cm long, with a diameter of 0.5-0.8 cm; they were mostly used in edge joints and butt joints.
2) Larger dowels: 2.5-5.0 cm long, with a diameter of 1.0-2.5 cm; they were mostly used in miter joints.

Three different types of joints used to connect the box planks were recorded:

1) A simple miter joint, which connect the lateral sides of the boxes. This joint, forming the corners of the box sides, is between the ends of two lateral pieces of wood cut at a 90° angle, so that the line of junction bisects this angle. The miters are held together with wooden pegs (Killen 2000: 364-365).

2) Butt joints, which connect the box sides to the base. The base planks have holes drilled along their edges where small dowels are placed, which cross the lateral planks of the boxes to hold them to the base.
3) Dowelled edge-joints, which connect the matched flat planks of the base and the lid. The planks have holes drilled along their edges in which small dowels are placed (Killen 2000: 360).

A similar box to those excavated at Mersa/Wadi Gawasis was found by Flinders Petrie at Kahun, in a 12th Dynasty context under the floor of a workman's house. Though smaller, the Kahun box is constructed similarly to the Mersa/Wadi Gawasis ones (Killen 1994: 12, Figure 15; 13; 15, Figure 16, and Plates 5-8).[2]

Some of the Mersa/Wadi Gawasis boxes had special features, as described below:

1) Box 2 had a hieroglyphic inscription painted in black on the external surface of one of the long sides (see 8.5), which helps to identify these boxes as cargo boxes, used to transport commodities by sea from Punt.
2) Box 14 had a painted black sign, ca. 2 cm long, on the external side of the lid.
3) Box 9 had a painted black inscription (uncertain reading), ca. 11 cm long, on the external surface.
4) Box 8 had a repair in the plaster, ca. 3.5 cm thick, on one side.
5) Box 13 had a repair in the wood, ca. 7.5 cm x 12.5 cm, on one long side.
6) Box 18 had traces of painted signs.

In the area outside Caves 2-6, several fragments of wood, with pegs inside, were probably from edge-joints or others types of joints, such as a "doweled edge-joint," "shoulder miter joint," or "spliced scarf joint" (see Killen 2000: Figures 15.26, 15.42, 15.48). Additional evidence of boxes was found scattered in the sand deposit of WG 28, Cave 1, and in WG 16 and WG 24, including wooden planks covered

[2] See also the sample in the Petrie Museum UC7513.

with white plaster and/or with traces of red paint similar to those excavated in WG 32.

6.1.b Miscellaneous wooden artifacts

6.1.b.1 Furniture

Five fragments of wooden artifacts found in WG 24 are believed to be parts of furniture, possibly broken feet originally from small tables, beds, or chairs (W/F1-5). They consist of fragments of wood with a square cross-section, ca. 4 cm x 4 cm at one end and 2 cm x 2 cm at the other. The average length of these fragments is 20-25 cm. No traces of fastenings are seen on these samples.

6.1.b.2 Miscellaneous wood

Several other fragments of wooden artifacts were also recorded:

1) M/W1: a wooden stick, round in cross-section.
2-3) M/W2-3: two small reels, each with a groove on the edge (Figure 71), 4.3 cm in diameter, 1 cm thick. These are similar to 12th Dynasty artifacts found at Kahun, which have been interpreted as reels used in net making (Petrie 1890: 28, Plate 9, 24-25).
4) M/W4: a wood punch consisting of a pointed fragment of wood plank, most likely from the side of a wooden box, 8.1 cm long, 1.7 cm wide, 1.1 cm thick.
5) M/W5: a small fragmentary wooden disk with a groove on the edge, 8.3 cm in diameter and 1 cm thick.
6) M/W6: a fragmentary wooden stick with an incised line along its edges, 8.3 cm long, 1.5 cm wide, and 1 cm thick. It may have been used to record numbers (of unspecified items) or measurements (of small items).
7) M/W7: a conical wooden peg or stopper, 2.75 cm long, with a diameter of 2.2 cm.
8) M/W8: a fragmentary wooden stick, rounded cross-section and pointed at one end, 21.5 cm long, with a cross-section of 1.3 cm.
9) M/W 9: a wooden disk, 12 cm in diameter and 3 cm thick. It was probably a jar stopper.

10) M/W 10: fragment of a conical wooden peg or stopper, 4.1 cm long and 2.7 cm in diameter.
11) M/W 11: fragment of a conical wooden peg or stopper, 4.2 cm long and 3 cm in diameter.
12) M/W 12 : fragment of an elongated wooden scoop with a lozenge-shaped handle, 31.5 cm long, 7.4 cm wide, and 1.1 cm thick. Elongated scoops with a similar handle were recorded in tombs at Ukma (in the Second Cataract region), dating to ca. 2000-1500 BC (Vila 1987: 212, Figure 239, 1). The occurrence of this scoop in WG 31, SU2 is possible evidence that rations were prepared in this area.
13) M/W 13[3]: a well preserved wooden scoop, but with a thin layer of salt encrustation at its base. Some vegetal remains were found inside (Figure 72).

This ovoid-shaped vessel is a wide, shallow tray with a flattened bottom, 48 cm long, 28 cm wide, and 20 cm deep. Along the shorter ends, the vessel has a slightly flattened rim, 2 cm wide, with a rounded rim along the longer sides. The interior and exterior surfaces have been smoothed. The bowl was cut vertically from one piece of wood, exhibiting the wood grain lengthwise.

This bowl is similar to wooden bowls in the Petrie Museum, which are described as "grain-scoops." They most likely date to the New Kingdom (especially UC58978 and UC58979). Measuring the volume capacity of these bowls might help to explain the original use of this vessel type, and verify if their capacity can be associated with the ancient Egyptian measure of grain, the *heqat* (ca. 4.8 liters), or its multiples or subdivisions.

Pot stands, or parts of a framework for the transport of ceramic vessels, and pot stoppers were excavated in WG 16, SU19. In the same area or near it were concentrations of clay sealings and mat fragments, materials which were probably associated with the opening

[3] C. Perlingieri provided the detailed description of this artifact.

and closing of containers. This combined evidence suggests that this area may have been where goods were kept and redistributed.

6.2 Identification of charcoal and wood

R. Gerisch

Remnants of charcoal from the 2005-06 field season at Mersa/Wadi Gawasis were analyzed during two weeks in January 2006. The main objective of the anthracological examination was a survey of indigenous and foreign shrub and tree species, which provided information on the ancient plant cover, the range of woody plants utilized for fuel, and evidence of long-distance trade through the occurrence of valuable imported timbers. Of most interest in the study of wood was the microscopic analysis of wooden components of the oldest known seagoing ships, which were recovered in abundance. These included hull components and maritime equipment, such as a deck beam, numerous planks and tenons, dovetails, blades from two steering oars/rudders, and a crutch and knobs, which may be oarlocks. Plastered wooden cargo boxes were also excavated which were used to transport commodities to Mersa/Wadi Gawasis from the land of Punt. For studies on desiccated wood and charcoal from other archaeological sites along the Egyptian Red Sea (mostly from Roman times), see El-Hadidi and El-Fayoumi (1996), Peacock *et al.* (1999), Vermeeren (1998, 1999, 2000/2003), Vermeeren and Cappers (1997/2002).

6.2.a Analysis and discussion of charcoal assemblages

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 hearths of wood fires as well as in those of charcoal fires, provided that 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°C 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, 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 or cut by a sharp blade, and the wood structure is observed in transversal, tangential longitudinal, and radial longitudinal sections using an incident light microscope. Anatomical characteristics used to identify the different types of hard- and softwood on the genus or species level are presence or absence of growth ring boundaries, porosity, form and size of vessels and pattern of vessel arrangement, wall thickness and arrangement of fibers, distribution and arrangement of axial parenchyma, ray size and composition, the type of vessel perforation, and in coniferous wood the presence or absence of resin ducts or traumatic ducts, composition and height of rays, tracheid to ray pitting, presence of bordered pits with fringed torus margins, etc. For documentation, pieces of each taxon in the sample were counted and its volume and weight were measured (see Fahn *et al.* 1986, Gale and Cutler 2000, Gerisch 2004, Jagiella and Kürschner 1987).

The charcoal from Mersa/Wadi Gawasis is very well to well preserved in the strong larger pieces, often with small to, more rarely, large salt crystals. In some cases the charcoal has been badly preserved, and is either heavily encrusted with salt or is crumbling or disintegrating into powder. From the interior of the caves where sometimes very large charcoal pieces have been excavated, material is generally in very good condition and without much salt.

To some extent timber and wood finds are also very well to well preserved. Thick crusts of salt and crystals were occasionally observed on finds. Porous materials absorb water with dissolved salt by capillary action, and as the water evaporates on the surface, deposits of solids are left behind forming crystals. In some cases, mostly from outside the caves, the wood is badly preserved, and is either crumbling or disintegrating into powder. Although rare, mold damage has occurred on some timbers in the caves, and occasionally there is damage by termites (on the cargo boxes) or evidence of beetle holes.

The studied charcoal comprises 1,310 pieces combined in 56 samples with a volume of 1,567.5 ml. From these, 1,287 (1,547.6 ml) are identifiable pieces of wood charcoal; the remaining portion is unidentified wood charcoal as well as bark charcoal. The material was recovered by hand selection and through dry sieving. The majority of the charcoal fragments came from fire pits in the industrial area (WG 19/25/26/27) at the base of the western slope of the fossil coral terrace where a variety of activities such as pottery and bread mold production had taken place. The largest deposits of charcoal were found in: WG 19, SU50 (541 pieces, 450.4 ml), and WG 19, SU58 (108 pieces, 50.1 ml), both of which were circular fire pits with large concentrations of ash (ca. 30-40 cm deep and 70-80 cm in diameter), chunks of charcoal, and a huge amount of pottery and bread mold sherds, most of which were burnt. A charcoal rich deposit was also found in WG 19, SU44-45 (102 pieces, 98.6 ml), which were two possible post-holes (ca. 15 cm in diameter), and WG 16, SU19 (180 pieces, 133.7 ml), consisting of soft sand mixed with wood and rope fragments, potsherds, and dung.

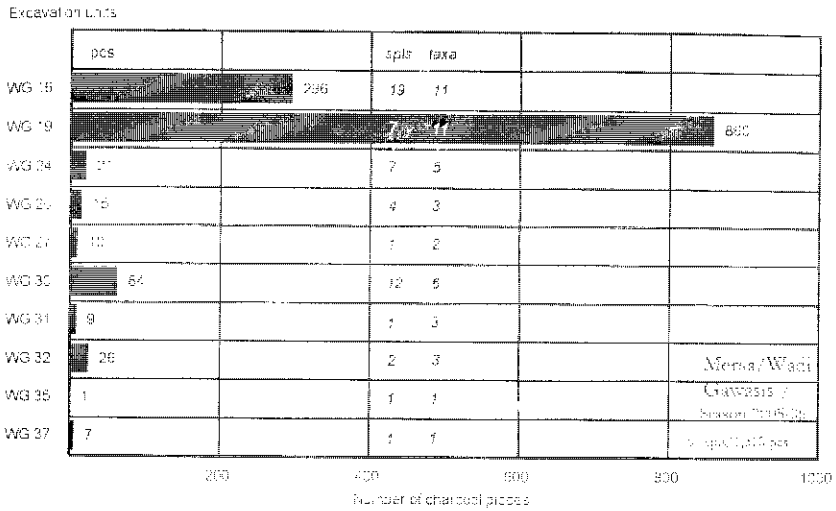
The nature of the charcoal spectrum was strongly influenced by wood remnants from the repair work at the ancient shipyard, where man-made caves were cut into the coral terrace and were used as workshops and store rooms. After long sea voyages, ship planks were weathered and some were badly damaged by shipworms and marine borers. Such pieces were later disassembled by sawing or chiseling through the tenons. In the entrances of Caves 2 and 3 activity areas of woodworking were found, which were characterized by concentrations of wood fragments, some of which could be identified as fragments of planks, mortise-and-tenon joints and dovetail joints. The wood debitage and larger pieces of wood debris left by ship-breaking activity represented an important source of fuel in the coastal desert environment.

Charcoal analysis on finds of the examined excavation units has yielded 14 taxa, among which Nile acacia (*Acacia nilotica*), cedar of Lebanon (*Cedrus libani*) and grey mangrove (*Avicennia marina*) are the main constituents. The identified woods, presented in Table 6, came from three different geographical regions and the local environment: the mountain forests of the eastern Mediterranean: *Cedrus libani*, pine (*Pinus* sp.), and deciduous and evergreen oak (*Quercus* sp.); the floodplain of the Nile Valley: *Acacia nilotica*, white acacia (*Faidherbia albida*), and sycomore fig (*Ficus sycomorus*); the dry savanna woodlands of the South: ebony (*Diospyros* sp.); and the Egyptian Red Sea coastal desert: *Avicennia marina*, *Leptadenia pyrotechnica*, and sea blite (*Suaeda* sp.). Tamarisk (*Tamarix* sp.) occurs in the Nile Valley as well as along the Red Sea. The majority of the charcoal remnants obtained during the 2005-06 field season was from excavation units WG 19 and WG 16, in which most of the wood taxa occurred (11 in each unit), whereas in the other excavation units 1-6 taxa were present, corresponding to the lower number of charcoal finds (Table 7).

Table 6: Anthracological spectrum from Mersa/Wadi Gawasis.

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	510	779.7	586.3
Acacia sp.	4	7	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
***occasionally affected by salt crystals**	56	1,287	1.547.6	914.5

Table 7: Number of charcoal pieces in the different excavation units. One sample from outside the excavation units not included.



In the identified charcoal *Acacia nilotica* dominates at 39.6%, occurring in 510 pieces (779.7 ml) in 45 samples; the percentage of presence 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* occurs with 130 pieces (136.3 ml) in a smaller amount (10.1%), but occurs in 29 samples (51.8%). The other taxa make up less then 10% of 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 a percentage of presence of 23.2%. *Leptadenia pyrotechnica* is found mostly in single pieces, but in 9 samples (16.1%) (Tables 6, 8, 9). The obtained results in relation to excavation units and their stratigraphic units are given in Tables 10 and 11.

Table 8: Number of pieces and percentage for the identified wood taxa.

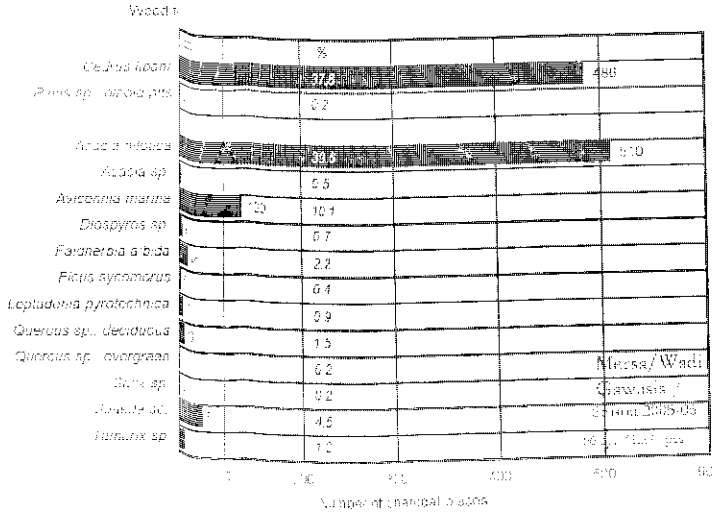


Table 9: Number of samples and percentage of presence for the identified wood taxa.

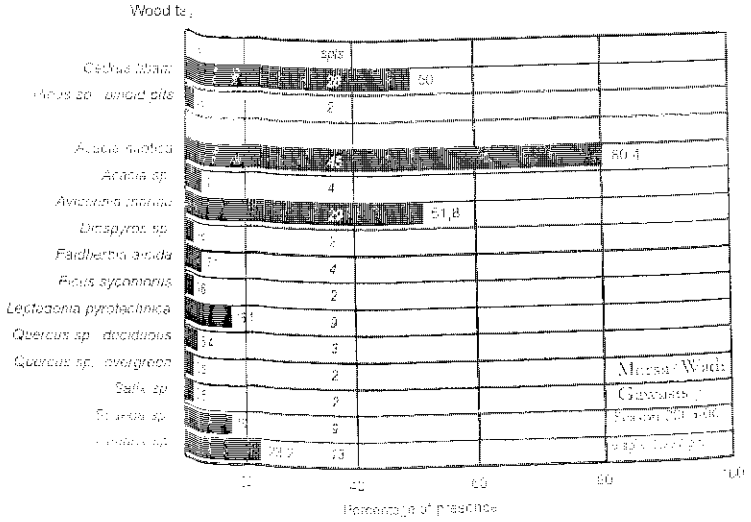


Table 10: Wood taxa identified in the charcoal material of the different excavation units.

MERSA/WADI GAWASIS / **Excavation units (10)** **Wood taxa (14)**	WG 16	WG 19	WG 24	WG 26	WG 27	WG 30	WG 31	WG 32	WG 35	WG 37
Analyzed spls	19	7	7	4	1	12	1	2	1	1
material pcs	296	860	21	15	10	64	9	26	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 8: Number of pieces and percentage for the identified wood taxa.

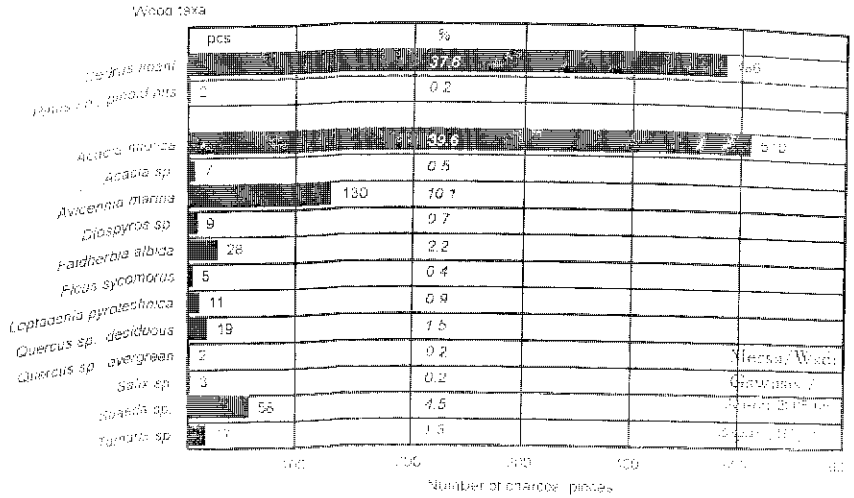


Table 9: Number of samples and percentage of presence for the identified wood taxa.

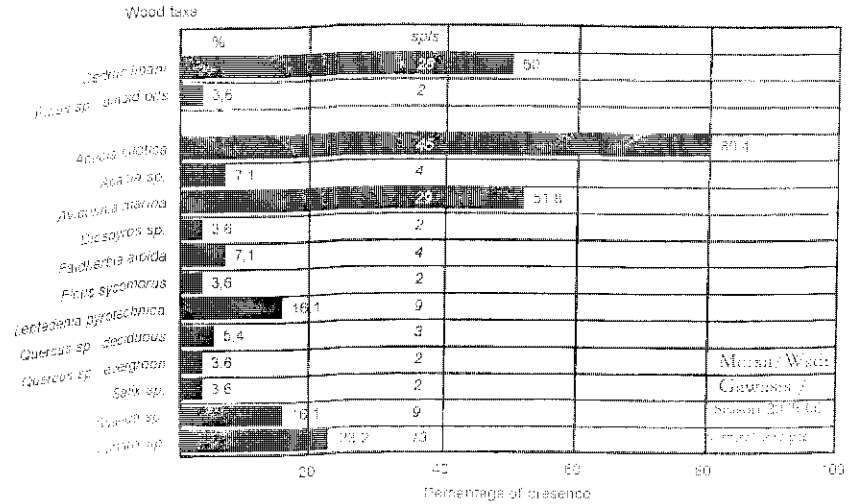


Table 10: Wood taxa identified in the charcoal material of the different excavation units.

MERSA/WADI GAWASIS / **Excavation units (10)** **Wood taxa (14)**	WG 16	WG 19	WG 24	WG 26	WG 27	WG 30	WG 31	WG 32	WG 35	WG 37
Analyzed spls	19	7	7	4	1	12	1	2	1	1
material pcs	296	860	21	15	10	64	9	26	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 11: Results of charcoal analysis in relation to stratigraphic units of the WG 05-06 field season.
The values in brackets concern finds of uncharred or slightly charred wood in the samples.

Excavation Unit	SU number(s) / No. of samples	Wood taxa	Count [pcs]	Volume [ml]	Weight [g]*
WG 16	SU1 / 1 sample	*Acacia nilotica*	3	4	2.2
		Avicennia marina	2	1.2	0.6
		Cedrus libani	1 (1)	0.3 (1.5)	0.1 (0.9)
	SU19 / 8 samples	*Acacia nilotica*	108	80	43.8
		Acacia sp.	3	3.2	2
		Avicennia marina	30	19.2	8.7
		Cedrus libani	16	14.2	3.2
		Diospyros sp.	1	0.1	0.1
		Ficus sycomorus	3	1	0.4
		Leptadenia pyrotechnica	6	2.3	0.7
		Salix sp.	3	1.9	0.5
		Suaeda sp.	2	3.7	2.2
		Tamarix sp.	6	7	2.4
	SU45 / 1 sample	*Acacia nilotica*	1	1.6	1.1
		Cedrus libani	1	0.6	0.2
	SU48 / 1 sample	*Acacia nilotica*	2	1.4	0.7
		Avicennia marina	1	0.4	0.2
		Cedrus libani	1	0.7	0.2
		Suaeda sp.	1	0.7	0.4
	SU49 / 1 sample	*Acacia nilotica*	6	2.6	1
	SU66 / 1 sample	*Acacia nilotica*	2	24	19
		Pinus sp., pinoid pits	1	9.5	3.8
	SU74 / 1 sample	*Acacia nilotica*	4	20	15.9
	SU75-77 / 1 sample	*Acacia nilotica*	(5)	(3.5)	(0.7)
		Avicennia marina	4 (1)	4 (1)	2.8 (0.4)
		Cedrus libani	(2)	(2)	(0.7)
		Suaeda sp.	49 (19)	29 (16)	20 (7.9)
		Tamarix sp.	1	0.1	0.1
	Sand surface / 4 samples	*Acacia nilotica*	19	16.2	8.4
		Avicennia marina	8	3.7	1.8
		Cedrus libani	3	1.3	0.3
		Leptadenia	1	1.2	0.5

		pyrotechnica	1	2.7	2
		Pinus sp., pinoid pits	4	3.3	1.2
		Tamarix sp.			
WG 19	SU11 / 1 sample	*Acacia nilotica*	16	20.5	7
		Avicennia marina	6	9.5	5.2
		Cedrus libani	2	3	0.8
		Quercus sp., deciduous	2	1.2	0.7
	SU42 / 1 sample	*Acacia nilotica*	42	62	21.7
		Avicennia marina	8	14.5	6.9
		Quercus sp., deciduous	16	23	9.8
Excavation Unit	**SU number(s) / No. of samples**	**Wood taxa**	**Count [pcs]**	**Volume [ml]**	**Weight [g]***
WG 19	SU44-45 / 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	1	0.2	0.1
		pyrotechnica	1	1.7	0.9
		Suaeda sp.	1	0.2	0.1
		Tamarix sp.			
	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	1	0.1	0.1
		pyrotechnica	1	0.6	0.4
		Quercus sp., deciduous	1	0.3	0.2
		Quercus sp., evergreen	1	0.4	0.2
		Suaeda sp.	1	0.4	0.1
		Tamarix sp.			
	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	1	0.2	0.1
		pyrotechnica			

WG 24, Cave 2	SU34 / 1 sample	*Acacia nilotica* *Avicennia marina*	5 1	72 18.2	50.5 10.2
	SU37 / 1 sample	*Acacia nilotica* *Acacia* sp. *Cedrus libani* *Suaeda* sp.	3 1 1 1	4.2 1.4 0.3 0.4	3.4 0.7 0.1 0.2
	SU43 / 2 samples	*Acacia nilotica* *Avicennia marina*	1 2	20 12	16.1 6.4
	SU53 / 2 samples	*Acacia nilotica* *Avicennia marina*	2 2	5.5 2.4	4.2 0.9
WG 26	SU30 / 1 sample	*Acacia nilotica*	1	45	97.7
	SU72 / 1 sample	*Acacia nilotica* *Leptadenia pyrotechnica*	1 1	66 3.5	69.2 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
	SU 68 / 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

*occasionally affected by salt crystals

During the Middle Kingdom Egyptian kings maintained trade routes with the Syro-Palestinian area; more distant contacts with the Near East are assumed. Finds of Egyptian products in Syria and Palestine as well as finds of products of Mesopotamia and Crete in Egypt are indications of far-reaching trade relations. In Africa Egyptian trade contacts extended far to the south and east of Lower Nubia, through which raw materials and commodities from eastern Sudan and the Horn of Africa were transported. But in the Middle Kingdom these African raw materials and commodities were also transported by sea, due to the control of Upper Nubia by the Kerma kingdom.

Byblos developed into the most important timber shipping center of the eastern Mediterranean from where cedar, pine, and other coniferous timbers were transported to Egypt. The valuable timber from the cedar of Lebanon was the most frequent among the imported coniferous timbers, 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. *Cedrus libani* is a majestic tree, between 20 and 30 m high, with large wide-spreading, horizontal branches. It can reach an age of more than 1,000 years.

Extensive forests were found in Asia Minor in the Taurus Mountains, and in southwest Asia in Syria and Lebanon. Cedar trees grow primarily in rocky soils at about 1,800 m ASL. In antiquity the wooded areas in Lebanon covered approximately 6% of the country, but now only relicts of the original forests are still preserved. Cedar forests have been reduced to less than 3% of their former extension and are limited to 12 separate stands in the Mount Lebanon range. The Beharre 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 Horch Ehden forest in northern Lebanon.

At Mersa/Wadi Gawasis the largest amounts of cedar charcoal were found in the fire pits of WG 19, SU50 (301 pieces, 246.5 ml) and SU58 (82 pieces, 38 ml), as well as in SU44-45 (36 pieces, 23 ml). Contact with the Syro-Palestinian region is also demonstrated by the presence of charcoal from pine and oak. Among the coastal pines are the Aleppo pine (*Pinus halepensis*) and the stone pine (*Pinus pinea*), which form a characteristic part of the Lebanese mountain landscape. Oak wood was not imported frequently into ancient Egypt. Palestine oak (*Q. coccifera* subsp. *calliprinos*) and Cyprus oak (*Q. infectoria* subsp. *boissieri*) belong to the main widespread forest tree types in Lebanon. To deciduous or summergreen oaks belong Turkey oak (*Q. cerris*), *Q. infectoria* subsp. *boissieri*, Tabor oak (*Q. ithaburensis*), Lebanon oak (*Q. libani*), an evergreen oak is *Q. coccifera* subsp. *calliprinos*. The yellowish brown heartwood of oak is very durable and rot-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), also in WG 19, SU11 (2 pieces, 1.2 ml), both with deciduous oak; and in the fire pit of SU50, with a single piece each of deciduous and evergreen oak (1 piece, 0.6 ml; 1 piece, 0.3 ml).

In Egypt the wood of the Nile acacia has been exploited since Predynastic times. The reddish to light brown, hard, dense and termite resistant wood was used as a high quality fire wood and for charcoal making because of its excellent calorific properties. It was used to a great extent as timbers in construction, for boat and ship building, and to make furniture, coffins, statues, boxes, tools, and dowels. The tree prefers alluvial soils and a continuous water supply and grows in the floodplain of the Nile Valley and in the oases. *Acacia nilotica* is a 2-15 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. The tree is important in arid regions where wood is scarce. *Faidherbia albida* grows on the Nile and channel banks in Egypt and Sudan; in Egypt it is now 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 is distributed in tropical and subtropical Africa, in Lebanon, Palestine and in Yemen on alluvial and sandy soils and moist grounds.

Other identified trees from the Nile Valley are *Ficus sycomorus* and the Egyptian willow (*Salix subserrata*). The sycomore 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, such as for coffins, furniture, statues, and boat and ship building, but it is too coarse for fine furniture. *Salix subserrata* 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-weight, non-splintering wood was used for bowls, small domestic items, cordage, and withies for basketry, but it is a poor quality fuel.

The shortest route between the Nile Valley and the Red Sea coast is the Wadi Qena. From Wadi Qena, passing through Wadi Gasus, Wadi Gawasis and the harbor of Mersa Gawasis was reached from where expeditions were sailing south to Punt. It is assumed that the Egyptian ships for the Red Sea route were initially built at a Nile shipyard and then transported in pieces across the wadi to the coast where they were reassembled. Food and other supplies had to be brought from the Nile Valley.

The most interesting find in the charcoal assemblages was made by the identification of *Diospyros* sp. (ebony) in two samples at Mersa/Wadi Gawasis: in WG 16, SU19 (1 piece, 0.1 ml), of soft sand mixed with wood and rope fragments, potsherds, and dung; and in WG 32, SU16 (8 pieces, 9 ml), a layer of sand beneath a layer of sea grass (SU15), which included a hearth with a potsherd and some pieces of wood. The identified charcoal probably provides substantial evidence of raw materials imported from Punt. The genus *Diospyros* belongs to the Ebenaceae family; the tropical hardwood trees, favored for their beautiful and highly valued wood, mainly grow in Africa and East India. *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 eastwards up to Ethiopia and southwards up to Namibia and Transvaal. It is most commonly found in savannas and savanna woodlands. The tree is up to 20-25 m high, with a trunk that can reach 1.4 m in diameter; it has a dense, dark green and spreading crown. Its wood is hard, heavy, and very dense. The more brown than black, fine grained heartwood, clearly defined from the pale sapwood, is very decorative and was used mainly for high quality furniture, and for inlays and veneering to contrast with other woods or ivory.

One of the few sources of timber and fuel of the local region is the grey mangrove. The tree can be found along the east coast of Africa, from the Red Sea to South Africa, and to the western Pacific. Mangrove stands are relatively small in Egypt. The usual habitat of mangroves is the shallow water along the Egyptian Red Sea coast, especially in protected areas such as lagoons, bays, coral reefs parallel to the shore, and where wadis enter the sea from the mountains. In a few locations *Avicennia marina* occurs on the terrestrial side of the shoreline. Stands can be found on the western shoreline of Safaga Island, with trees up to 4.8 m high, to the south of Safaga and on the bay of Quseir. The northernmost locality of the mangrove is the bay of Myos Hormos, about 22 km north of Hurghada. It does not extend northward to the coast of the Gulf of Suez (Zahran and Willis 1992: 126). The tree is most common along the Egyptian/Sinai coast of the Gulf of Aqaba. Another 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, bright glossy green on the upper surface and pale whitish grey and hairy underneath. The yellow flowers occur in clusters of 3-5. Numerous vertical pneumatophores arise from horizontal roots. More uncommon are short aerial roots originating on the stem very close to the ground. Avicennia 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 for millennia, as the results of wood and charcoal analyses testify. Mangroves have been more widespread in the past. Woodcutting and other human activities led to a reduction of the original richer growth along the costal area of the Red Sea. In most localities, they represent remnants of larger plant communities.

A common plant on the Red Sea coast, representing similarly the use of local resources, is the Sea blite (*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, leafless shrub with 8-12 cm long glabrous follicles, is distributed along the Red Sea coast, the Sinai as well as in the Nile region, in sandy plains and wadis. Tamarix is widespread in Egypt; the shrub or small tree grows on saline soils, in desert wadis, and on edges of salt marshes. Tamarisk wood was predominantly used for furniture, coffins, statues, dowels and as fuel.

6.2.b Ship timbers and parts, cargo boxes

About 50 samples of timber and wood from ships have been identified at Mersa/Wadi Gawasis which comprise 7 woody taxa; the most abundant wood types are *Cedrus libani* and *Acacia nilotica*. Occasionally present is *Ficus sycomorus*, and as single specimens *Avicennia marina*, *Faidherbia albida* and *Tamarix* sp. (Table 12). The deck beam (T32) was identified as cedar wood. Also for planks mostly cedar wood was used, and rarely that of Nile acacia, sycomore fig, and in one case of grey mangrove. The tenons were all made from wood of the Nile acacia. The timber of steering oar/rudder Blade 2 was identified as *Acacia nilotica*, that of the upper portion of steering oar/rudder Blade 1 as *Faidherbia albida*, and the lower portion of this blade as *Acacia nilotica*. Presumably, the vessels were entirely or

nearly built from *Cedrus libani*, the wood of which is light-weight and relatively resistant to termite attack due to naturally occurring resins. The hard, strong wood of the Nile acacia was used for tenons and the shipwrights already knew the importance of using tenons that were harder than the wood surrounding them. The examined plank fragments of Cheryl Ward's type 4, which are thinner than hull planks and joined with both mortise-and-tenon fastenings and ligatures, are all of *Acacia nilotica*. The examined deck planks of type 3 are of *Cedrus libani*, with some of *Ficus sycomorus* (Steffy 1994, Ward 2000, 2004).

The different construction elements of 6 of the 21 wooden cargo boxes excavated in WG 32, in front of the entrance to Cave 6, were analyzed by taking off splinters and thin slices. Microscopic analysis revealed that the planks of these boxes are predominantly of sycomore wood. A few box planks are of white acacia and Christ's thorn (*Ziziphus spina-christi*). The furring strips are mostly of *Ficus sycomorus*, but a few are of *Acacia nilotica* and *Tamarix* sp. Dowels are of *Tamarix* sp. and *Acacia nilotica*.

Table 12: Analyzed timber and wood finds.

Cat No.	Timber and Wood finds	Type of wood	Season	Excavation unit	Stratigraphic unit
T 1a	rudder Blade 1 (upper portion)	*Faidherbia albida*	2004-05	WG 24, Cave 2	SU26
T 1b	rudder Blade 1 (lower portion)	*Acacia nilotica*	2004-05	WG 24, Cave 2	SU26
T 2	rudder Blade 2	*Acacia nilotica*	2004-05	WG 24, Cave 2	SU26
T 5	plank, type 2	*Cedrus libani*	2004-05	WG 24, Cave 2	SU35
T 8	plank, type 3	*Ficus sycomorus*	2004-05	WG 24, Cave 2	SU34
T 9	plank, type 3	*Cedrus libani*	2004-05	WG 24, Cave 2	SU34
T 13	plank, type 4	*Acacia nilotica*	2005-06	WG 30	SU62
T 14	plank, type 4	*Acacia nilotica*	2005-06	WG 30	SU62
T 15	plank, type 3	*Ficus sycomorus*	2005-06	WG 16	SU19
T 16	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	SU56
T 17	plank, type 3?	*Cedrus libani*	2005-06	WG 24, Cave 2	SU56

T 19	plank, type 2	*Cedrus libani*	2004-06	WG 24, Cave 2	SU32
T 20	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	Entrance corr.
T 21	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	Entrance corr.
T 22	plank, type 3?	*Cedrus libani*	2005-06	WG 24, Cave 2	Entrance corr.
T 23	plank, type 2	*Cedrus libani*	2004-05	WG 24, Cave 2	SU32
T 25	plank, type 3	*Cedrus libani*	2005-06	WG 30	SU62
T 26	plank, type 3	*Cedrus libani*	2005-06	WG 30	SU62
T 27	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	SU57
T 28	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	SU57
T 29	plank, other	*Avicennia marina*	2005-06	WG 24, Cave 2	SU57
T 31	plank, type 4	*Acacia nilotica*	2005-06	WG 30	SU69
T 32	deck beam	*Cedrus libani*	2005-06	WG 30/16	SU71
T 33	plank, type 2	*Cedrus libani*	2005-06	WG 30	SU71
T 34	plank, type 2	*Cedrus libani*	2005-06	WG 32	SU9
T 39	plank, type 2	*Cedrus libani*	2005-06	WG 24, Cave 2	SU57
T 41	plank, type 4	*Acacia nilotica*	2005-06	WG 30	SU62
T 42	plank, other	*Cedrus libani*	2005-06	WG 24, Cave 2	SU64
T 44	crutch	*Acacia nilotica*	2005-06	WG Cave 4	SU1
T 45	knob, possib. oarlock	*Ficus sycomorus*	2005-06	WG 24, Cave 2	SU56
T 46	box	*Cedrus libani*	2005-06	WG 30	SU50
T 48	plank, other	*Cedrus libani*	2005-06	WG 24, Cave 2	SU57
T 50	plank, other	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU57
	with dowel	*Acacia nilotica*			
T 60	plank, other	*Cedrus libani*	2005-06	WG 16	SU75
W 8	plank, other	*Ficus sycomorus*	2005-06	WG 24, Cave 2	SU34
	dovetail tenon	*Acacia nilotica*			
	stick	*Tamarix* sp.			
W 9	tenon, size III	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU34
W 23	tenon, size I	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU53
W 33	tenon, size II	*Acacia nilotica*	2005-06	WG 30	SU50
W 51	tenon, size I	*Acacia nilotica*	2005-06	WG 30	SU62
W 53	tenon, size II	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU57
W 61	plank, other	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU53
	plank, other	*Cedrus libani*			
W 135	tenon, size I	*Acacia nilotica*	2005-06	WG 30	SU50
W 143	plank, other	*Cedrus libani*	2005-06	WG 24, Cave 2	SU34
	tenon, size I	*Acacia nilotica*			

	half-round piece	*Ficus sycomorus*			
W 145	tenon, size I	*Acacia nilotica*	2005-06	WG 24, Cave 2	SU34
W 147	wedge-shaped piece	*Ficus sycomorus*	2005-06	WG 24, Cave 2	SU43
W 167	tenon	*Acacia nilotica*	2005-06	WG 24, Cave 2	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

*+ several samples were taken from each type of construction element where possible

6.2.c Miscellaneous wood use

In the eastern sector on the top of the coral terrace, a stone platform near the seashore (WG 29) was excavated by Rodolfo Fattovich which was some kind of ceremonial structure. It was constructed with conglomerate stone slabs covered with rocks of fossil coral and limestone, which covered a center framework of wood, identified as *Avicennia marina*.

Chapter 7
Other Finds

ALFREDO CARANNANTE, S. TERRY CHILDS, GIULIO LUCARINI, ANDREA MANZO, CARLA PEPE AND CHIARA ZAZZARO

7.1 Textiles

C. Zazzaro

About forty textile fragments have been excavated at Mersa/Wadi Gawasis, mainly in the excavation units on top of the slope along the western edge of the fossil coral terrace (in WG 16, WG 30, WG 31, WG 32, WG 24, and Cave 2).

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 recognizable by the natural rotation of the fiber (S-spun) and by the characteristic sheen (Jennifer Malone personal communication).[1] 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,[2] as is common in pharaonic period textiles. Very few textile fragments were made alternating two wefts over and under one warp, or alternating two wefts over and under two warps. Two small woven fragments have a tight weave of thread, and an unequal number of warp and weft (L1 and L2). In these two samples the number of warp threads is greater than the weft ones.

One textile fragment found in front of the entrance of Cave 3 (L3) was burned. Associated with a hearth, this fragment was probably intentionally burned with other fuel. No painted textile fragments

[1] I am grateful to Ksenija Borojevic and Jennifer Malone for helping me with this preliminary identification.

[2] For the terms employed in the description of textile technology see Jones 2002: 339.

were found; a fragment from Cave 2 has irregular spots of red color, of paint or some other substance (L4).

A small textile fragment was found knotted in an overhand knot (L5). Knotted textiles had several uses and it is difficult to determine the function of this small fragment. Three fragments from the entrance corridor of Cave 2 were stuck on mud plaster or on small branches (L6-8); they were probably used in jar sealings, placed under or below the plug of clay (see Volgelsang-Eastwood 2000: 291).

Splinters of wood were found adhering to one textile fragment from Cave 2 (Figure 73a). Eight textile fragments were also found inside or near the wooden boxes in WG 32, mixed with the sand deposits. These samples have been interpreted as fragments of lining for the boxes.[3]

One textile fragment from Cave 2 was found partially impregnated with a black substance (Figure 73b), possibly from a jar sealing. Preserved as a dark residue, resin was used to secure stoppers of jars containing liquids (see Jones 2002: 337-338). Another textile fragment from Cave 2 was compressed, possibly from being inserted into some kind of crack.

A long textile fragment (L11, 65 cm long) was found inserted in the northeastern wall of the entrance corridor of Cave 2. It had a simple hem (1 cm wide) (see Volgelsang-Eastwood 2000: 283, Figure 111, 11a), which was folded twice and sewn 5 weft by 5 weft (Figure 73c).

7.2 Cordage[4]

C. Zazzaro

Cordage materials were found mostly in excavation units on top of the slope along the western terrace (in WG 16, WG 30, WG 31, WG 32, WG 24), and in Caves 2 and 5. The deep deposits of soft sand and the dry condition of the caves' environment were important factors in the preservation of the cordage in this area of the site. A large quantity of cordage, consisting of an estimated 30-35 coils of lines, was found in Cave 5 and will be described separately below.

During the five field seasons at Mersa/Wadi Gawasis, 330 fragments of cordage, 40 of which also have knots, were recorded. The cordage was found in small and large fragments; their lengths vary from a few centimeters to 5 meters.

Description of the rope is based on the following criteria[5] (Figure 74):

1) Plant fiber, thickness, and spin direction of the fiber composing a yarn.
2) Diameter, ply direction, and number of yarns composing a strand.
3) Diameter of the strand.
4) Different kinds of knots.

About two-thirds of the cordage recorded at the site (excluding the rope in Cave 5) consists of rope made of a thin fiber spun in an S or Z direction and composed of a single strand, or of two yarns plied in an S direction; the strand diameter is generally less then 7 mm. About one-third of the cordage consists of ropes with a fiber thicker than 2 mm, S-spun, and three yarns Z-plied; the strand diameter is generally from 7 mm up to 30 mm.

Observations on the cordage occurring at the site are summarized in Table 13.

[3] Similar evidence has been interpreted as possible lining for wooden containers. See Jones 2002: 336.

[4] During the 2005-06 field season Gwendoline Plisson also contributed to the recording of the cordage. Ksenija Borojevic, André Veldmeijer, and Jennifer Malone helped in the fiber identifications. For some technical terms used in this text see Veldmeijer 2005.

[5] See Ryan and Hansen 1987; Wendrich 1991.

Table 13: Attributes of the cordage.

Plant	Fiber dimension	Spin direction	Yarn diameter**	Ply direction	Number of yarns	Strand diameter**
linen/flax	Less than 1 mm	S	1-3 mm	S	1 or 2	2-5 mm
halfa grass or papyrus	1 mm	Z	2-5 mm	S	2	3-7 mm
halfa grass or papyrus	2-7 mm	S	5-14 mm	Z	3	8-30 mm

** Most of the yarns and strands were slightly loose, and the average diameter was calculated on the tighter samples.

Halfa grass (*Demostachya bipinnata* or *Imperata cylindrica*), papyrus (*Cyperus Papyrus*), and flax are the most common plant species used during pharaonic times for making rope (Ryan and Hansen 1987: 6-17; Wendrich 2000: 255). These three principal species of plants were preliminarly identified at the site based on observation of the general appearance of the material.[6] Flax is recognizable in some thin and small rope fragments (Jennifer Malone personal communication), and the characteristics of halfa grass and papyrus leaves and stalk are visible in most of the rope fragments.

Fragments of thin ropes (3-7 mm diameter) without knots were often found alone, and their original function is difficult to determine. These include:

1. Two very thin flax ropes (C/S1, C/S2) found attached to the backs of clay sealings (see 8.4).

[6] I am grateful to Ksenija Borojevic, André Veldmeijer, and Jennifer Malone for helping with this preliminary identification.

2. A very thin flax rope (C/S3) used to secure the end of another rope made of halfa grass or papyrus.
3. A flax or halfa grass/papyrus rope (C/C4) used as lashing in a fragmentary cedar ship timber.
4. Two ropes knotted together (overhand) at one end (C/S5; Figure 75a).
5. A group of 15 ropes (C/S7), 10 cm in length, attached to plaster at one end.
6. A thin rope (C/S9) that ties a bunch of leaves together, found in the oven in WG 17.
7. A concentration of thin burned ropes (C/S8) found in a hearth in WG 16, which had probably been discarded in the fire.
8. Four reef knots (Figure 75b, d, e).

Ropes with a thicker diameter were also found, sometimes knotted. A coil of rope, 5 m long and 28 mm in diameter, was found outside Cave 2 in WG 24, and had probably been abandoned on a floor at the entrance of the cave.

The most frequent variety of knots consists of the double or single overhand knot, often made at the end to secure the rope itself; some figure-of-eight knots are also attested. Analysis of knots, associated artifacts, and the archaeological context suggest multiple interpretations. Two eye splices and two grommets (C/R1-4) may have been part of ship equipment, as they were commonly used in ancient (and modern ships) for several functions. Eye splices and grommets have a strand diameter of 30 mm and an internal diameter of 50-80 mm. One of the two grommets has a string tied in a figure-of-eight knot (Figure 75f).

Interpretation of the excavated contexts of these ropes strongly suggests that cordage found at the site was used in maritime activities and for ship equipment, but it was also used for other activities connected to the expeditions. Thin ropes, less than 7 mm in diameter, might have been used to connect ship timbers, some of which have evidence of lashing channels ca. 4 mm wide. Thicker ropes might

have been used on anchors or steering oar/rudder blades, passing through the holes.

7.3 Cordage in Cave 5[7]

The floor of Cave 5 is almost completely filled with cordage (Figure 76). According to André Veldmeijer, who examined the ropes in 2006-07, at least 18 coils of rope are visible on the surface; others are stacked below them, with a possible total of 35 coils of rope. All the coils seem to be massed with coherence, almost perpendicularly to the walls of the cave. According to Cheryl Ward, each coil bundle of line is about 1 m long and 60 cm wide. The coil bundles are complex, each representing at least 20 m and probably 30 m of line. Those easily visible from the viewpoint in Cave 2 have "horizontal" wraps of 15-18 turns around "vertical" loops of about 1 m, of which 15-20 may be counted in the visible portion of the coil.

In the central sector of Cave 5 a bundle with a different coiling was recorded. It consisted of a sort of circle closed by 6 turns of lines around 10–15 lines. This kind of coil is similar to those depicted in tomb reliefs, such as a rope-making scene in the Theban tomb of Rekhmira (TT 100) (Davies 1944: Plate 52).

In 2005-06 the cordage in Cave 5 was not examined because of its fragile consistency,[8] and only preliminary observations have been made. This cordage is characterized by a fiber 3-7 mm width, S-spun, three yarns Z-pied, and a strand diameter of 30-35 mm. Some tangles

[7] Cheryl Ward also examined cordage from Cave 5.

[8] According to Cheryl Ward, the long and slow desiccation of the rope in the constant environment of the cave created a situation that may be akin to freeze-drying in terms of its appearance, but without the cellular integrity necessary to maintain the strength of the material. The rope looks stable, but the scatter of thousands of tiny fragments around each bundle offers testimony to the internal decay at a cellular level as the fibers weaken over time and collapse. The extreme dryness of the fibers promotes brittleness, and the dislocation of any of the individual strands during recovery will likely result in breakage and destruction of the entire coil.

and knots are visible in this assemblage, and a possible diamond knot was noted at the extremity of a line visible from Cave 2.

Written sources from the late New Kingdom attest to the economic value of rope: 100 cubits of rope (50 meters) were valued at 1 deben of silver (about 2 cattle) (Janssen 1975: 175; Ward 2000: 31). The great amount of cordage in Cave 5 must have been very valuable. Nevertheless, it was most likely left there for the next expedition, as a large block of conglomerate stone had been placed at the cave entrance to seal it (see 3.2.d).

7.4 Rope bag and papyrus sandal

A rope bag was found on a floor in Cave 2, Room 1. The bag is well preserved except where the ropes are broken, at the bottom and in the central part (Figure 77).

The bag has a rectangular shape, 60 cm x 45 cm, with two loops at the top. It is made of closely twined ropes and consists of 85 horizontal ropes (ca. 7 mm in diameter) on each side, fixed together (two by two) by vertical strings (about 2 mm in diameter). Only eleven vertical strings are preserved on one side; they are twined around the horizontal ropes and around each other, and are spaced 20-40 mm apart (see Wendrich 2000: 256, Figure 10.1c; 259, Figure 10.5c). Two loops are fixed to the upper corners by a sequence of knots (100 mm) along each side.

The technique used to make this bag is similar to that of several excavated samples (eg. Gourlay 1981: Plate 4, A and B; Peet and Woolley 1923: Plate 20, 4). It has been suggested that these bags were used to transport harvested wheat and barley, as they are frequently represented in agricultural scenes in tombs (Wendrich 2000: 262, Figure 10.8d). The Mersa/Wadi Gawasis bag was found in a stratum of organic materials, including seeds, near a grinding stone, round pestle, and wooden vessel (possibly a grain scoop), which suggests a food processing area or stored materials from a food processing area (see 3.2.d). These kinds of bags were probably used by expeditions for carrying provisions from the Nile Valley.

A small fragment of twined thin ropes, 90 mm x 40 mm, possibly from a bag, was also recorded (WG 24).

Two fragments of a papyrus sandal, ca. 20 cm x 7.5 cm and 11.3 cm x 9.4 cm in size were found in WG 31, SU2 (Figure 78).

7.5 Copper

S. Terry Childs

The majority of the sizeable pieces of copper (approximately 20) were flat strips or bands with standardized widths of either 1.5 or 2.0 cm. They were less than 2 mm in thickness and several were 10-12 cm in length. Most typically, they were bent and flattened at one end or bent in the middle during use. Several were bent and folded over in several places, almost as though they were crumpled for discard. Most strips were found next to, below, or on variously sized ship planks. Some had traces of wood or rope attached to the corrosion product, but only one plank found to date had clear traces of copper on it. Given their context and standardization, it is possible that the function of the copper strips was related to ship construction. They did not wrap around a plank, but seemed to link and reinforce planks side-by-side.

Also recorded were a thin (2 mm diameter) pointed rod or pin approximately 8.5 cm long, and a tapered and pointed artifact made from a rolled sheet less than 3 cm long. With a maximum external diameter of 4 mm, the sheet was a millimeter thick.

7.6 Lithics and grinding stones

G. Lucarini

In the 2001-02 to 2005-06 field seasons at Mersa/Wadi Gawasis the following were collected: 1,892 lithic pieces in chert, quartz and obsidian; 32 large stone tools (saddle querns, upper grinders, palettes, rubbers and large stones of undetermined function); 2 stone rings; and 199 pebbles and fragments of different stones, such as quartz,

obsidian, siltstone, schist, jasper and malachite. The lithic industry included 39 cores (2.1 %), 1,754 debitage elements (92.7 %), and 99 retouched tools (5.2 %).

The stone artifacts were collected on the surface of the site and in the following excavation units: WG 1, WG 3, WG 7, WG 8, WG 9, WG 10, WG 12, WG 13, WG 16, WG18, WG 19/25/26/27, WG 20, WG 21, WG 22, WG 23, WG 24, Cave 2, WG 28, Cave 1, WG 29, WG 30, WG 31, WG 33, WG 34.

The highest number of lithic artifacts was found in WG 19/25/26/27. In WG 19, 714 pieces, 4 large stone tools, and 1 stone ring were collected, while 345 lithics and 4 grinding stones were brought to light in WG 25/26. In WG 10, 159 pieces were collected, mainly in a large dump of sand and potsherds. WG 16 yielded 104 lithic artifacts, 3 large stone tools, and 1 stone ring. In WG 18, 244 pieces and 4 large stone tools were uncovered. Only 326 artifacts were collected in the other excavation units.

The Mersa/Wadi Gawasis lithic assemblage was classified with a *Microsoft Access* database for stone artifacts, based on the typology of the Maghreb Epipaleolithic industries by J. Tixier (1963). Procedures of the *Combined Prehistoric Expedition* for analysis of Late Palaeolithic and Neolithic artifacts from Wadi Kubbaniya (Close 1980; 1989) were adopted, as well as the procedures of D. Holmes (1989) for the analysis of Predynastic lithic industries. The *Munsell Soil Color Charts* (1990) were used to describe the color of the raw materials.

A small collection of 46 pieces was selected for a detailed description in this report.

At present, analysis of the lithic industry from Mersa/Wadi Gawasis suggests that cores (39 in number, corresponding to 3.3% of the assemblage) are the smallest component of the assemblage. Their frequency ranges from 0.9% in WG 16 and WG 25, to 4.6% in WG 26, where 6 cores were found. The very low incidence of cores may be due to the well represented use of "initially struck elements" characterized

by a very low grade of exploitation. Some pebbles could be knapped in order to obtain just one or a few flakes and then discarded.

In particular, 9 small and well standardized cores (2.9%) associated with microlithic debitage and retouched tools from WG 18 point to an intense exploitation of chert nodules for manufacturing patterned multiple and 90° platform cores.

Debitage has the highest frequency in all excavation units, ranging from 86.2% in WG 26 to 97.4% in WG 10. This high frequency may be related to the occurrence of many pieces of debris (chips and chunks). In the area at the base of the western slope of the terrace (WG 19/25/26), where rocks and archaeological materials that had fallen from the upper coral terrace are visible on the surface, many chunks could have been naturally flaked. Flakes are the most represented class in the debitage.

The high occurrence of core trimming elements points to local manufacturing activities. Many core sides were found in almost all the excavation units.

The blade index is in generally low, but well standardized blades from single platform cores, mostly used as blanks for pieces with continuous retouch or for perforators, occur in WG 16, WG 24 and WG 27. These artifacts are similar to those in the lithic industry at Elephantine (Hilkade 2002). Crested blades occur as well.

Retouched tools range in frequency from 1.3% (WG 10) to 9.2% (WG 26, WG 16, WG 18). The most frequent tools are side-scrapers, denticulated tools, notches, perforators, and pieces with continuous retouch and truncations.

Many pieces with continuous retouch and truncations are often manufactured on long chert blades from a single platform core. Several flakes and blades are irregularly and/or partially retouched in an opportunistic way, or show small use detachments on their edges, indicating frequent use of unretouched artifacts in working activities. These kinds of tools are particularly frequent in WG 19/25/26.

A progressive reduction in size of the lithic artifacts was recorded in the stratigraphic sequence at WG 18. Larger tools occur in the upper strata, while smaller ones occur in the lower strata. In particular, several microlithic chert perforators, bladelets, and flakes, as well as small quartz products were recorded in the lower stratigraphic units.

It is also relevant to remark that different multifunctional retouched tools occur frequently at the site. In particular, several perforator/side-scrapers were found in the area to the west of the coral terrace.

Table 14: Mersa/Wadi Gawasis lithic complex.

Mersa/Wadi Gawasis Lithic Complex				
Excavation unit	*Cores*	*Debitage*	*Tools*	*Total*
WG General Surface		2	2	4
WG 1			1	1
WG 3		12	7	19
WG 7	4	34	7	45
WG 8	1	59	2	62
WG 9		2		2
WG 10	2 - 1.3	155 97.4	2 1.3	159
WG 12			2	2
WG 13		11	1	12
WG 16	1 0.9	95 – 91.4	8 – 7.7	104
WG 18	7 – 2.9	223 - 91.4	14 5.7	244
WG 19	13 – 1.8	684 95.8	17 - 2.4	714
WG 20			1	1
WG 21		5	1	6
WG 22		10	2	12
WG 24	2	75	3	80
WG 25	2 - 0.9	204 94.9	9 – 4.2	215
WG 26	6 4.6	112 – 86.2	12 9.2	130
WG 27	1	37	5	43
WG 28, Cave 1		4		4
WG 29		2		2
WG 30		14	1	15
WG 31		2		2
WG 34		1		1
WG General Surface		3	1	4
WG 30		8	1	9
TOTAL	**39**	**1754**	**99**	**1892**

The 32 large stone tools from the site include saddle querns, upper grinders, rubbers, and 2 stone rings. Among the remaining 199 stones fragments, the occurrence of quartz, schist, siltstone, obsidian, malachite, and a jasper pebble was noted.

Twelve grinding stones (fragmentary saddle querns and upper grinders) were found inside the upper strata of the excavation units on the western side of the terrace. They include a very large complete saddle quern (55 cm x 36 cm x 16 cm, with a weight of ca. 50 kg) from WG 16, and two very well preserved grinding stones from WG 24, Cave 2 and WG 28, Cave 1. Four grinding stones, including a small saddle quern, were also collected in the lowest strata of WG 18 (SU14).

Table 15: Mersa/Wadi Gawasis: other stone tools.

Mersa/Wadi Gawasis: Other stone tools				
Excavation unit	*Large stone tools*	*Stone rings*	*Others*	*Total*
WG General Surface	2			2
WG 10			12	12
WG 16	3	1	97	101
WG 18	4		42	46
WG 19	4	1	22	27
WG 22			1	1
WG 23	1		1	2
WG 24	1		5	6
WG 25	1		7	8
WG 26	3		10	13
WG 27	1		1	2
WG 28, Cave 1	5			5
WG 30	3			3
WG 31	3			3
WG 33	1			1
WG General Surface			1	1
TOTAL	**32**	**2**	**199**	**233**

7.6.a Analysis of the selected sample

The selected sample includes 42 artifacts from WG 16, WG 18, and WG 19; and 2 pieces and one palette in siltstone from the 2001-02 surface survey of the site. Almost all artifacts are well preserved, even though some of them are fragmentary.

Surface collection (2001-02)

Debitage (1 core trimming)

- Core side from multiple platform core, manufactured in obsidian. It shows a crushed, irregular platform and a scaled bulb. Measures: 26 mm x 44 mm x 12 mm. Weight: 10.1 g. Color: black.

Retouched tools (1 endscraper, 1 perforator)

- Endscraper on core tablet, manufactured in chert. The platform is cortical, irregular wide shaped, while the bulb is diffuse. The tool shows an obverse, distal, continuous, convex, marginal, abrupt, scaled retouch. Measures: 40 mm x 55mm x 5 mm. Weight: 24.9 g. Color: 10YR 2/2 (very dark brown) (Figure 79g).
- Perforator on crested blade (fragmentary on proximal end). Manufactured in chert. Platform and bulb are missing. The tool shows a bifacial, distal, covering, scaled retouch. Measures: 62 mm x 15 mm x 7 mm. Weight: 8.6 g. Color: 5YR 3/2 (dark reddish brown) (Figure 79e).

Large stone tools (1 palette)[9]

- Rectangular palette. Manufactured in siltstone. It shows a slightly concave upper surface and a flat lower surface. Measures: 85 mm x 67 mm x 11 mm. Weight: 120 g. Color: Gley 5Y 5/1 (green) (Figure 79f).

[9] The palette was collected on the surface of the terrace to the south of Wadi Gawasis.

WG 16

Retouched tools (1 piece with continuous retouch)

- Transect W-E 2, SU7: Piece with continuous retouch on a tertiary blade from single platform core, manufactured in chert. The platform is linear, while the bulb is small and prominent. On the dexter side, the tool shows a bifacial, continuous, rectilinear, marginal, semiabrupt retouch, with scaled scars, while on the sinister edge an obverse, continuous, denticulated on proximal end and rectilinear on distal end, marginal, semiabrupt, scaled retouch is present. Measures: 81 mm x 15 mm x 3 mm. Weight: 7.8 g. Color: 7.5YR 4/4 (brown / dark brown) (Figure 80e).

WG 18

Cores (2)

- B1-B2-C1-C2, SU1: Multiple platform core (fragment) manufactured in chert. Two platforms are visible. The first one shows a cortical surface with no traces of preparation and an angle of 90°. The other one is characterized by a surface with scars of previous flake removals, no traces of preparation and an angle of 80°. The core, knapped for the production of flakes, shows a subcylindrical shape and it is highly exploited on most of periphery. Measures: 31 mm x 22 mm x 17 mm. Weight: 18 g. Color: 7.5YR 4/3 (brown / dark brown).
- SU 14: Multiple platform core (fragment) manufactured in chert. Just one platform is clearly recognizable, characterized by a cortical surface, no traces of preparation and an angle of 45°. The core, knapped for the production of flakes, shows an irregular shape and it is highly exploited and patinated. Measures: 15 mm x 32 mm x 15 mm. Weight: 8.1 g. The piece shows a very strong white (5YR 8/1) patina.

Debitage (7 flakes, 1 bladelet, 2 core trimmings, 1 chunk, 14 chips)

- SU8: Hinged flake from single platform core manufactured in chert. The item, showing a light patina, is characterized by an unfaceted, triangular platform and a diffuse bulb. Measures: 52 mm x 30 mm x 10 mm. Weight: 16.7 g. Color: 7.5YR 6/2 (pinkish grey).
- SU8: Flake from multiple platform core manufactured in chert. The item shows a crushed, irregular platform and a scaled bulb. Measures: 54 mm x 31 mm x 5 mm. Weight: 8.8 g. The piece shows a very strong white (10YR 8/2) patina.
- SU13: Flake from single platform core (distal fragment) manufactured in chert. Platform and bulb are missing. Measures: 10 mm x 15 mm x 4 mm. Weight: 0.9 g. Color: 5YR 4/1 (dark grey).
- SU13: Flake from multiple platform core (fractured on platform) manufactured in obsidian. Platform is absent while bulb is diffuse. Measures: 14 mm x 21 mm x 4 mm. Weight: 1 g. Color: black.
- SU14: Flake from single platform core manufactured in quartz. The item shows an unfaceted, semicircular platform and a diffuse bulb. Measures: 38 mm x 18 mm x 4 mm. Weight: 3.0 g. Color: white.
- SU14: Flake from 90° core, manufactured in chert. The item shows an unfaceted, trapezoidal (larger base) platform and a scaled bulb. Measures: 22 mm x 51 mm x 8 mm. Weight: 7.6 g. Color: 7.5YR 3/3 (dark brown).
- SU14, layer 2: Flake from multiple platform core (distal fragment), manufactured in chert. The artifact shows traces of fire. Platform and bulb are missing. Measures: 19 mm x 18 mm x 4 mm. Weight: 1.5 g. Color: 5YR 7/1 (light grey).
- SU12: Bladelet from single platform core (fragmentary on distal end). The item, manufactured in quartz, is characterized by an unfaceted, irregularly lenticular platform and a diffuse bulb. Measures: 16 mm x 8 mm x 2 mm. Weight: 0.5 g. Color: white.
- A2, SU1: Crested blade (mesial fragment), manufactured in chert. Platform and bulb are missing. Measures: 25 x 10 x 7 mm. Weight: 2.3 g. Color: 5YR 3/3 (dark reddish brown).
- SU8: Core side from 90° core. The item is manufactured in chert. It shows a cortical, irregular platform and a small and prominent

bulb. Measures: 50 mm x 47 mm x 17 mm. Weight: 47.1 g. Color: 7.5YR 5/3 (brown).

- SU9: Chunk. Chert. The item shows traces of fires. Color: 10YR 7/1 (light grey).
- SU9: Chip. Chert. The item shows traces of fire and a very strong white (5YR 8/1) patina.
- SU10: Chip. Chert. The item shows traces of fire and a very strong white (5YR 8/1) patina.
- SU10: Chip. Chert. The item shows traces of fire. Color: 7.5YR 5/0 (grey).
- SU10: Chip. Chert. Color: 7.5YR 5/2 (brown).
- SU10: Chip. Chert. Color: 7.5YR 5/2 (brown).
- SU10: Chip. Chert. Color: 7.5YR 5/2 (brown).
- SU10: Chip. Chert. Color: 7.5YR 5/2 (brown).
- SU13: Chip. Chert. The item shows a very strong white (5YR 8/1) patina.
- SU13: Chip. Chert. Color: 2.5YR 3/4 (dark reddish brown).
- SU14: Chip. Chert. Color: 7.5YR 3/4 (dark brown).
- SU14: Chip. Chert. The item shows a very strong white (5YR 8/1) patina.
- SU14: Chip. Quartz. Color: white.
- SU14: Chip. Quartz. Color: white.
- SU14: Chip. Quartz. Color: white.

Retouched tools (1 crescent, 3 perforators, 1 sidescraper)

- SU12: Crescent manufactured in chert. Measures: 15 mm x 8 mm x 2 mm. Weight: 0.4 g. The item shows a very strong white (5YR 8/1) patina.
- SU14: Perforator on undifferentiated core trimming manufactured in chert. Platform and bulb are absent. The tool, characterized by a very developed patina, shows an obverse, bilateral, discontinuous, concave, marginal, flat retouch with scaled scars. Measures: 27 mm x 25 mm x 16 mm. Weight: 6.1 g. Color: 10YR 4/1 (dark grey) (Figure 79d).

- SU14: Perforator on core side from single platform core, manufactured in chert. The tool shows a cortical, triangular platform and a diffuse bulb. It is characterized by an obverse, bilateral, partial distal, denticulated, slightly invasive, abrupt, scaled retouch, forming a point on the distal end. Measures: 18 mm x 19 mm x 5 mm. Weight: 1.4 g. The item shows a very strong white (5YR 8/1) patina (Figure 79c).
- SU14: Perforator on core side from multiple platform core, manufactured in chert. The tool shows an unfaceted, irregular wide shaped platform and a diffuse bulb. It is characterized by an obverse, bilateral, partial distal, rectilinear, invasive, abrupt, scaled retouch, forming a point on the distal end. Measures: 27 mm x 31 mm x 6 mm. Weight: 5.4 g. The item shows a very strong white (5YR 8/1) patina (Figure 79a).
- SU14: Sidescraper on tertiary flake (undetermined fragment) from unidentifiable platform core, manufactured in chert. Platform and bulb are unidentifiable. The item is characterized by a bifacial, covering, flat retouch with scaled scars. On the edges the artifact shows a secondary, obverse, continuous, convex, slightly invasive, abrupt, scaled / stepped retouch. On the mesial part of the dexter side a bifacial notch (7 mm x 1 mm) is visible. Measures: 38 mm x 32 mm x 6 mm. Weight: 10.7 g. The item shows a very strong white (5YR 8/1) patina (Figure 79b).

WG 19

Cores (2)

- A3, SU8: Multiple platform core (fragment) manufactured in obsidian. Measures: 10 mm x 17 mm x 8 mm. Weight: 1.3 g. Color: black.
- D2, SU 44: Multiple platform core (fragment) in obsidian. Highly exploited. Measures: 22 mm x 23 mm x 12 mm. Weight: 4.8 g. Color: black.

Debitage (1 core trimming)

- A1, SU1: Core side from multiple platform core (fragmentary on distal end), manufactured in chert. It shows an unfaceted, irregular

wide shaped platform and a small and slightly prominent bulb. Measures: 30 mm x 36 mm x 12 mm. Weight: 15.1 g. Color: 7.5YR 4/3 (brown / dark brown).

Retouched tools (4 sidescrapers, 1 denticulate, 1 piece with continuous retouch)

- A1, SU1: Lateral sidescraper (fragmentary on left side and distal end) on a tertiary blade from single platform core. The tool is manufactured in chert. The platform is unfaceted, lenticular, while the bulb is diffuse. On the dexter side, the tool shows an inverse, continuous, concave, marginal, semi-abrubt retouch, with scaled scars. Measures: 46 mm x 22 mm x 9 mm. Weight: 14.3 g. Color: 5YR 3/3 (dark reddish brown) (Figure 80b).
- A1, SU1: Sidescraper on undifferentiated core trimming element (fractured on platform), manufactured in chert. Platform and bulb are missing. The tool shows a bifacial, sinister, discontinuous, rectilinear, marginal, flat retouch, with scaled scars. Measures: 62 mm x 21 mm x 17 mm. Weight: 20.3 g. Color: 7.5YR 3/2 (dark brown).
- A1, SU1: Sidescraper on core side from opposed platform core. The item is manufactured in chert. It shows a faceted, triangular platform and a small and prominent bulb. The tool is characterized by an alternating, dexter, discontinuous, rectilinear, marginal, flat retouch with scaled scars. Measures: 36 mm x 32 mm x 13 mm. Weight: 15.7 g. Color: 7.5YR 6/3 (light brown).
- A1, SU1: Denticulate on secondary flake from unidentifiable platform core (fragmentary on platform). The item is manufactured in chert and shows traces of fire. Platform and bulb are missing. The tool shows an alternating, continuous on most of the perimeter, denticulated, invasive, semi-abrupt retouch with scaled scars. Measures: 38 mm x 40 mm x 15 mm. Weight: 23.2 g. Color: 5YR 4/3 (reddish brown) (Figure 80a).
- A2, SU13: Sidescraper on tertiary flake from 90° core, manufactured in chert. The tool shows a faceted, irregularly lenticular platform and a scaled bulb. On the dexter side, the item shows an obverse, continuous, convex, marginal, flat retouch with scaled scars. Measures: 65 mm x 62 mm x 10 mm. Weight: 62.1 g. Color: 7.5YR 4/4 (brown /dark brown) (Figure 80c).
- A2, SU13: Piece with continuous retouch on a secondary blade from single platform core (fragmentary on platform). The item is manufactured in chert. Platform is missing, while the bulb is diffuse. The tool shows an obverse, bilateral (continuous on the whole dexter side, partial mesial on the sinister side), rectilinear, marginal, semi-abrubt retouch with scaled scars. Measures: 62 mm x 20 mm x 6 mm. Weight: 11.2 g. Color: 7.5YR 5/3 (brown) (Figure 80d).

7.6.b Main technological features

The main technological features of the selected pieces are:

Raw material

Chert was definitely the most frequent raw material (36 artifacts), followed by quartz (5) and obsidian (4). 26 artifacts in chert were found in WG 18, 7 come from WG 19, 1 from WG 16, and the remaining 2 from the coral terrace. The morphology and size of the artifacts suggest that medium and large chert pebbles were mainly used in the area to the west of the coral terrace. On the contrary, smaller pebbles seem to be used in the WG 18 lithic assemblage. Chert pebbles of various dimensions were available, in a great quantity, along the course of the wadi. Chert is usually brown in color (5YR, 7.5YR and less frequently 10YR), ranging from a very dark brown (10YR 2/2) and dark gray (5YR 4/1; 10YR 4/1) to pinkish gray (7.5YR 6/2). The most frequent color is brown, 7.5YR 5/2.

The artifacts from WG 18 show a very developed, light gray (5YR 7/1, 10YR 7/1) or white (5YR 8/1; 10YR 8/2) patina, often reaching a thickness of 0.5 mm, which makes the original color completely unidentifiable. Few pieces show traces of fire.

Five quartz artifacts are present in the selected sample: 1 bladelet from WG 18 (SU12), and 1 flake and 3 chips from WG 18 (SU14).

Only four artifacts were manufactured in obsidian: 1 flake from WG 18 (SU13), 2 fragmentary cores from WG 19, A3 (SU8) and WG 19, D2 (SU44), and 1 core side from the surface collection of the western terrace.[10]

Cores

Cores are represented by 4 fragmentary specimens, two from WG 18, SU14, and the other two, manufactured in obsidian, from WG 19. They are multiple platform cores with a small size, sometimes microlithic. The platform surfaces do not show evident traces of preparation. The negatives of the removals on the flaking surfaces indicate that the cores were intensively exploited for making flakes.

Debitage

The debitage consist of 7 flakes and 1 bladelet from WG 18 (SU8, SU12, SU13, SU14); 4 core trimmings, including 1 core side and 1 crested blade from WG 18 (SU1, SU8); 1 core side from WG 19 (SU1); 1 core side from the western terrace; and 15 pieces of debris (1 chunk and 14 chips) from WG 18 (SU9, SU10, SU13, SU14). Primary flakes and blades are not present.

Specific features of the cores and stone debris from WG 18 (in particular SU14) can be related to a local manufacture. This is also suggested by the occurrence of several core trimming elements, which points to a prolonged exploitation of the cores.

The flakes are from single platform cores (3 specimens), multiple platform cores (3 specimens), and a 90° core (1 specimen). The only bladelet is from a single platform core.

[10] Petrographic analysis of the obsidian samples and the location of the quarrying areas will be one of the main goals of the project because of their relevance for a better understanding of the trade routes along the Red Sea.

The platform of the flakes and bladelet, when present and recognizable, is unfaceted (4), crushed (1), and cortical (1). The main occurrence of plain, unfaceted butts indicates a general, simple preparation of the striking platform. The bulbs are mainly diffuse (4) and scaled (2).

Core rejuvenation practices are attested by 3 core sides, 1 crested blade, and numerous retouched tools manufactured on different types of core trimmings as a blank.

The core side platforms are unfaceted (1), crushed (1), and cortical (1); and the bulbs are small and prominent (1), small and slightly prominent (1), and scaled (1).

Retouched tools

The retouched tools of the selected lithic sample include 1 endscraper from the surface of the terrace, 5 sidescrapers (1 from WG 18, SU14, and 4 from WG 19, SU1 and SU13), 1 denticulate from WG 19, SU1, 4 perforators (1 from the terrace and 3 from WG 18, SU14), 2 pieces with continuous retouch (1 from WG 16, SU7 and 1 from WG 19, SU13), and 1 crescent from WG 18, SU12. The tool kit does not show a particular standardization of the products and, on the whole, pieces to be used for scraping or cutting seem to be more frequent, representing the majority of the retouched tools.

The endscraper is circular in shape and was obtained from a core tablet. The scraper has an obverse, abrupt retouch characterized by scaled scars, which form a convex front on the distal end of the tool.

Two sidescrapers are manufactured on core trimming elements (1 undifferentiated core trimming and 1 core side), while the other 3 are on a tertiary blade from a single platform core, a tertiary flake from 90° core, and an unidentifiable flake. The first 4 scrapers have a marginal retouch, while the last one is characterized by a covering retouch with a secondary obverse retouch along the edges. On its dexter side, this tool shows a bifacial retouched notch.

The denticulate is manufactured on a secondary flake from an unidentifiable platform core and shows an alternating retouch along most of the edge with a semicircular pattern.

The angle of the retouch in the sidescrapers and denticulate can vary from a flat to a semi-abrupt or abrupt angle. The morphology of the scars is usually scaled.

The 4 perforators are from core trimming elements (2 on core sides, 1 on a crested blade, and 1 on an undifferentiated core trimming element). Two perforators from WG 18, SU14 show an obverse, bilateral retouch which forms a point at the distal end of the tool. The perforator from a crested blade is the only one with a bifacial, covering retouch, characterized by scaled scars. The angle of the retouch is often abrupt, even if an artifact with a flat retouch is present as well.

The 2 pieces with continuous retouch are on blades from a single platform core. The specimen from WG 16 is on a large chert blade showing a bifacial, marginal retouch on the dexter side and an obverse denticulated retouch on the other edge. It could be a sickle blade.

The last retouched tool present in the lithic sample is a small crescent, manufactured in white chert, from WG 18.

Large stone tools

The only item of the selected sample belonging to this class of artifacts is a small palette manufactured in green siltstone. Rectangular in shape, it shows a slightly concave upper surface and a flat lower surface. Considering its small dimensions, a use for grinding grains can be excluded, and it appears to be similar to late Predynastic (Naqada III) cosmetic palettes.

7.6.c Cultural and chronological setting

Preliminary analysis of the lithic assemblage from Mersa/Wadi Gawasis, as well as a more detailed analysis of selected specimens, suggest the occurrence of two main technological traditions at the site.

The first lithic tradition can be identified on the western slope of the terrace, in the upper strata of WG 16, and in WG 19/25/26/27. This industry is characterized by large, opportunistic tools such as different kinds of rough scrapers, together with other better manufactured tools, such as perforators on flakes, truncations, and pieces with continuous retouch, often on large blades. Several sandstone rubbers, most likely used to shape pottery disks, as the thickness of the potsherds always coincides with the width of the grooves on the rubbers, were also associated with this industry in WG 19/25/26/27.

This lithic assemblage is comparable to industries from other sites in the Nile Valley and northern Sudan. The blade products associated with 12th Dynasty ceramics are similar to the Predynastic industries of Upper Egypt (Holmes 1989) and Old Kingdom industries from Elephantine (Hikade 2002). Industries with a great amount of perforators on flakes were also recorded in Nubian sites dating to the early 2nd millennium BC (Gratien and Olive 1981; Säve-Söderbergh 1989).

The second lithic tradition at Mersa/Wadi Gawasis is represented by evidence from the southern slope of the terrace, especially WG 18. This industry, also associated with Middle Kingdom pottery, is characterized by different technological features, with a higher microlithic index and occurrence of particular tools, most likely related to an intense exploitation of marine resources.

A group of microlithic perforators from the lower strata of WG 18 (SU11 - SU14) were associated with a concentration of shells and fish remains. These tools could have been used for manufacturing shell beads or other shell artifacts. The inner surface of the holes on different pierced shells, observed with a stereoscopic microscope at a magnification of 10-63 x, demonstrated the occurrence of typical striations produced by a lithic perforator.

Four fragmentary grinding stones from WG 18, SU11 and SU14, were also associated with a large concentration of shells, crab remains, and fish bones, pointing to a possible use of these tools to process sea food or make shell tools (e.g. Tosi and Biscione 1981).

This hypothesis is supported by Agatarchides of Cnidus (Diodorus, III, 7), who described the practice of Red Sea coastal peoples (*Ichtyophagoi*) during Hellenistic times of grinding dried fish and seeds for making food (Burstein 1989).

The occurrence of two different, but apparently contemporary, technological traditions, on the two slopes of the terrace suggests either a functional diversification of the various areas of the site, or the contemporary presence of two distinct cultural entities at the site: the Egyptians coming from the Nile Valley and the indigenous "fish eaters."

7.7 Shells

A. Carannante and C. Pepe

Many bioarchaeological remains, including those of fish, mammals, birds, and sea shells, have been excavated at Mersa/Wadi Gawasis. Preliminary remarks here are based on archaeomalacological investigations in January 2006.

Shells of molluscs and other marine invertebrates recovered from archaeological sites supply two types of information. Shell taphonomy may suggest their uses in ancient cultures and their role in the economy, while the ecology of the species may supply palaeoecological information about the local environment, climate, and landscape. Because of their high degree of sensitivity to environmental conditions, molluscs are more important climatic and ecological indicators than mammals, birds, and fish.

At Mersa/Wadi Gawasis two small barnacles were found at the entrance to Cave 2. Barnacles are crustaceans which live attached to hard substrates, such as rocks or rigid frames of coral reef. One of the barnacles from the entrance to Cave 2 encrusts a small copper strip (Figure 81). This metallic artifact must have been part of a seafaring ship that had been beneath the water-line for a long time.

The other barnacle, found in the same excavation trench (WG 16), had marks on the bottom of the wooden substrate to which it was attached (Figure 82). Such evidence provides information about the length of time that the ship wood was in sea water.

Other evidence of crustaceans at the site includes land hermit crabs (*Coenobita sp.*) still in their shells, at the cave entrance as well as inside the caves. Most of the land hermit crabs were recovered in a large well-preserved jar from WG 31 in which there were also many leaves of marine weeds (Figure 83). Land hermit crabs move around the coast during the night in search of food, and evidence of these crabs at the site suggests that the coastline was not far from the caves.

Table 16: List of identified shell species.

GASTROPODA	BIVALVIA	ECHINOIDEA
Bursa sp.	*Anomia sp.*	*Heterocentrotus mamillatus*
Cassidae	*Brechites attrahens*	*Phyllacanthus imperialis*
Cerithium ruppelli	*Callista sp.*	
Cerithium sp.	*Chlamys sp.*	CIRRIPEDIA
Conus arenatus	*Codakia tigerina*	*Tetraclita squamosa*
Conus lithoglyphus	*Glycymeris costata*	
Conus sp.	*Loripes sp.*	CRUSTACEA
Conus textile	*Mactra sp.*	*Coenobita sp.*
Cypraea sp.	*Modiolus sp.*	*Ocypode sp.*
Harpa amouretta	*Ostrea sp.*	
Hinia reticolata	*Paphia sp.*	ANTHOZOA
Hydatina sp.	*Pinctada margaritifera*	*Tubipora sp.*
Lambis lambis	Pinnidae	
Littorina sp.	*Psammobia sp.*	
Mauritia sp.	*Scapharca sp.*	
Muricidae	*Tellina sp.*	
Nassaridae	*Tridacna maxima*	
Nassarius arcularis	Veneridae	
Natica onca		
Nerites sp.	CEPHALOPODA	
Neritidae	*Sepia sp.*	
Oliva sp.		
Rhinoclavis sp.		
Strombus erythrinus		

Strombus fasciatus		
Strombus gibberulus		
Strombus tricornis		
Terebra crenulata		
Turbinidae		
Turritella sp.		
Volema pyrum		
Xenoturris cingulifera erythraea		

Samples of shells, crustaceans, and fish remains (Figure 84) that were collected in geoarchaeological test trenches testify to sub-recent taphocoenosis (assembages of buried skeletal remains). The analysis of the taphocoenosis will contribute to the palaeoecological reconstruction of the area. Shells from these trenches are also significant for their association with artifacts, such as in WG 36, where an anchor (A11) was found along with marine shells and barnacles. At present, however, it is only possible to state that malacological remains excavated in archaeological strata from the western slope and base at Mersa/Wadi Gawasis consist of marine shells from coral reef and lagoon ancient ecosystems. Shells from brackish water conditions are not attested in the area.

Table 17: Shells from WG 36 found associated with an anchor. The assemblage of species in the taphocoenosis (buried remains) attests to normal marine water conditions.

CLASS	SPECIES	HABITAT
Gastropoda	*Nerites undata*	Rocks in very shallow and littoral zones
Gastropoda	*Turbo sp.*	Shallow hard bottoms
Bivalvia	*Ostrea sp.*	Cemented on rocks and coral reef
Bivalvia	*Mactra achatina*	Sand from the low tide zone to depth of 40 m
Bivalvia	*Veneridae* indeterminate	

Three small finds in shell were definitely worked by humans: a spoon made from a Cassidae shell (Figure 85a-b), and two small beads (Figure 86) of an unidentifiable shell. The spoon was carved from a sector of the last whorl of a large gastropod shell, a Cassidae specimen with a tiny undulated shell. It is very different from the common shell spoons found in Bronze Age sites in the Mediterranean and Near East.

More than 650 large specimens of *Lambis lambis*, and a few *Tridacna squamosa* shells were discovered in WG 29 lying around an ancient structure on the coast (Figure 87). All the Lambis shells show a consistent pattern of fragmentation and only two of them are complete. Bioerosion marks, which are present on most of the Lambis shells, suggest that they were already dead when collected and were eroded on the beach. Thus, these shells had not been utilized as food or as raw materials to work.

Further studies of shells at Mersa/Wadi Gawasis will certainly reveal new information about the paleoecology of the site, use of sea shells, and the complex network of sea trade.

Chapter 8
Textual Evidence

ELSAYED MAHFOUZ, ANDREA MANZO AND ROSANNA PIRELLI

8.1 Stelae

8.1.a Stelae 1, 2, 5

R. Pirelli

Stela 1 (Figure 88)

Provenance: Stela 1 was found in 2004-05 *in situ* in niche 1, affixed with mud plaster and wooden wedges.

Dimensions: Height 27, Width 27, Thickness 5-7 cm

Material: Limestone.

Conservation: The upper half of the stela is missing. The lower preserved part shows no surface damage.

Description: The lower half of the stela only has a carved image of a seated man facing right. There is no text. The man is seated on a low-backed chair with bull legs. He is depicted with a bag wig, short beard, and a short kilt with a rigid apron. In his left hand he holds a long staff, and a folded cloth is in his right hand.

Date: According to its context and the style of the figure, the stela dates to the late 12th Dynasty.

Stela 2 (Figure 89)

Provenance: Stela 2 was found in 2004-05 *in situ* in niche 2.

Dimensions: Height 40.1 cm, Width 23.5 cm, Thickness 9.5 cm.

Material: Limestone.

Conservation: The stela is very damaged: the surface of the recto is severely eroded, and the text and images are illegible, especially in the upper part where some of the limestone has flaked off.

Description: The stela has a rounded top. The surface of the recto had been smoothly finished, while the sides that were fixed in the niche were left rough-hewn.

The decoration is divided into two parts. The upper part consists of 12 horizontal lines of text; the lower part is a carved with an offering scene. Two men are seated to either side of a huge offering of food, placed on a flat platform. Each of the men is depicted with a short wig, collar necklace, and kilt(?). The man on the right has a short beard; his right hand is placed across his breast and his left hand is on his thigh, holding a (folded) piece of cloth. The man on the left is depicted symmetrically to the one on the right, except that his right hand is without a cloth. They are sitting on low backed chairs, probably with lion legs.

To date, this is the only "funerary type" stela found at Mersa/Wadi Gawasis.[1]

Text: Unfortunately, most of the text is not legible. Only a few groups of hieroglyphic signs are complete, and the text can only be reconstructed from known texts of this type. The first text occupies 10 of the 12 horizontal lines and contains an "appeal to the living," followed by the first part of the offering formula (*ḥtp di nswt*). The second part of the offering formula is in the lowest 2 lines, which are divided into left and right parts, with each part above a seated man. The left and right texts consist of "for the *ka* of" (*n kȝ n*) followed by the titles and the names of the two men. These titles and names (of the men and their mothers?) are only partially preserved.

Although more groups of hieroglyphic signs are recognizable in the upper part of the stela, only some words of the beginning of the "appeal to the living" can be suggested in line 3. At the end of line 7, an epithet of the god Soped can probably be read. In line 8 a

[1] I use the term "funerary type" to distinguish this stela from all the other inscribed stelae found at Mersa/Wadi Gawasis, which record expeditions.

possible translation is proposed, but only a few signs can be reconstructed. Lines 9-12 have been better preserved.

1-2) [...] 3) ity.sn [...] *4-6) [...]* 7) [.....*Nb ḫȝswt* (?)] *8) ḥȝw.*[*tn*(?)] *r* [... *m ḥtp*?] *ḥ*[ʿ*w*?].*ṯn wʿb* 9) *šw m nḳmt mi ḏd.*[*tn*] *ḥtp di nswt* [...*nb* ...?] *10) di.f prt-ḫrw kȝw ȝpdw snṯr nrḥt ḫt nb*(*t*) *nfr*(*t*) *wʿb*(*t*) ʿ*nḫt nṯr im*

11) (right half) n kȝ n [*sš n ḏȝḏȝt n wʿrt tp-rsy*]

12) (right half) [*Nḫti*] *ir.n* [*Rḥw*]-ʿ*nḫ nb imȝḫ*

11) (left half) n kȝ n [*sš n sm*[*dt n* ...?]

12) (left half) [ʿ*nty*(?)]*m-ḫȝt ir n* [.....] *mȝʿ-ḫrw nb imȝḫ*

1-2) [...] 3) who shall pass [...] 4-6) [...] 7) [... lord of the foreign countries (?)] 8) you will enter [.....in peace], your [body] being pure, 9) without any affliction, as [you] say: "A funerary offering of [.....(?)], 10) that he may give an invocation offering consisting of bread and beer, oxen and fowl, incense and oils, and all things good and pure on which a god lives

11) (right half) for the *ka* [of the scribe of the board[2] of the Department of the Head of the South] [.....] 12) born of [Rehu-]ankh, the revered

11) (left half) for the *ka* of the [scribe of the called-up laborers[3] of the .....?] 12) [Anty]emhat born of [.....?] true of voice and revered

Date: According to its context, the stela dates to the late 12th Dynasty, which is confirmed by stylistic criteria, onomastics, and palaeography.

Stela 5[4] (Figure 90 and Figure 91)

[2] On this translation and on the meaning of *ḏȝḏȝt* in the Middle Kingdom, see Quirke 1990: 54-55 and 136.

[3] Ward 1982: n° 1431.

[4] A first translation with notes about the names and the titles of the officials mentioned in the texts of the two stelae was presented at the Vth Italo-Egyptian Congress, held at Sharm el-Sheikh in December 2005 and is now in press in the Congress Proceedings. A more complete article on the two stelae, with transliteration, translation and comments will appear in *Revue d'Égyptologie*.

Provenance: Stela 5 was found in 2004-05 lying in the sand, inscribed side down, just below its original niche (niche 10).
Dimensions: Height 38.0 cm, Width 26.0 cm, Thickness 10.5-11.0 cm.
Material: Limestone.
Conservation: The stela is very well preserved, except for a small part of its upper edge, which is partially encrusted with salt.
Description: This round-topped stela is decorated in sunk relief, with a border incised around the edges. There is no trace of color. The decoration is divided into three parts: 1) the upper part, with a carved offering scene to the god Min; 2) the central part, with two symmetrical horizontal texts in three lines; and 3) the lower part, with the final part of the two texts, each inscribed in two vertical columns, which are flanked by the figures of two men.

The profiles of the figures (especially the human faces) are outlined and not very detailed. Some hieroglyphic signs are inaccurately drawn and unintentional cuts appear on the surface.

In the upper scene, the ithyphallic god Min stands on the left, facing right. King Nymaâtrâ (Amenemhat III) is standing in front of him, facing left and presenting the god with a conical loaf in his left hand. The king wears a short kilt with a rigid triangular apron, a bull's tail, and an unusual crown resembling a double-plumed headdress. The owner of the stela, Nebsu, is standing on the far right behind the king, facing left. Nebsu is carved on a smaller scale than the king. He is depicted with a shaven head and long skirt, with his arms at his sides.

Two more human figures are in the lower part of the stela, on either side of the vertical inscriptions. On the right is Nebsu, standing and facing left, with his arms at his sides. He wears the same long skirt as in the upper scene, and a short wig. On the left is the reversed image of his brother, Amenhotep, facing right and wearing the same attire.

Text:

Above the god Min:	*mry Mnw Gbtywy* beloved of Min, the Coptite
Above the king:	*Ntr nfr nb t3wy (Ny-M3ᶜt-Rᶜ) ḏi ᶜnḫ* the good god Nymaâtrâ given life
Between the god and the king:	*di.t sḍt* to offer the *shât*-cake
Above Nebsu:	*Imy-r ᶜḫnwty n tp-rsy Nbsw* overseer of the cabinet of the "Head of the South," Nebsu

The central and lower parts:

Right horizontal (3 lines) and vertical (2 columns) text (referring to Nebsu)

1) rdi.n ḥm.f iwt.i r bi3 2) Pwnt ḥnᶜ imy-r pr wr 3) Snb.f ḥr mnḫ sḫr.i 4) ink rḫ(w) st-rd.f mtr ḥ3ty 5) imy-r ᶜḫnwty Nbsw nb im3ḫ

1) His majesty caused me to go to Bia 2) Punt together with the high steward 3) Senbef because of the excellence of my plans: 4) I am one who knows his rank, loyal of heart 5) overseer of the cabinet, Nebsu, the revered

Left horizontal (3 lines) and vertical (2 columns) text (referring to Amenhotep):

1) sn.f sš ḥry ḥtm n pr-ḥḍ Imn-ḥtp ḏd.f 2) rdi.n ḥm.f iwt.(i) r sb.t 3) imy-r pr wr Snb.f
4) r Pwnt n mnḫ(.i) ḥry-ib n ḥm.f 5) ᶜ3 wrt Imn-ḥtp nb im3ḫ

1) His brother, the scribe responsible for the seal of the treasury, Amenhotep, he says: 2) His majesty caused (me) to go to lead 3) the high steward Senbef 4) to Punt because I am pleasing to the heart of his majesty 5) to the greatest degree, Amenhotep, the revered

Date: Reign of Amenemhat III.

8.1.b Stelae 6, 7, 8

E. Mahfouz

Stela 6, niche 12 (Figure 92 and Figure 93)

Provenance: Stela 6 was found in 2005-06 *in situ* in niche 12 about 2 m to the south of the group of the niches discovered in 2004-05. The stela was fixed inside the niche with gypsum plaster and small stones. A small piece of wood (wedge?) fixed the stela at the base.

The niche dimensions are: Height 44 cm high, Width ca. 30 cm. The niche is deeper in the lower part: 27 cm at the base and 8 cm in the upper part.

Dimensions: Height 36.5 cm, Width 22.5 cm, Thickness 5 cm.

Material: Limestone.

Conservation: The lower part of the inscription and the right part of the winged sun disk at the top of the stela are badly damaged. Most of the text and images seem to be in good condition; remains of paint were noted in the upper part of the stela.

Description: The stela has a round top, and the inscribed text is divided into three parts. The upper part is carved with an image of the winged sun disk and two horizontal line of hieroglyphic signs. The middle part consists of a horizontal line of a scene of the ithyphallic form of the god Min with his epithets in front of the five names of Amenemhat III. The lower part consists of a central vertical hieroglyphic text of four columns to each side of which are two men. The inscription and decoration were very carefully made and are of high quality, mainly if we consider that the stela was found in a deserted area far from the Nile Valley. At the top of the stela are incised lines defining the stela's border. There are traces of red paint on the crown of Min and the sun disk.

Text:

In the upper part is a line of hieroglyphic signs beneath the sun disk:

Bḥdty ntr ʿȝ sȝb ṯwt nb pt nb Msn

He of Edfu, august god, of variegated plumage, master of the sky, Lord of Mesen[5].

A damaged line with a date, but only the number 2 is preserved and, at the end, the name of the king.

... +2 ḫr Ḥm n nsw-bity ny-mȝʿt-rʿ di ʿnḫ...

...under the Majesty of the king of Upper and Lower Egypt Ny-

[5] *Msn* is a toponym which indicates Edfu or Tell Abu-Seify (Qantara). In this context, however, the text probably refers to Horus, Lord of expeditions to the East (*LÄ* IV: coll. 1085).

maât-Rê given life....

The central part is occupied by the representation of the god Min and the epithet of the sovereign *mry Mnw nb Ghtyw di ʿnḫ* "Beloved of Min, Lord of Coptos, given life" on the right and the titulary of Amenemhat III:

Horus name: *ʿȝ ḥȝw*

Nbty name: *ỉṯỉ-iwʿt-tȝwy*

Horus of Gold name: *wȝḥ-ʿnḫ*

King of Upper and Lower Egypt : *nṯr nfr nb irt ḫt* "the good god, lord of rituals," *Ny-mȝʿt-Rʿ*[6]

Son of Ra (*sȝ-Rʿ*): *Imn-m-ḥȝt*[7]

In the third (lower) part, on the lower left and right, the heads and shoulders of two persons face a vertical inscription in the center.[8]

Only one column (the right one) of this incomplete text refers to the man on the right.

→ *wḏ ḥm.f iw ḫry*

His majesty ordered the head officer(?) to go . . .[9]

The other three columns refer to the man on the left:

1) wḏ ḥm.f rdi w... 2) sḫw-Ḥr ḏsr n.f . . . 3)sȝb imy-r sš(w) m ḥwt-wr[t]...

1) His majesty ordered that one (?) be appointed . . . 2) . . . 3) chief overseer of scribe(s) in Hut-weret....[10]

Date: Reign of Amenemhat III.

The upper part of the stela has the full royal titles and names of Amenemhat III facing the god Min. The lower part of the inscription is only partially preserved and describes the duties assigned by royal decree to two officials, whose representations are

[6] *Nsw –bity* is replaced by *nṯr nfr nb ir ḫt*.

[7] The text adds to *sȝ-Rʿ* the words *n ḫt.f* "of his body."

[8] The two persons were probably standing.

[9] A toponym is probably missing here.

[10] Quirke 1986: 128 note 60 and 1990: 59, 69-70, notes 24-25.

partially preserved on the two sides of the text. Unfortunately, due to the bad preservation of the text, these duties cannot be specified.

Stela 7 (Figure 94)

Provenance: Found in 2005-06, this small stela was located 330 cm north of the niche of Stela 6 (and 23 cm lower).

Dimensions: Height 23 cm, Width 23 cm.

Material: Limestone.

Conservation: The stela is completely encrusted with a thick layer of salt and the inscription is now missing except for a few traces of the last two lines.

Description: The stela is an almost square, with traces of a hieratic inscription written with black ink. It is possible to recognize some signs from the two last lines. These are probably part of the title *imy-r*, "overseer."

Date: Middle Kingdom (by its context, from the reign of Amenemhat III).

Stela 8

Provenance: Stela 8 was found in 2004-05 while clearing the corner of the vertical coral wall on the western slope.

Dimensions: Height 21 cm, Width 14 cm, Thickness 7 cm.

Material: Limestone.

Conservation: The surface of the stela is encrusted with a layer of salt; consequently, the inscription is destroyed. Nevertheless, a few traces of the inscription are still visible. Red paint can also be seen on the figure of Min, on the body, lower face, and upper part of the head.

Description: This small votive stela is divided into two parts. The upper part is occupied by a representation of the ithyphallic form of the god Min in front of the cartouche of *Ny-mꜣꜥt-Rꜥ*, the crown

name of Amenemhat III. On the more damaged lower part of the stela a standing man raises his hands in a scene of adoration.[11]

Date: Reign of Amenemhat III.

8.2 Ostraca[12]

E. Mahfouz

Ostracon WG 101

This ostracon, made of marl ware (12.5 cm x 10 cm x 1.5 cm), was found in Cave 1, WG 28,[13] SU3, a stratum of compacted sand which represents the floor of the cave.[14]

Rosanna Pirelli believes that the eight lines of signs are from an accounting text.[15] I would like to make some additional, preliminary remarks.

The text is written with a black charcoal substance. The right part of the text is complete, but the left part is missing. The hieratic text is difficult to read, and a preliminary reading is suggested here. The first line starts with the sign ("to receive") written with the sign of a fence,[16] the phonetic complement of *sp* *p*, and the arm sign . The other sign in the first line is of a twisted wick of flax for the letter *ḥ*, and then a space for a sign which ends in the missing part.

[11] The damaged lower part possibly has another cartouche and an offering table in the center with another (missing) man on the right.

[12] In December 2005, I examined three well-preserved ostraca in the SCA storeroom in Qift. These ostraca inventory numbers begin with 101, leaving numbers 1-99 for the ostraca found by Professor A. M. Sayed in 1977. I am grateful to my colleague Rosanna Pirelli for her remarks.

[13] K. Bard and C. S. Lim excavated this unit in 2004-05.

[14] R. Fattovich, K. Bard *et al.* 2005, pp. 14-15.

[15] R. Pirelli in R. Fattovich, K. Bard *et al.*, 2005, p. 24.

[16] *HP* I, #368; for comparisons on the use of *ssp* in the archives of el-Lahun see UC 32204 verso (M. Collier and S. Quirke 2002, pp. 118-119); UC 32149A fragment 3.2: (M. Collier and S. Quirke 2004, pp. 14-15); UC 32102Ai, vertical (M. Collier and S. Quirke 2006, pp. 164-165); UC 32137E (ibid. pp. 238-239); UC 32306 (ibid. pp. 296-297).

This sign might be a bird, such as the swallow wr[17], or the newborn bubalis jw,[18] and an illegible sign, but I cannot read this group of signs.

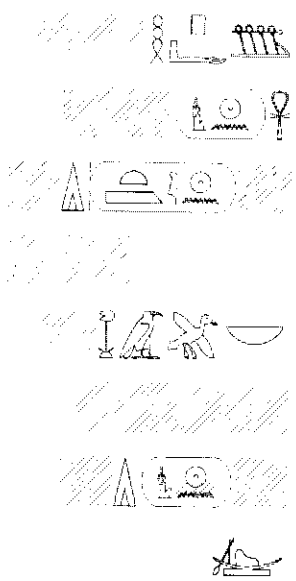
The cartouche of *Ny-m3ᶜ.t-Rᶜ*,[19] the coronation name of Amenemhat III, is repeated three times, in the second, third, and sixth lines of the text.

The second line starts with a vertical sign that could be the sandal strap[20] *ᶜnḫ* or the scepter[21] *sḫm* or *ḥrp*. After the royal cartouche, we would expect an epithet, such as *dj ᶜnḫ ḏ.t r nḥḥ*, *dj ᶜnḫ ḏ.t*, or *ᶜnḫ ḏ.t*. The royal cartouche with a prefixed epithet and another suffixed epithet are in the third line.

The right part of a group of signs, which I consider to be the fourth line, is written between the previous line and the following one.

The fifth line has a basket sign *nb* and then the definite article *p3* with the phonetic complement *3* and the sign of *ḥ3* ("office, bureau"). The seventh line starts with a missing part followed by the cartouche of Amenemhat III and then the first part of the epithet *dj ᶜnḫ ḏ.t*. The text finishes with a horizontal sign that might be the hieratic sign of a ship.[22]

[17] *HP* I, #197.
[18] *HP* I, #143.
[19] J. von Beckerath 1984, p. 199.
[20] *HP* I, #534.
[21] *HP* I, #449.
[22] *HP* I, #374.



šsp ḥ..
ᶜnḫ Ny-m3ᶜ.t-Rš..
..Ny-m3ᶜ.t-Rš dj..
..
nb p3 ḥ3
..
..Ny-m3ᶜ.t-Rš dj
ᶜḥᶜw
Received ...
The living Nymaâtrê...
... Nymaâtrê endowed...
...
All the office (or: thousand)...
...
... Nymaâtrê endowed ...
The fleet

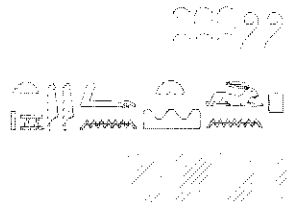
On the basis of the cartouche (of Nymaâtrê), the ostracon can be dated to the reign of Amenemhat III.

Ostracon WG 102

The second ostracon (8.5 cm x 6.7 cm x 1.3 cm) is also made of marl ware.[23] It was found at the entrance of Cave 2, WG 24[24], SU26, a stratum of loose sand with wood debris, fragments of rope and cloth, mud plaster, and a few potsherds.

In the 2004-05 field report Rosanna Pirelli[25] indicates that the first visible line of the hieratic text consists of the numerical signs for 200 and probably for 60. In the second line are the signs of the letter *p* and the rabbit *wn* for the toponym *Pwnt*. She also suggests the presence of *rmnyt* ("district") after Punt, comparing this expression with that on another ostracon found at Wadi Gawasis by A. M. Sayed (Sayed 1983).[26] She concludes her commentary by remarking that this inscription is more similar to jar tags than administrative texts.

A preliminary translation of this text is:



260
Pwnt rmnyt
[...]
260
Punt, the district.

[23] R. Pirelli in R. Fattovich, K. Bard *et al.*, 2005, p. 24.

[24] This unit was excavated by K. Bard and C. Zazzaro.

[25] R. Pirelli in R. Fattovich, K. Bard *et al.* 2005, p. 24.

[26] O. WG 40: G. Posener, in A. Sayed 1983, p. 25, Figure 1; Elsayed Mahfouz 2006, pp. 31-34; the author presented a study of this ostracon in a paper concerning the expedition of Senusret III to the land of Punt, presented at the 11th Congress of Nubian Studies, Warsaw August - September 2006. The paper will be published in a volume of the Congress in 2008.

We propose that this text dates to the second half of the 12th Dynasty, on the basis of its archaeological context, the paleographic style of the hieratic signs, and the evidence of the ostracon from A. M. Sayed's excavations.[27]

Ostracon WG 105

This ostracon (12.3 cm x 9.7 cm x 1.15 cm) is made of a ware of Nile alluvium clay. It was found in 2004-05 at the entrance of Cave 2, WG 24, SU24 in a stratum of soft sand mixed with wood debris, fragments of rope and cloth, mud plaster, and a few potsherds. A thin layer of encrusted salt covered all of these materials. On the basis of its archaeological context, this ostracon might be contemporary to O. WG 102.[28]

The hieratic text has at least four lines, but few signs are still legible. The right part of the text is missing. In the second line, the following signs can be identified: number signs for 74, the sign of the seated man, and three plural lines . We propose the presence of a bull sign to the right of the numerical signs in the third line. The two following horizontal lines might be signs for the number 8. Following these number signs is a group of three signs which are the hieratic form of c.t "part of bodies," followed by three plural lines and the number 10 at the end.

[27] O. WG 40.

[28] R. Fattovich, K. Bard *et al.* 2005, p. 5.

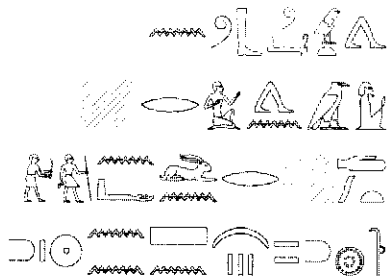
...
[...] *74 s* [...]
[...] *k3 8*[29] *ꜥ.wt 10*
...
...
[...] 74 men [...]
8 [...] of ox, 10[+x] pieces of meat.
...

The content of the text is a food ration given to a group of people working in the harbor. On the basis of the archaeological context and paleographic comparisons, the ostracon dates to the second half of the 12th Dynasty.

Ostracon WG 106

Made of marl ware, this ostracon, 9 cm x 13 cm x 1.5 cm, was found in 2005-06 at the entrance of Cave 2, WG 24, near Timbers 20-22.[30] The inscription on the ostracon consists of four lines written in hieratic characters with black ink (Figure 95).

A preliminary translation of the text is:



[29] For the comparison with this part: see O. WG 17 in my forthcoming article. Comparing the two passages, we can restore the expression *spr n* before *k3* to form *spr n k3* 8 "8 ribs of oxen."

[30] This unit was excavated by C. Ward, C. Zazzaro and Mohammed Mustafa Abdel Maguid.

jwt 100 bw n
s3w ..r..
ḏr.t .. r wn.wt
rnp.t-sp 12 3bd 3 šmw sw 10
The arrival of 100 meals for a
Guard ???....tr.
In the hand of...for the workers
Year 12, 3rd month of Shemu, the
20th day.

On the basis of the paleographic style, the ostracon can be dated to the Middle Kingdom, most likely to the second half of the 12th Dynasty. Excluding the brief reign of Amenemhat IV and Sobekneferu, it could be dated to the reign of Senusret III or Amenemhat III.

Ostracon WG 106

This potsherd was discovered in 2005-06 in WG 16,[31] SU19, a stratum of loose sand with fragments of wood and rope, potsherds and animal bones.

Only one hieratic sign *ḏd* is preserved. It should be the first part of the institutional royal name *ḏd-b3w*, which has already appeared on other Wadi Gawasis ostraca.[32]

Ostracon WG 107

This ostracon was found in 2005-06 in WG 16. The signs written on the surface are not legible.

[31] A. Manzo excavated this trench.

[32] See: O. WG 23 and O. WG 41; G. Posener, in A. Sayed 1983, p. 25; P. Vernus 1986, p. 139; E. Mahfouz 2006, p. 31-34; the author presented this ostracon in a paper concerning the expedition of Senusret III to the land of Punt for the 11th Congress of Nubian Studies in Warsaw August - September 2006. The paper will be published in 2008.

8.3 Wooden tags

R. Pirelli

Two wooden tags were found in WG 24 in 2004-05. The first one, 7.0 cm long and 3.4 cm wide, has a round top with a hole in the upper part (Figure 96a). Only two signs are inscribed in the center of this tag: the hieratic sign for *w* (Gardiner G 43) and a cursive hieroglyphic sign for "foreign land," "hill-country," or "desert." It should probably be translated as "District of the Desert."

Only the right half of the second tag was preserved. This tag has a round top, and is 9.3 cm long and 2.0 cm wide (Figure 96b). The partly preserved hieratic text probably contains the word *Djed-Baw*, literally "Firm of Power," referring to foreign lands under the power of the king (Vernus 1986), followed by two very damaged signs which appear to be a vase and a fish, possibly referring to a container of *khamet*, a type of beer.

8.4 Sealings

A. Manzo and R. Pirelli[33]

Clay sealings excavated at Mersa/Wadi Gawasis provide some preliminary insights into the administration and organization of seafaring expeditions from this harbor to Punt. The clay sealings, both with and without seal impressions, were found in one area of the site, on both sides of the entrance to Cave 2 (WG 16 to the north of the entrance, and WG 32 to the south). Only one fragment of prepared clay was discovered in WG 31 (northwest of WG 16).

Four types of Middle Kingdom seal impressions are present at Mersa/Wadi Gawasis (Figure 97): 1. Shield-shaped institutional

[33] A. Manzo studied the sealings without seal impressions; R. Pirelli studied the sealings with seal impressions. Both contributed to the introduction and final comments.

sealings. 2. Oval-shaped sealings with private names. 3. Oval-shaped sealings with one sign. 4.Oval-shaped sealings with a spiral design (e.g. Smith 2001).

The hieroglyphic signs of the two shield-shaped sealings (S06/1, S06/7) consist of "*pr ḥḏ*" ("treasury") preceded by the ideogram for "foreign land" with one or more unclear signs (probably a "*t*") (Figure 97f). Although the inscriptions on the two sealings are incomplete, the remaining signs demonstrate that the text was from the same seal. It is difficult, however, to fill in the lacunae: the position of the signs for "treasury" in the sealing is irregular, as *pr ḥḏ* usually precedes the name of the institution to which it is attached as a direct genitive.[34] In some cases, however, the sealing can also include the name and title(s) of a high status official, as evidence from Abydos demonstrates (Wegner 2001). In the Mersa/Wadi Gawasis sealings, a possible transliteration is "*imy-r ḫ3swt*[35] [. . ?] *pr ḥḏ*" ("overseer of the foreign lands and [director?] of the treasury"), but then there is no space for the name of the official. This solution is not impossible if the two titles were temporary ones, assigned to an official who was responsible for a specific expedition,[36] and not permanent titles of a specific official.

The second group of sealings consists of two oval-shaped sealings (S06/5, S06/10) of one official (Figure 97c, d). His name, which can probably to be identified as Djed(i), is the same one that was found on the inscribed wooden box (Box 2) from WG 32,[37] but the title which

[34] The same is true for the "granary of" or "the administrative gatehouse of." See Smith 2001; Wegner 2001; Reisner 1955.

[35] Ward 1982: 290, a.

[36] Something comparable may be seen in the epithet *ḥtmw nṯr*(?) ("seal bearer of the god"), which was usually associated with officials who led expeditions. Although it cannot be established that these two positions were held by the same person, it is more likely that the head of the seafaring expedition was a different official from the one who was in charge of the local "treasury" at Mersa/Wadi Gawasis.

[37] The titles on the wooden box are *ḥrp ʿnḫw sš nswt* ("overseer of the recruits," "royal scribe").

precedes this name on the clay sealings cannot be read. The inscriptions on these two sealings end with the late Middle Kingdom epithet "*whm ʿnḫ*" ("repeating of life").

Only one sealing (S06/4) has the place name "*Wʿdt*," the name of the Nome X of Upper Egypt on the west bank, which was probably followed by the name of the official, *Mry*; unfortunately, his title is not readable (Figure 97e). Possibly the title consisted of *ḥʿty-ʿ Wʿdt*, as attested in Martin: 19, 15; 20, 1; and 23, 24 (Martin 1971: 394, 589, 1163; Ward 1982: 869). On the same sealing there is also a second seal impression with a scroll decoration. The back of the sealing has two different surfaces: one, which is almost flat, is impressed with the texture of a fabric crossed by a thin string, while the other surface is deeply impressed with a thicker string.

Of the remaining sealings, three are too poorly preserved to read their texts. Two sealings can probably be interpreted as institutional stamp sealings because of their shape and the spiral border design. Two other sealings only have spiral border designs, one without hieroglyphs and the other probably with some signs that have not been well preserved.

The excavated sealings are all of known Middle Kingdom types found at other sites, both in Egypt and abroad, and demonstrate the complexity of administrative organization, in which multiple sealings and counter-sealings were used.

8.4.a Classification of sealings

The impressions on the back of the sealings identify the following types:[38]

1. Vessel sealings, with the impression of a textile and ropes on the verso, and smoothed on the recto. Most likely these fragments were from sealings of small vessels containing dry materials (Figure 98a) (Pätznick 2001: 140, Plate 15, E; von Piligrim 2001: Plate 18, D).
2. Jar/vessel sealings, with impressions of fibers on the verso and smoothed on the recto. Sometimes on the verso there are traces of horizontal grooves, and the shape of the sealing can be reconstructed as a truncated cone with a flat top. Sealings with traces of fiber impressions on the verso, a smoothed recto, and a truncated cone shape are usually ascribed to medium- to large-sized vessels that contained liquids (Figure 98b) (Pätznick 2001: 140, Plate 15).
3. Peg sealings, smoothed on the recto and with the impression of a peg and string on the verso. These sealings were probably used with a peg and string to close wooden boxes (Figure 98c) (Foster 2001: 132-133, Plate 11; see also Ferioli and Fiandra 1983: 490-496; Wegner 1998: Figure 17, 1; Wegner 2001: 81-84, Figure 2).
4. Box sealings, with the impression of a flat surface with wood grain and string on the verso, probably the sealing of a wooden box (Figure 98d) (Pantalacci 2001: Plate 17, B-C).
5. Bag sealings, with the impression of a folded rope bag or basket. The fibrous but regular impressions on the internal part of these sealings may have been from rope bags and baskets (Figure 98e).
6. Fragments of clay sealings with the impression of seals described above, but without the impression of a sealed object. These sealings are called "noduli," and were used to test the seal, as a record of completed work, and/or to authenticate an oral message of the bearer of the nodulus (Figure 98f) (Foster 2001: 134, Plate 13).

Pieces of prepared clay and an elongated clay piece with a roughly circular cross-section were also excavated in WG 32 (SU10 and SU16), WG 16 (SU73), and WG 31 (SU2) (Figure 98g, h). These materials have been interpreted as clay that had been prepared for sealings but was not used (Foster 2001: 135, Plate 14/ MFA 32-1-38; Ferioli and Fiandra 1983: 472-473, Figure 2).

Thus, the impressions on the verso of sealings suggest the kind of containers that were sealed. They also provide insights into the administered goods. Jar sealings were used on containers for food,

[38] To facilitate comparisons with collections from other sites, types were distinguished and named according to the system adopted by Ferioli and Fiandra 1983, and Foster 2001: 130-136.

most likely expedition supplies from the Nile Valley. Work activities may have been recorded at Mersa/Wadi Gawasis using the sealings, such as the ones represented by the noduli.

8.4.b List of sealings and seal impressions

Table 18 shows the distribution of the different types of sealings and their find places. The sealings and seal impressions are described according to the above classification.

Table 18: Distribution of the different types of sealings and their find places.

Id	Excavation Unit	SU	Type: recto	Type: verso
S06/40	WG 32	10	C	1
S06/41	WG 32	10	B	1?
S06/59	WG 32	10	B	1
S06/38	WG 32	10	D	3
S06/39	WG 32	10	A	4
S06/60	WG 32	10	unidentified	5
S06/95	WG 32	14		?
S06/63	WG 32	14	B	3
S06/92	WG 32	16		?
S06/94	WG 32	16		?
S06/62	WG 32	16	unidentified	3
S06/61	WG 32	16	unidentified	6
S06/64	WG 32	16	A	6
S06/88	WG 32	16		6
S06/07	WG 16	19		1
S05/01	WG 24	26		1
S06/05	WG 16	48		1
S06/04	WG 24	49		1
S06/78	WG 16	73		2
S06/79	WG 16	73		2
S06/80	WG 16	73		2
S06/81	WG 16	73		2
S06/82	WG 16	73		2
S06/83	WG 16	73		2
S06/84	WG 16	73		2
S06/86	WG 16	73		2
S06/87	WG 16	73		2
S06/90	WG 16	73		2
S06/91	WG 16	73		2
S06/89	WG 16	73		4
S06/42	WG 16	73	A (?)	5
S06/43	WG 16	73	C	5
S06/44	WG 16	73	D	5
S06/85	WG 16	73		5
S06/96	WG 16	73	A (?)	5
S06/93	WG 16	81		2

To date, 37 excavation units were investigated at Mersa/Wadi Gawasis and sealings were recovered in only three of these, all of which were located on the western slope of the coral terrace, near the rock wall and the entrance to Cave 2. This evidence strongly suggests that administrative activities were performed in this area.

Moreover, the distribution of the types of sealings listed in Table 17 suggests that in an earlier phase of use (WG 16, transect 2, SU73-81) administrative activity consisted mainly of management and storage of supplies for the crew of the expedition(s). In the later phase (WG 16, transect 2, SU19, SU48; WG 32, SU10, SU14, SU16), however, there is a greater number of seal impressions of a greater variety, which suggests more complex administrative control of a greater variety of goods, i.e., different types of containers (pots, bags and/or baskets, boxes).

In the strata of both phases of use was clay that had been prepared for sealings but not used, which demonstrates that the containers were not only opened, but were also sealed at Mersa/Wadi Gawasis. This suggests that the goods imported from Punt were placed in different containers(?) and sealed at Mersa/Wadi Gawasis before being transported overland to the Nile Valley.

8.5 Inscribed box

E. Mahfouz

Provenance: In 2005-06 the remains of 21 wooden cargo boxes were excavated in a deposit of sand on the western slope of the coral terrace near the entrance to Caves 5 and 6 (see 6.1.a). On one side of Box 2, a painted black inscription was noted (Figures 99 and 100). Unfortunately, the state of preservation of this box was very bad and the wood was so fragile that the inscription fell off when the box was removed from the deposit.

Material: Black ink inscription on wood covered with gypsum plaster.

Conservation: The box was very fragile and could not be removed whole from the sand deposit.

Description: The damaged inscription consisted of four lines with missing signs, written in large characters:

rnpt-[sp] 8 ḥr ḥm n
[nsw-bi]t[y] ... dí ꜥnḫ ḏt
... n bi3wt pwnt
...ḥrp nfrw sš nsw Ḏdi

Year 8 of his majesty,
[king of the Upper and Lo]wer [Egypt] ....[39] given eternal life.
...[40] of wonderful things of Punt.
...[41] overseer of the recruits, the royal scribe Djedy.[42]

Date: Reign of Amenemhat IV.

[39] As a result of excavations in 2006-07 we now know that the damaged royal name here is that of Amenemhat IV.

[40] Traces of two small vertical lines, which could be the lower part of the sign *in*, of the first sign of the word *int* "to bring" or *inw* "tribute."

[41] I could not identify this title, which is composed of two vertical signs.

[42] A name previously attested, but with different orthography from the Old and Middle Kingdoms (Ranke 1935: 412, n°2).

Chapter 9
Synthesis

KATHRYN A. BARD AND RODOLFO FATTOVICH

9.1 The site of Mersa/Wadi Gawasis

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 Upper 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 Upper 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 on the 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 because of the difficulty of navigation there, with the sea voyage beginning at Mersa/Wadi Gawasis, ancient *Sawu*, instead of farther north. The harbor of *Sawu* was also located near the shortest overland route from the Nile Valley in Upper Egypt to the Red Sea, from Qift through Wadi Qena and then Wadi Gasus, but the exact reasons for choosing this location remain uncertain.

According to Abdel Moneim Mahmoud, who conducted the preliminary geomorphological survey of the site, the following environmental factors may have determined the choice of Mersa Gawasis as a suitable anchorage for ancient Egyptian ships:

1. The bay forms a marina, which is easily accessible from the sea through a channel that cuts through the coral reef up to the coast. Today the coral reef is only ca. 80 cm below the surface at high tide, but in ancient times the marina could have been much deeper, as over the course of 4000 years the reef may have increased in height by as much as 10 m.[1]
2. The bay is closed and offers a better shelter to boats than other larger bays such as at Mersa Gasus, 1 km to the north.
3. Granite, basalt, chert, limestone, and clay all occur in the region.
4. Mud from the wadi could have provided the raw material for making mud-bricks.
5. Mangroves could have provided wood for fuel.

Unlike the 17 large mud-brick forts that were built in Nubia during the 12th Dynasty, there is no evidence of large permanent architecture at Mersa/Wadi Gawasis and use of the site was temporary – for seafaring expeditions. The main problem for permanent habitation at *Saww* was a lack of fresh water, which must have been obtained by excavating wells/holes in the wadi. Although the sea could have provided edible protein, and some hunting of (scarce?) desert mammals was possible, emmer wheat and barley for bread and beer, the staples of ancient Egyptian life, could not be grown in the desert environment and had to be brought from the Nile Valley to supply all expeditions. Thus, the difficult environmental conditions, lack of resources, and logistical complexities all mitigated against permanent occupation at Mersa/Wadi Gawasis, and the archaeological evidence there only suggests temporary occupation.

[1] The rate of growth of the coral reef depends on the species of corals. Antonio Russo personal communication.

Although some of the caves of the western terrace slope at Mersa/Wadi Gawasis were disturbed in antiquity when the Egyptians were not there, and some of the central part of the site (between the eastern and western terraces) was destroyed by bulldozing when the modern road and railroad were constructed, much of the western and eastern parts of the site remain well preserved. After the last seafaring expedition from *Saww* that we have evidence of in the early New Kingdom, the western terrace slope became covered with meters of windblown sand, as the site was abandoned and forgotten, until Abdel Moneim Sayed located it in the 1970s. Environmental conditions at the site, especially in the caves, have helped preserve unique organic evidence of ship timbers and equipment, and the many supplies needed for these expeditions, and texts from the site provide more specific information about the expeditions. Thus, at Mersa/Wadi Gawasis there is unique and well preserved archaeological and textual evidence for major seafaring expeditions to the southern Red Sea. Remains of ship timbers and equipment also provide new information about nautical technology in the Middle and Late Bronze Age, and the excavated evidence from different activity areas at the site provide a wealth of data about how such expeditions were organized and conducted.

9.2 Chronology

The chronology of periods of use of the Mersa/Wadi Gawasis site is based on the relative ceramic sequence and associated inscriptions. Charcoal samples were also collected for radiocarbon dating and will be submitted to the Radiocarbon Laboratory of the French Archaeological Institute in Cairo (IFAO).[2]

The pottery typology and stratigraphic sequence at Mersa/Wadi Gawasis point to three different periods of site use: 1) late Old Kingdom (6th Dynasty, ca. 2345-2181 BC); 2) Middle Kingdom (later

[2] Samples could not be processed until recently because SCA regulations prevent the export of samples for analysis abroad.

11th, 12th and 13th Dynasties, ca. 2055–1650 BC); and 3) early New Kingdom (18th Dynasty, ca. 1550–1295 BC).

It cannot be assumed *a priori* that the site was not used during the First and Second Intermediate Periods (ca. 2160–2055 BC and 1650–1550 BC), as some diagnostic pottery found at Mersa/Wadi Gawasis that dates to the late Old Kingdom continued to be made in the First Intermediate Period. Some Middle Kingdom pottery first appeared in the First Intermediate Period, and Second Intermediate Period pottery continued to be made in the early New Kingdom. The use of the site in the First and Second Intermediate Periods, however, seems unlikely because the complex organization of maritime expeditions, and the manpower and material support for them, were probably only possible during periods when the centralized Egyptian state was functioning with a well structured and effective bureaucracy – and one that had direct access to Lebanon to obtain the large supplies of timber needed for ship-building.

Inscribed stelae and ostraca from Mersa/Wadi Gawasis record concentrated use of the site 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) (see Sayed 1999), and Amenemhat III (ca. 1831–1786 BC). (The 2006-07 field season has also provided evidence of an expedition from Amenemhat IV's reign.) An inscription from Wadi Gasus, recording a seafaring expedition during the reign of Amenemhat II (ca. 1911–1877 BC), suggests use of the site during the reign of this king as well (see Sayed 1999).

On the whole, the archaeological evidence from Mersa/Wadi Gawasis is consistent with the textual and representational evidence of maritime expeditions to Punt in the Nile Valley and Eastern Desert (see Kitchen 1982, 1993). The late Old Kingdom evidence may be associated with seafaring expeditions to Punt during the reigns Sahura (ca. 2487-2475 BC) and/or Pepy II (ca. 2278–2184 BC). The 11th Dynasty ceramics may be associated with an expedition to Punt in Year 8 of Mentuhotep III (ca. 2004–1992 BC). The early New Kingdom ceramics and ship blades may be associated with the famous expedition of Queen Hatshepsut (ca. 1473–1458 BC). Although there is textual evidence of a seafaring expedition to Punt during the reign of Ramses III, no late New Kingdom evidence has been found at Mersa/Wadi Gawasis.

9.3 Activity areas and site organization

The UNO/IsIAO and BU investigations at Mersa/Wadi Gawasis have provided more detailed information about the organization and development of the pharaonic site of *Saww*.

In the late Old Kingdom a man-made cave (Cave 1/WG 28), which was probably used as a store room, was cut into the terrace wall at the top of the western slope. Potsherds from closed bowls with an everted rim dating from the late Old Kingdom to early 12th Dynasty, found in the lower strata of WG 19/25/26/27, suggest that an activity area was located at the base of the western slope in front of Cave 1 in late Old Kingdom times. One potsherd which possibly dates to the late Old Kingdom was also collected in the lowest strata of WG 10, at the base of the southern slope along the wadi bed.

Cave 1 was later reused in the Middle Kingdom, when an ostracon was left there. A concentration of sherds from large Middle Kingdom storage jars were found on the surface down slope from the entrance to this cave (which helped to locate the cave entrance), and must have ended up there when the cave's sealed door was penetrated and the (probably empty) Middle Kingdom pots were thrown out.

In the Middle Kingdom the entire site, from the eastern terrace to the western slope and base, was occupied and used. Small ceremonial structures were built along the eastern and southern edges of the terrace, from the sea shore to inland above Wadi Gawasis. Shelters were erected on the top of the terrace in the western sector of the site. Large man-made caves were cut in the terrace wall at the top of the western slope and Cave 1 was reused. Activity areas were located at the base and along the western slope, as well as at the base of the southern slope. Storage areas were located along the southern and western slopes.

The occurrence of Middle Nubian pottery at Mersa/Wadi Gawasis in assemblages dating to the early to mid-2nd millennium BC suggests that the harbor was frequented by peoples of Nubian cultures (perhaps local Eastern Desert peoples), either when the Egyptians were there and/or in their absence. An unidentified potsherd associated with evidence of shell working from a Middle Kingdom assemblage along the southern slope (WG 18) possibly suggests that (so far unknown) coastal peoples were interacting with the Egyptians when they occupied the site.

Different types of ceremonial structures were erected on the sea and desert sides. Most likely these structures also had a functional meaning as landmarks to indicate the harbor entry to ships returning from Punt (see Frost 1996). Inscriptions from shrines along the sea shore were recorded by Abdel Moneim Sayed (1978) in the 1970s. Structures along the sea shore investigated by the UNO/BU project include a roughly oval stone enclosure with an inner circular chamber (WG 20), and two small shrines, each of which consists of two small rooms with walls of vertical slabs of conglomerate stone inside a mound (WG 12, WG 23). Associated ceramics and inscriptions suggest that the shrines along the sea shore were erected throughout the entire 12th Dynasty.

In some respects, the oval structure at WG 20 is similar to a shrine of Hathor, which was built in the New Kingdom on an earlier Middle Kingdom structure in the mining village at Gebel Zeit. The earlier shrine consisted of an oval-shaped enclosure with a small inner chamber in the western part (see Castel, Gout and Soukassian 1984-1985; Castel and Soukassian 1989).

Also along the sea shore is a stone platform (possibly an open air altar) associated with hundreds of conch shells (WG 29). The conch shells from this platform might have been ritual offerings to a marine deity, possibly identified with Min, as images of these shells are carved on two colossal statues of the god from Coptos dating to Dynasty 0/1st Dynasty (see Kemp 2000).

Along the desert side, structures in the western sector of the site consist of circular tumuli built of fossil coral and limestone blocks

(WG 3/6, WG 8). Associated ceramics date to the late 11th – early 12th Dynasties.

On top of the terrace in the western sector two types of shelters have been identified: 1) light shelters, probably made with mats supported by thin poles (WG 2); and 2) small circular huts or tents (WG 1, WG 4/5, WG 7, WG 9). The ceramics suggest a dating of these features to the late 11th – early 12th Dynasties. A number of light shelters were also probably set up in a large area in the central sector of the site, as concentrations of potsherds similar to those in WG 2 are still visible on the surface in areas which were not destroyed by construction of the railroad (see Fattovich, Mahmoud, Manzo, Perlingieri and Zazzaro 2002).

Shallow pits from 24 small huts or tents are aligned along the western edge of the terrace. The pits are ca. 2.3–2.8 m in diameter and 10-50 cm deep. Some of them were associated with post-holes and hearths. Similar structures are documented in Nubia from Mesolithic times onward (see Honneger 2003: 284-287, Figures 4, 5). In the 2nd millennium BC they occur at C-Group settlements in Lower Nubia (e.g. Bietak 1966: 31-32, Plates 12-14; Vila 1970: 197-201, Figures 5, 8; Williams 1993: 23-25, Figure 13, Plate A;) and in the Pan-grave settlement at Qau and Badari (Brunton 1930: 3-4).

Large rock-cut caves (Caves 1-5 and most likely Cave 6) were located at the top of slope of the western terrace. The excavation and/or enlargement of these caves, documented at WG 16 by a thick stratum with many chunks of rock debris (SU13), was associated with more intense activity in this area in the late Middle Kingdom.

A large activity area (WG 19/25/26/27) was located at the base of the western slope, where at least five different types of fire pits and hearths, and many ceramic scrapers were recorded. The earliest evidence of use of this area dates to the first half of the Middle Kingdom, but most of the area was used in the mid- to late Middle Kingdom. A concentration of jar sherds associated with a circular arrangement of coral blocks, traces of hearths, and a possible wood shelter, which date to the late 11th – early 12th Dynasties, were also

recorded in another activity area located at the base of the southern slope (WG 10).

Probably the main activity in WG 19/25/26/27 was the production of local ceramics: long cylindrical bread molds that are typical of the Middle Kingdom and large chaff-tempered ceramic platters of uncertain use (possibly for baking flat bread). Both of these types of artifacts are made of local clay and are not of wares produced in the Nile Valley. Huge deposits of ash and charcoal are from many fires from multiple use of the area. Charcoal samples examined from this area by Rainer Gerisch are of wood from many different regions: southwest Asia (cedar, pine, and two species of oak), the Nile Valley, and the southern Red Sea region (ebony), demonstrating that valuable imported woods were even used in these fires, probably when they were in such small pieces that they could not be used for anything else.

Emmer wheat and barley seeds were also identified in the production area. These cereals could not be grown at Mersa/Wadi Gawasis and had to have been brought by expeditions from the Nile Valley. Although no large ceramic vats for beer production have been found in the production area, it is likely that bread making at *Saww* was associated with beer making, as certainly occurred at pharaonic sites in the Nile Valley.

A few small ovens were also located along the western slope below the rock-cut caves in the late 12th Dynasty (WG 17). The ashes from one oven had been completely cleaned out and the oven had been filled with twigs of local bushes and then covered with branches, probably to preserve the structure for use on the next expedition. This oven is similar to the one depicted in the 12th Dynasty tomb of Antefoker (Davies 1920: Plate 11b), and for baking the long cylindrical bread molds may have been stacked horizontally inside.

Caves 2-5, cut into the coral terrace from the western slope, probably beginning from a natural rock shelter, provide evidence from the end of (several?) 12th Dynasty seafaring expeditions. (The entrance to Cave 6 was located at the end of the 2005-06 field season, but there

was no time to investigate it.) The plan of long, somewhat parallel galleries, which probably served as a kind of ship arsenal, is similar to what has been excavated at Ayn Soukhna, where older galleries for copper mining were extended into longer ones in the Middle Kingdom, when major expeditions to the mining areas of the Sinai were launched from this harbor (al-Raziq, G. Castel and P. Tallet 2004). Although the ships returning to Mersa/Wadi Gawasis must have been disassembled in another part of the site (the harbor area?), some large ship timbers were abandoned outside the caves, after they had been pried apart. Other ship timbers were used to construct a ramp to facilitate moving materials into (and out of?) the caves, while other timbers were placed in the caves for storage. Possibly some ship timbers were carried back to the Nile Valley, but this seems unlikely and there is no evidence of used timbers from seafaring ships at sites in the Nile Valley. Some timbers were also salvaged by carpenters to remove areas damaged by shipworms, as the large amounts of gribble in the entrances of Caves 2 and 3 demonstrate.

Sometime during the 12th Dynasty a huge amount of rope used for rigging was removed from ships after a voyage, carefully coiled, and left in piles on the floor of Cave 5. Officers of the expedition must have decided to leave it in this cave, planning to use it on a future expedition, but the rope was never reused and remains in Cave 5 today.

To the south of the entrance to Cave 2 are 12 carved niches for small limestone stelae, only a few of which were still found *in situ*. Some of these stelae may have had inscriptions that were painted on the plastered surface and are now gone. The best preserved of these stelae (Stela 5) was found face down in a deposit of sand beneath its niche. The inscriptions and scene on this stela are complete, with the cartouche of Amenemhat III at the top above an offering scene to Min of Coptos. The main text of this stela is about two expeditions to Punt and Bia-Punt, led by two officials, Nebsu and Amenhotep. The inscription provides important historical information, confirming that *Saww* was the harbor for seafaring expeditions to Punt. The toponyms

"Punt" and "Bia-Punt" only appear together in one other inscription, the biographical text from the 6th Dynasty tomb of Harkhuf at Aswan (Breasted 1906-07: I, 161; Sethe 1933: 130, line 15). That an expedition to Bia-Punt is mentioned on the Mersa/Wadi Gawasis text in association with one to Punt possibly implies that *Sawu* was the starting point for expeditions to both of these regions, and that Bia-Punt, the location of which is unknown, may also have been located somewhere in the southern Red Sea region.

More historical information is also provided in the inscriptions of Stelae 6 and 8, both of which have damaged texts. In the preserved part of Stela 6 are the five royal names of Amenemhat III and an image of Min of Coptos. The cartouche of Amenemhat III and the image of Min are also visible on Stela 8. These stelae commemorate a seafaring expedition(s) of Amenemhat III that probably started out from Coptos, the location of the cult of Min, a deity who was also associated with the Eastern Desert. The stelae commemorate seafaring expedition(s) during the reign of Amenemhat III, and also the officials who led them.

A seafaring expedition(s) to Punt during the reign of Amenemhat III was previously unknown, and an inscription on a wooden cargo box found in 2006-07 (see below) is clearly dated to Year 8 of Amenemhat IV, also from a previously unknown expedition. These inscriptions, together with those found by Abdel Moneim Sayed, provide textual evidence that the site was used for seafaring expeditions throughout most of the 12th Dynasty.

Of all the preserved scenes and inscriptions on stelae from the area of Cave 2, the most unusual one is on Stela 2. At the bottom of the stela is a carved scene of two seated men facing a huge pile of food offerings in the center. The offerings are not placed on the traditional offering table, but on a mat. Although most of the text is now missing, the beginning of the offering formula (*ḥtp di nsw*) is still visible. This stela is certainly not associated with a tomb at Mersa/Wadi Gawasis, and a shrine for some kind of cult has not been located.

Two much larger stela niches were carved above the entrance to Cave 4b, below which a large granite stela (Stela 9, 114 cm x 65 cm x 27 cm) and fragments of a limestone stela(ae) were found in deposits of sand. The large granite stela has very eroded surfaces, and any traces of a possible inscription are now gone. This stela must have been quarried elsewhere and brought some distance across the desert to Mersa/Wadi Gawasis.

As a result of continued excavations in 2006-07 in the area of the deposit of cargo boxes outside of Caves 5 and 6, we now know from a second inscribed box that the inscription on Box 2 was dated to Year 8 of Amenemhat IV, and not Amenemhat III, as was previously thought. These boxes are made of species of wood found in the Nile Valley and must have been transported to Mersa/Wadi Gawasis for the expedition to Punt. Although the sand deposits within and around the boxes were carefully sieved, there was no trace of what products or materials brought from Punt these boxes would have contained. The painted inscription on Box 2 describes its contents: "the wonderful things of Punt." Whatever was imported from Punt in these boxes must have been emptied into other containers (cloth bags?) for easier transport to the Nile Valley, and the 30 boxes were abandoned in this location.

Many broken clay sealings were also excavated in association with the boxes, with two phases of seal use. Sealings from the earlier phase were used for the management of expedition supplies, and were associated with artifacts such as a wooden jar stopper, whereas sealings of the later phase were used for the administrative control of imported goods (Manzo and Pirelli 2006: 95). The later sealings had been placed on the sealed boxes (in Punt?), and the sealings were broken off at Mersa/Wadi Gawasis as the boxes were emptied of their contents. Although most of the sealings do not have writing on them, two sealings have the name of a scribe, Djedy, whose name is also written on Box 2.

Although the harbor area has not yet been located, a test pit (WG 36) excavated in the wadi near the south slope of the terrace and ca. 700 m inland from the present beach contained the only stone anchor at Mersa/Wadi Gawasis that had definitely been in the sea water. The surface of this anchor is heavily pitted, and associated with it were

large sherds of a typical Middle Kingdom storage jar and shells of species of molluscs that lived in salt water. In future fieldwork this area will be investigated for evidence of a harbor, and geological studies are planned to determine the ancient coastline and location of the harbor.

Near the harbor(?) area at the base of the southern slope of the terrace are a great number of large fragments of bag-shaped jars with a flat bottom, which suggests that this was a storage area in the Middle Kingdom (see also Sayed 1977, 1978, 1979a).

There is no secure ceramic evidence for use of Mersa/Wadi Gawasis in the Second Intermediate Period. In the early New Kingdom Cave 2 at the top of the western slope was reopened and used again after a period of abandonment of the site, which is well marked in the stratigraphic sequence by a thick stratum along the whole terrace wall of windblown leaves containing bird nests. The two steering oar/rudder blades and associated ceramics that were found at the entrance to Cave 2 were lying on top of a deep deposit of windblown sand, which also represents a long period of abandonment.

9.4 Naval expeditions: evidence and organization

That Mersa/Wadi Gawasis was the ancient site of *Saww* used for seafaring expeditions to Punt and Bia-Punt has been demonstrated by inscriptions found at the site by Abdel Moneim Sayed. Inscriptions on Stela 5, excavated in 2004-05, and on Box 2, excavated in 2005-06, also clearly demonstrate that expeditions launched from *Saww* were to Punt and Bia-Punt.

Each seafaring expedition to Punt probably consisted of a well organized sequence of activities: 1) transporting cedar (and other timbers) from Lebanon to Coptos in Upper Egypt; 2) building the seafaring ships at Coptos (see Sayed 1977 for the text of the Antefoker stela that he found at Mersa/Wadi Gawasis, which mentions this); 3) carrying the dismantled ship parts and all expedition equipment, trade goods, and food across the Eastern Desert to the Red Sea coast; 4) assembling the ships and loading the cargo on the coast; 5) navigating

to Punt; 6) trading at Punt; 7) navigating back to the Egyptian coast; 8) unloading the imported cargo on the coast; 9) carrying the imports to the Nile Valley; and 10) transporting them to the royal seat. Excluding the importation of timbers from Lebanon, the entire operation probably took several months (see Bradbury 1988; Fabre 2005).

Textual evidence suggests that expeditions to Bia-Punt left in late spring (May). Expeditions to Punt left in late summer (September), and returned to *Saww* in mid-winter (January – February). Most likely, these expeditions required up to four months for navigating to and from Punt and trading there (see Bradbury 1988; Fabre 2005). The Middle Kingdom "Tale of the Shipwrecked Sailor" possibly suggests that separate expeditions were sent to Punt and Bia-Punt with an interval of four months (Fabre 2005).

Materials found at Mersa/Wadi Gawasis provide evidence of what was imported from Punt, including surface finds of obsidian, which occurs on both sides of the southern Red Sea, in Eritrea (mainly near Adulis on the Gulf of Zula) and Yemen (see Zarins 1990; Manzo 1999: 8). Ebony, a tree which grows in what is today eastern Sudan and Eritrea, was identified in the charcoal from the production area (WG 19/25/26/27).

Additionally, a few potsherds excavated at Mersa/Wadi Gawasis are of wares identified as originating in regions of the southern Red Sea, in what are today Yemen. These exotic sherds may have been brought there by men from these regions who accompanied the Egyptian expeditions. Exotic ceramics associated with Middle Kingdom assemblages at Mersa/Wadi Gawasis are of a ware of the Malayba culture in the region of Aden, which possibly suggests that the Egyptians entered the Gulf of Aden in the early 2nd millennium BC. Exotic ceramics associated with New Kingdom assemblages at Mersa/Wadi Gawasis are similar to those from Sabir (Aden region) and Wadi Urq' (Hodeidah region) (see Vogt and Sedov 1998).

The timbers and equipment from ships excavated at Mersa/Wadi Gawasis provide further evidence of these seafaring expeditions, as well as information about the technology of ship construction. But the

nautical evidence is incomplete, consisting of what remained at Mersa/Wadi Gawasis after successful voyages, and was either left there or recycled for other uses.

The stela of Antefoker that Abdel Moneim Sayed found erected in a shrine at Mersa/Wadi Gawasis (Sayed 1977: 169-173) lists the numbers of men on this expedition: two different types of soldiers (numbering 500 and 3,200), 50 escorts, 5 scribes, and 1 steward, totaling 3,756 men – which is an enormous expedition. The logistics required to organize, supply, and conduct such a large expedition would have been daunting. To date, however, there is no trace at Mersa/Wadi Gawasis of a camp for such a large number of men – or even of one for a much smaller expedition.

Certainly large numbers of men would have been needed to carry dismantled ships and ship rigging across the Eastern Desert to the harbor, but donkeys were also probably used as beasts of burden. A few donkey bones have been identified at Mersa/Wadi Gawasis along with donkey dung, which was not used in the fires of the production area. Wheat and barley were also brought from the Nile Valley to make bread (and beer?) at the site, and a great deal of effort was expended in the local production of long cylindrical molds for baking the bread. Large numbers of Middle Kingdom storage jars were also transported to the site, possibly for the storage of grain in the caves, from where rations were controlled by officers.

As Bradbury (1988) suggests, expeditions, which originated at Coptos, used the Wadi Qena route to the harbor. An unknown number of men would have sailed on the ships to the southern Red Sea region, depending on the number of ships in an expedition, while a few soldiers may have remained at *Sawu*. Given the paucity of resources at Mersa/Wadi Gawasis, however, it is unlikely that a large number of soldiers would have stayed there. Possibly a small garrison was left to guard the caves and the activity areas. Assuming that 2-3 men could sleep in a tent, the 24 circular features (tents?) along the western edge of the terrace could have been used by a "company" of 40-50 soldiers (see Schulman 1999). The occurrence of Egyptian bowls with

decorations imitating Nubian motifs also suggests the presence of *Medjau* soldiers at the site.

After the seafaring expedition was launched, many soldiers may have headed for the Wadi Hammamat to the south, where they worked in mines and quarries before returning to the Nile Valley. Some soldiers may have returned to the harbor after the estimated length of time of the seafaring expedition, to help transport the imported materials to the Nile Valley.

9.6 Conclusions

The first five field seasons at Mersa/Wadi Gawasis have fulfilled the two main objectives of the project, to obtain better information about: 1) ancient Egyptian navigation in the Red Sea, and 2) the possible location of Punt.

The remains of seafaring ships at Mersa/Wadi Gawasis demonstrate that these ships were built with a more sophisticated technology than the well known Egyptian boats used on the Nile (see Ward 2000). We also now know that different kinds of imported wood (cedar, oak, pine) and wood found in the Nile Valley were used for their construction.

Imported materials and exotic ceramics suggest that Punt was located in the southern Red Sea, and possibly as far east as the region of Aden.

Many questions, of course, remain unanswered. What we think is the harbor area remains to be excavated, and more information is definitely needed about the logistics of seafaring expeditions, construction (and size) of the ships, long-distance trade, and the interaction with local peoples of the Eastern Desert and sea coast. These problems will be some of the main foci of future investigations at Mersa/Wadi Gawasis.

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Abbreviations:

Ä & L: *Aegypten und Levante*
AION: *Annali dell'Istituto Universitario Orientale di Napoli*
ASAE: *Annales du Service des Antiquités de l'Égypte*
BASOR: *Bulletin of the American School of Oriental Research*
BIFAO: *Bulletin de l'Institut Français d'Archéologie Orientale*
CAJ: *Cambridge Archaeological Journal*
CRIPEL: *Cahiers de Recherche de l'Institut de Papyrologie et d'Égyptologie de Lille*
IJNA: *International Journal of Nautical Archaeology*
JARCE: *Journal of the American Research Center in Egypt*
JEA: *Journal of Egyptian Archaeology*
LÄ: *Lexikon der Ägyptologie*. Wiesbaden: Otto Harrassowitz.
MDAIK: *Mitteinlugen des Deutschen Archäologischen Instituts Abteilung Kairo*
MIFAO: *Mémoires de l'Institut Français d'Archéologie Orientale du Caire*
MM: *Mariner's Mirror*
OLA: *Orientalia Lovaniensia Analecta*
RÉ: *Revue d'Égyptologie*
SSEA: *The Society for the Study of Egyptian Antiquities*
ZÄS: *Zeitschrift für Ägyptische Sprache und Altertumskunde*

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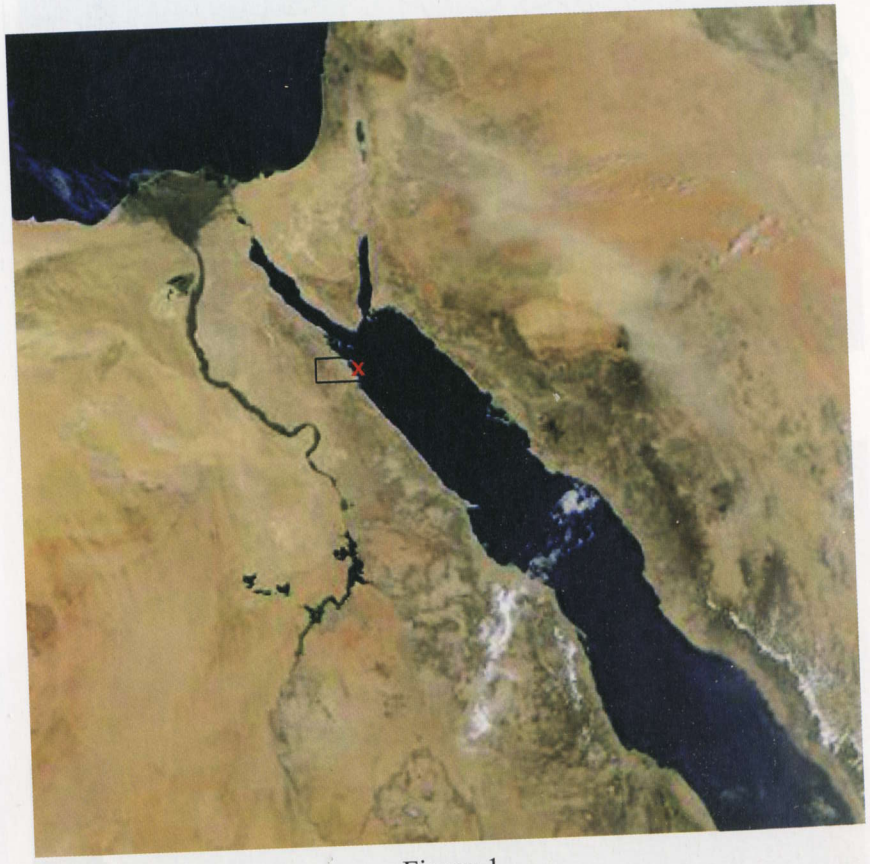
ILLUSTRATIONS



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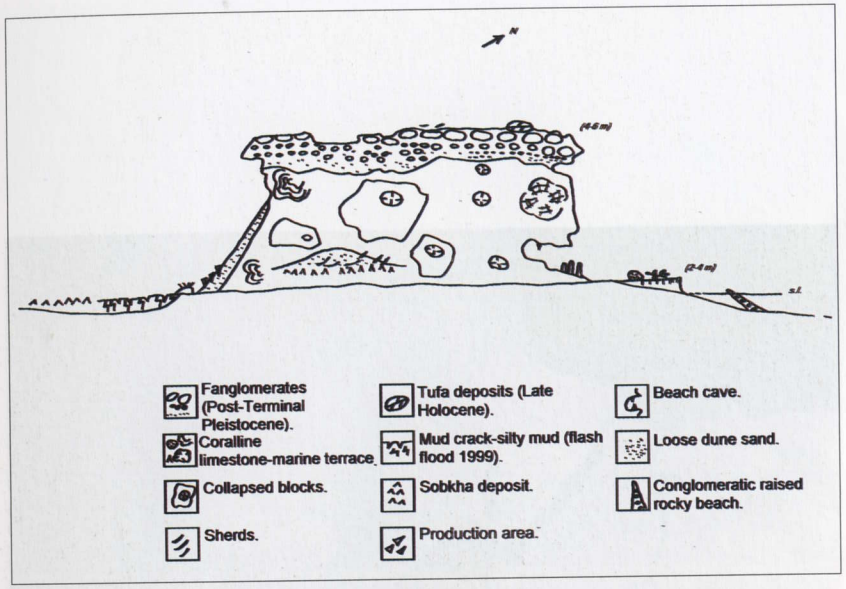

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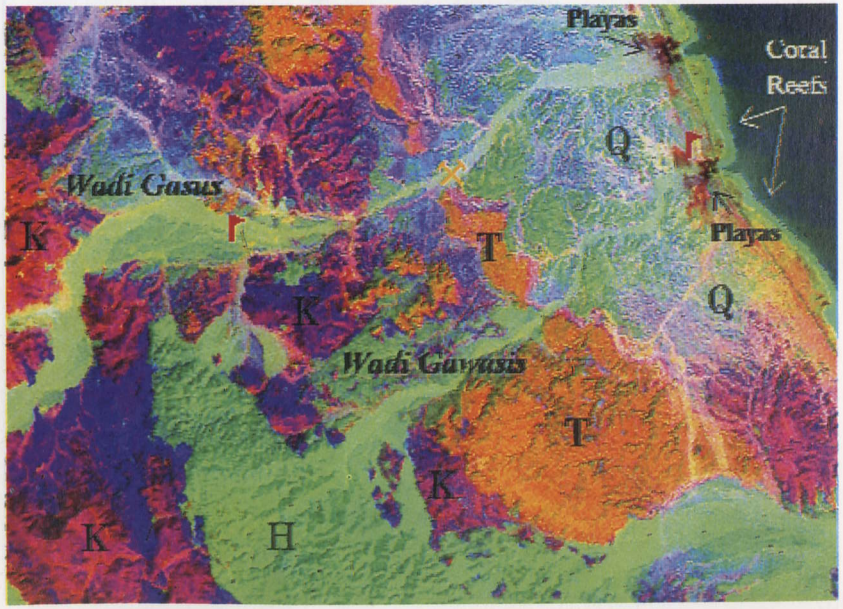

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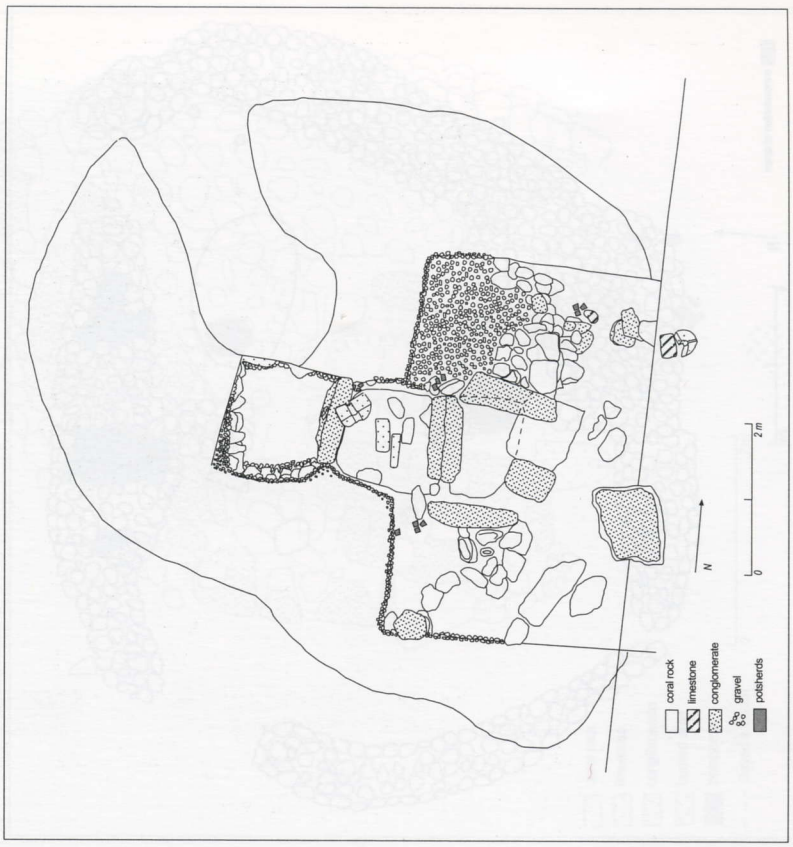

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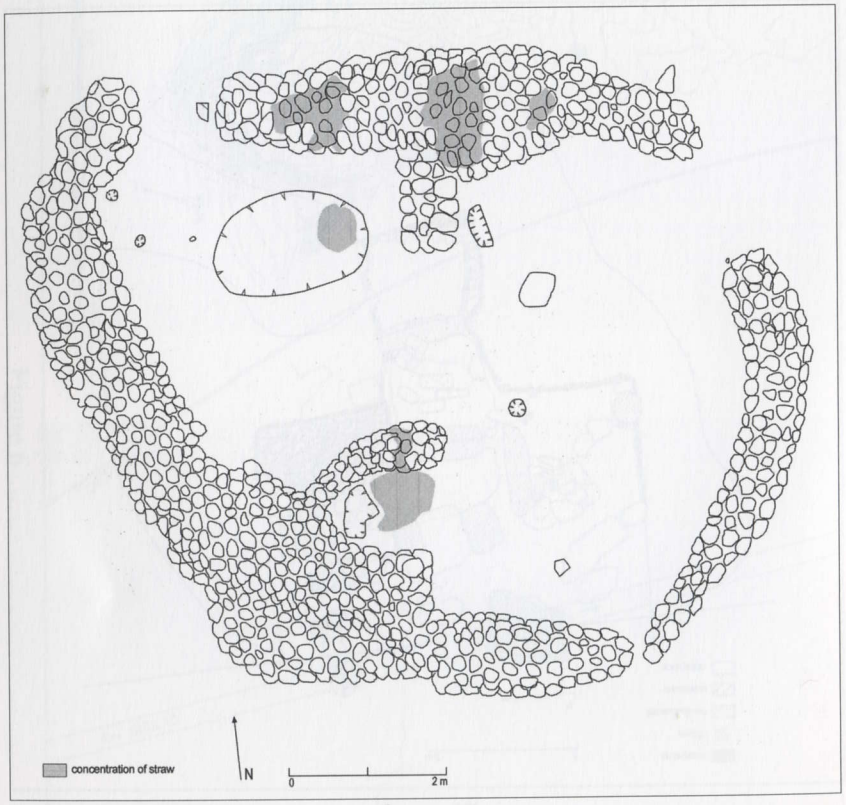

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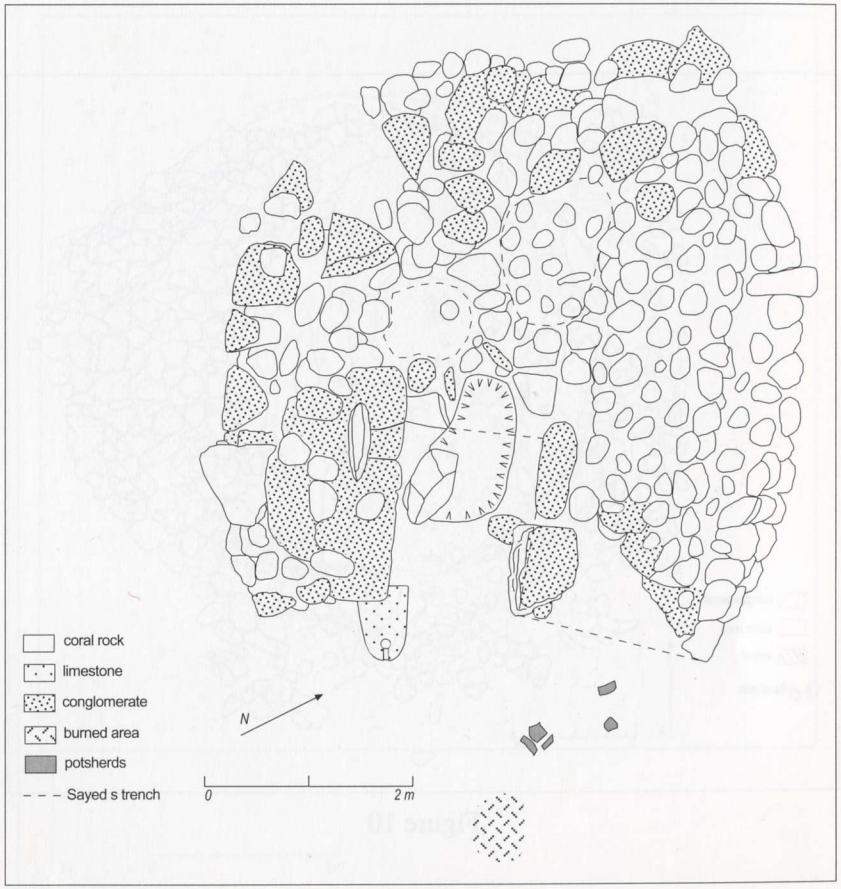

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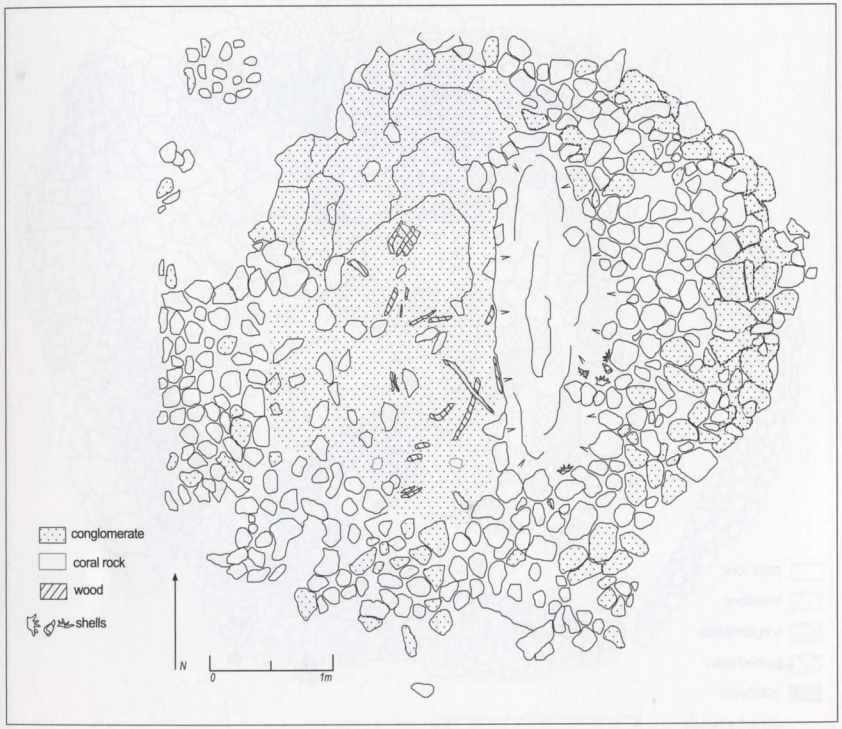

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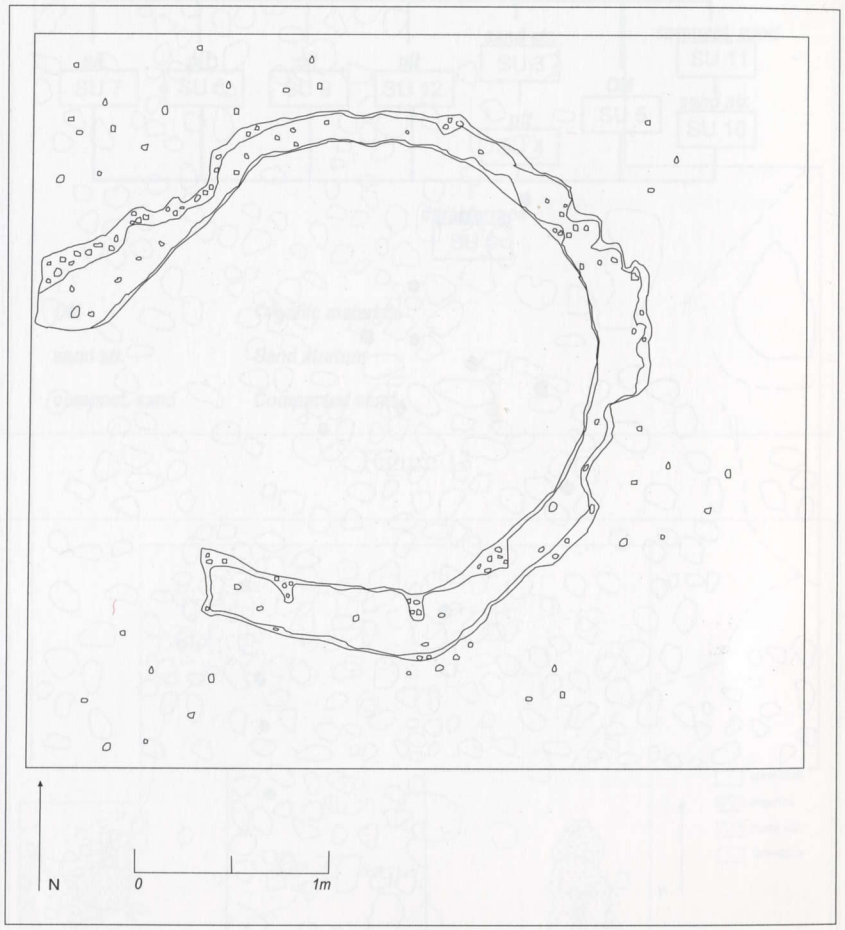

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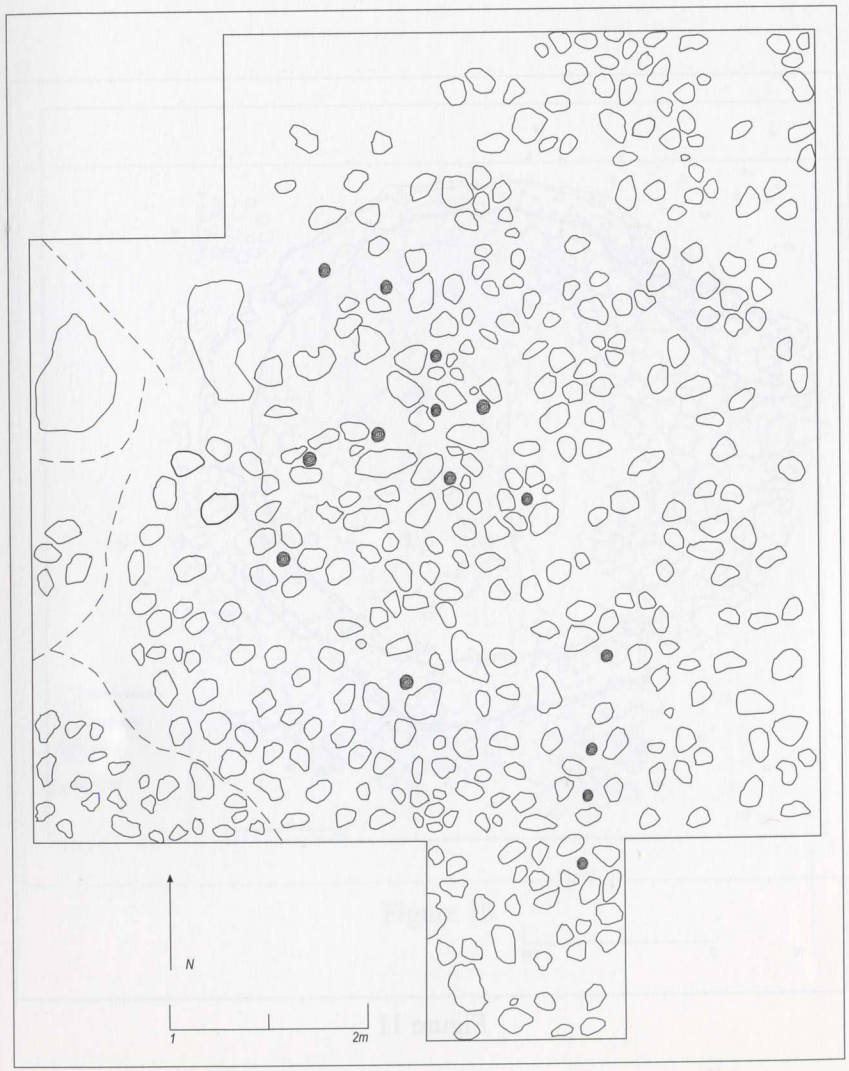

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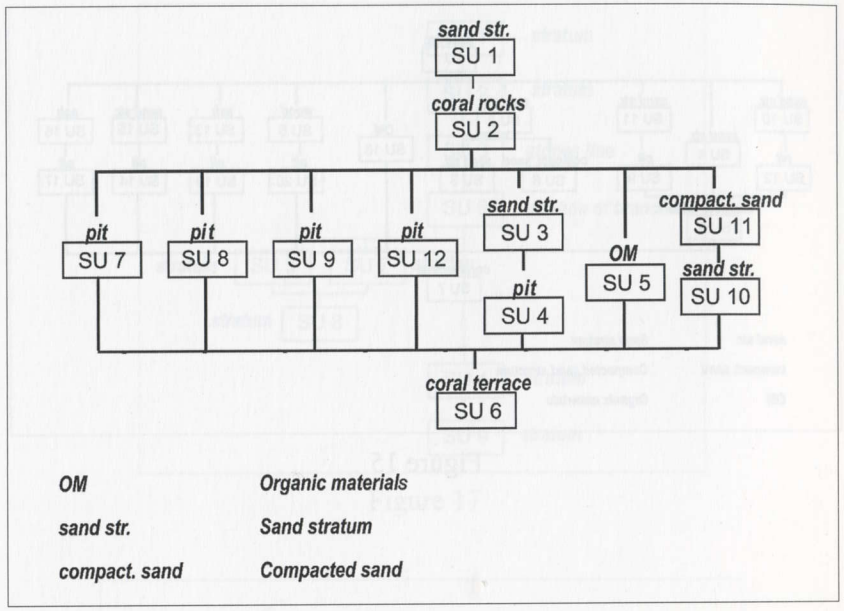

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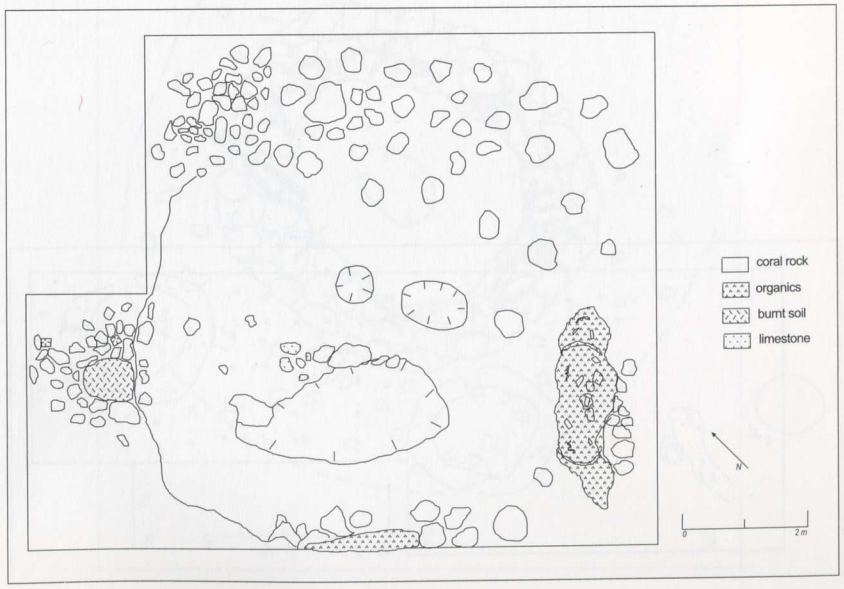

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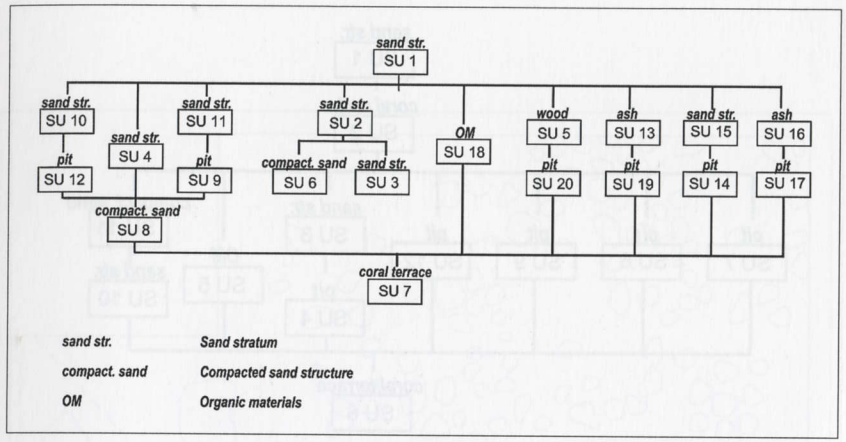

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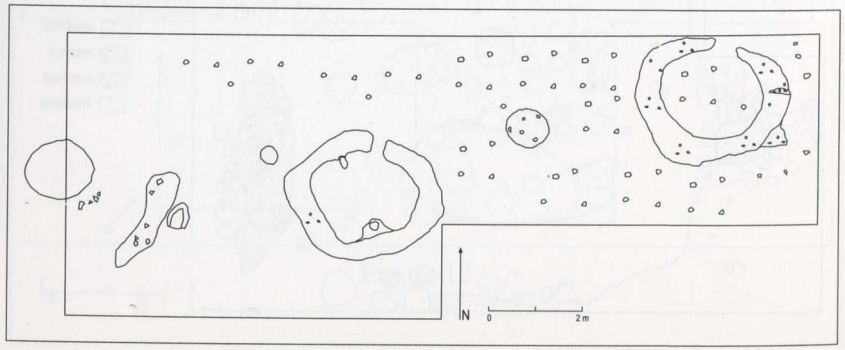

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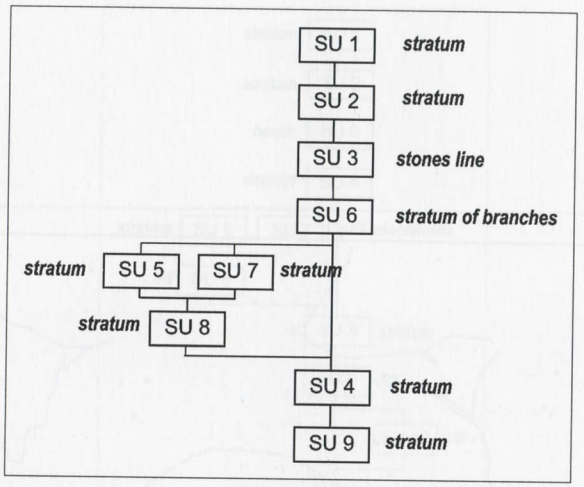

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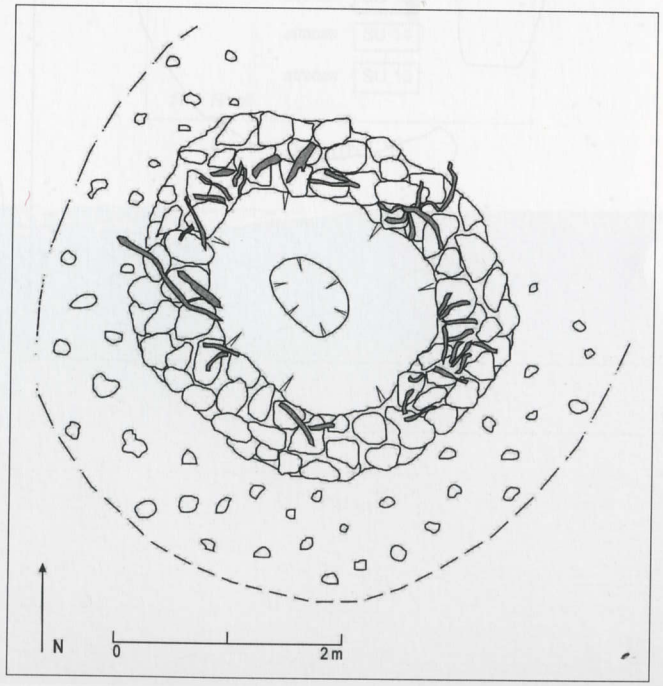

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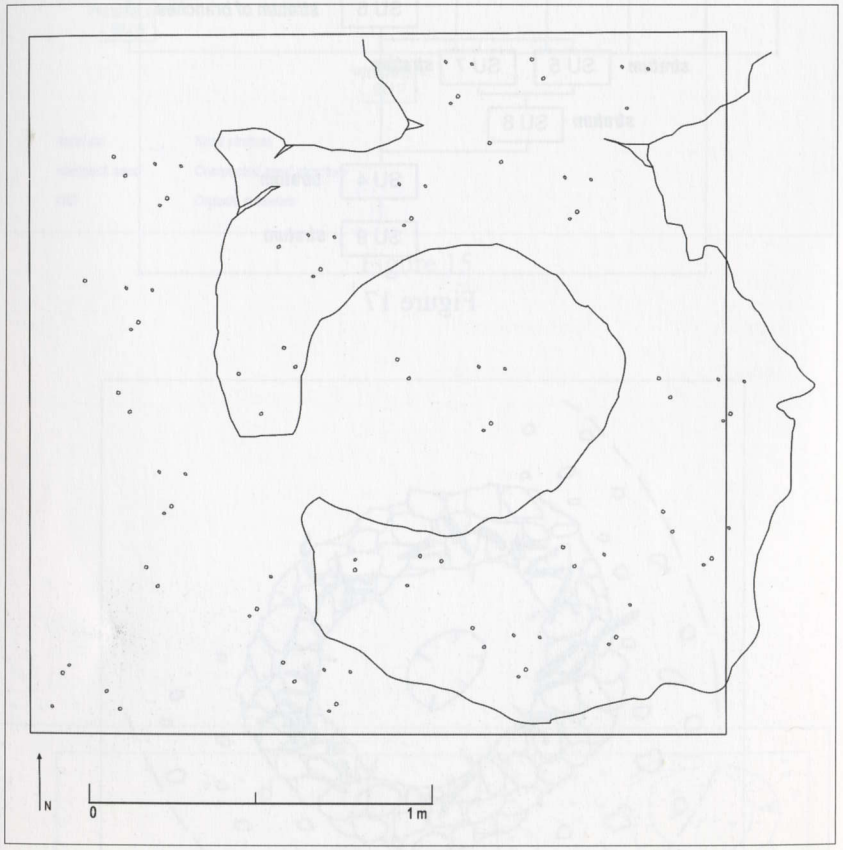

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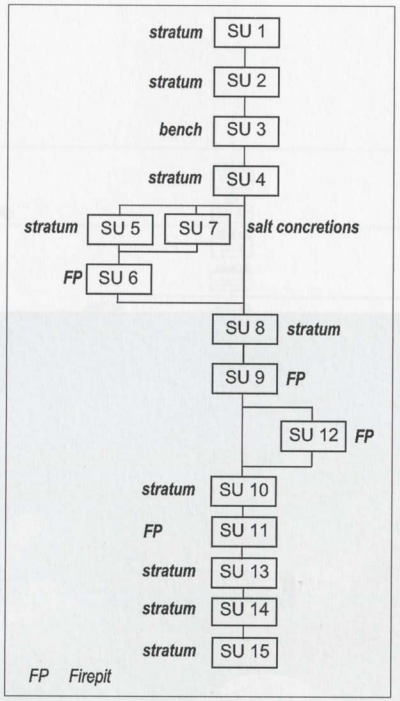

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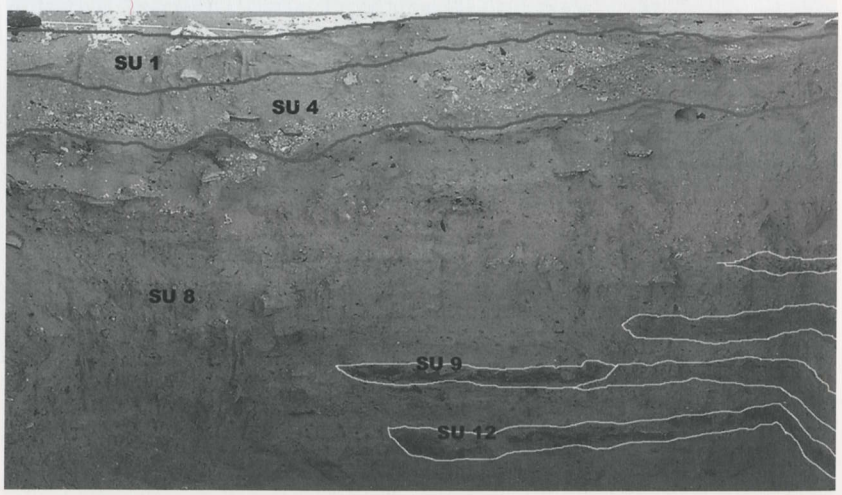

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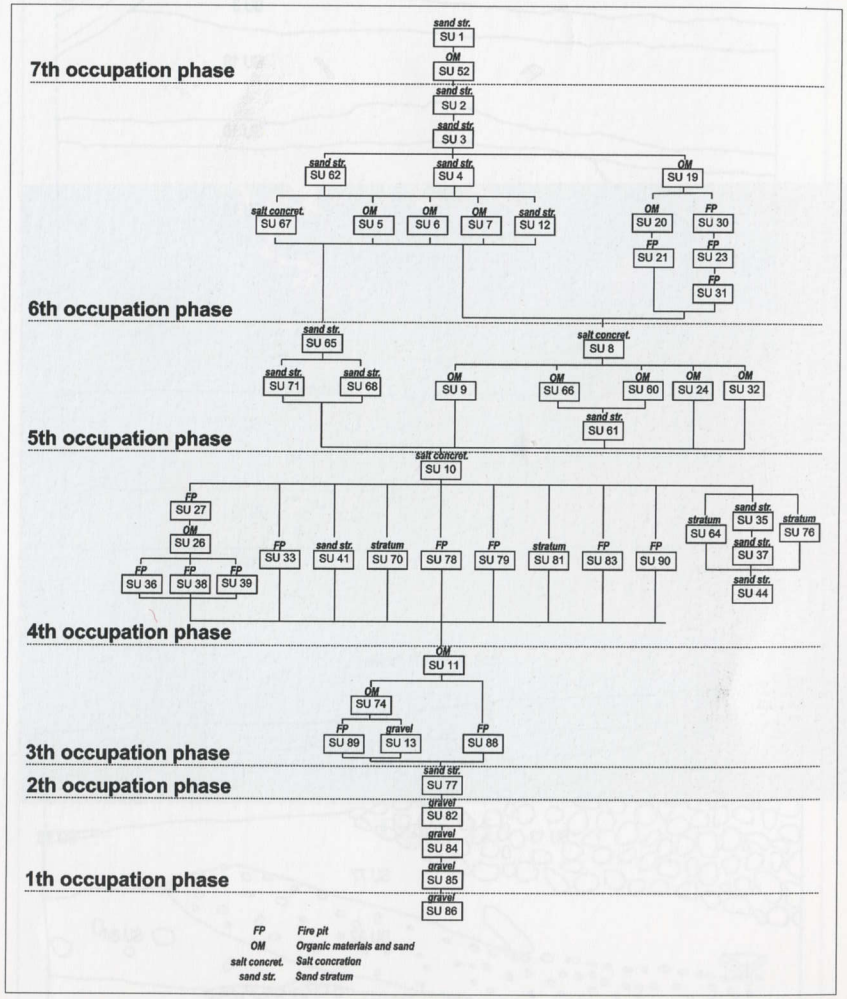

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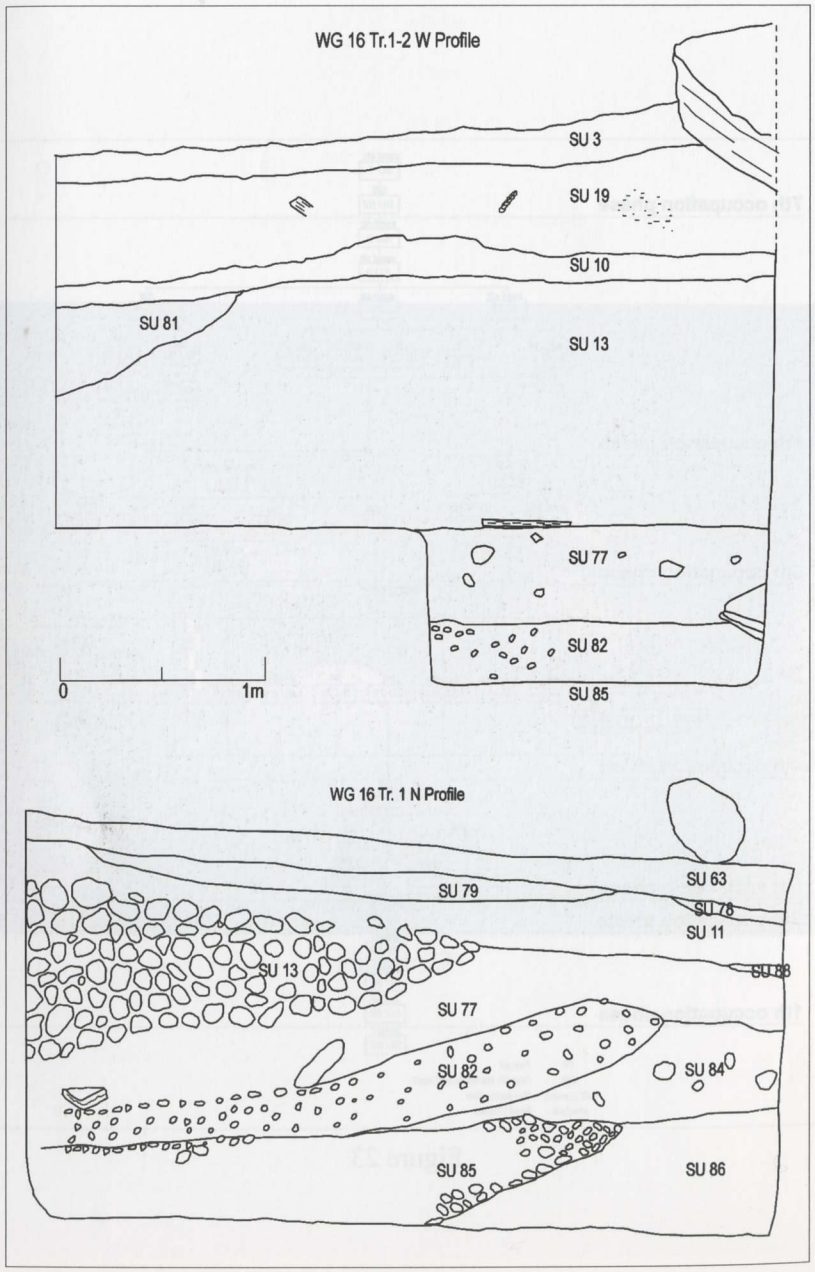

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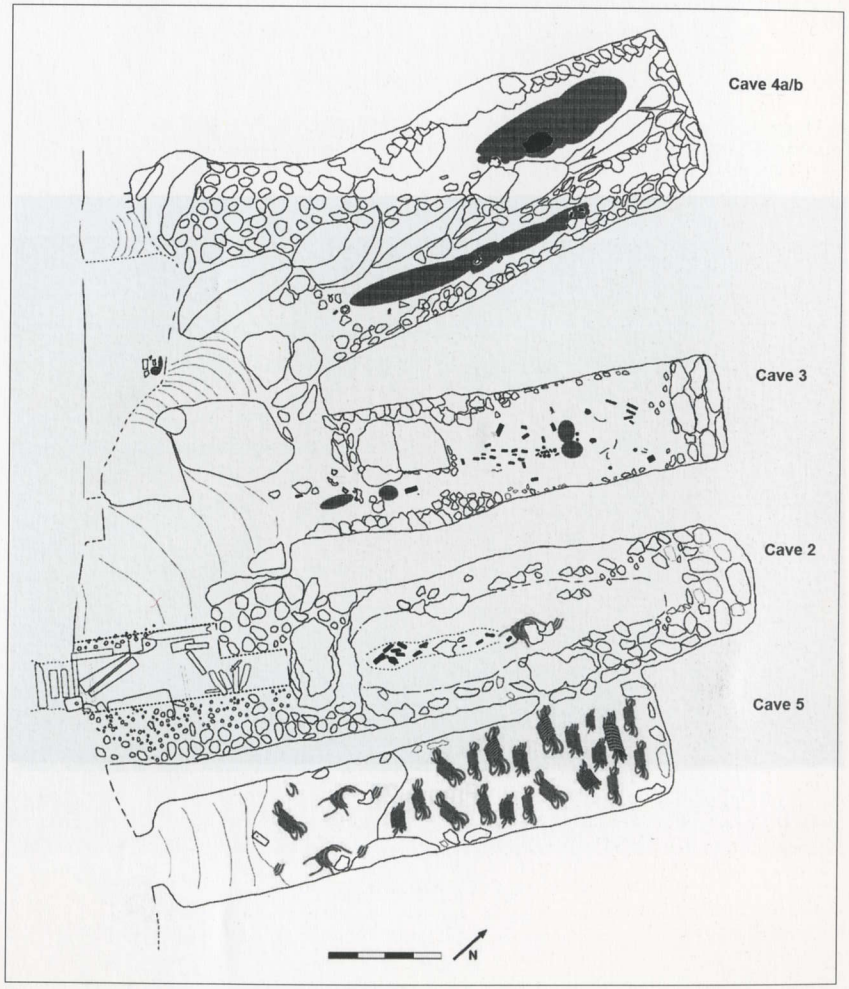

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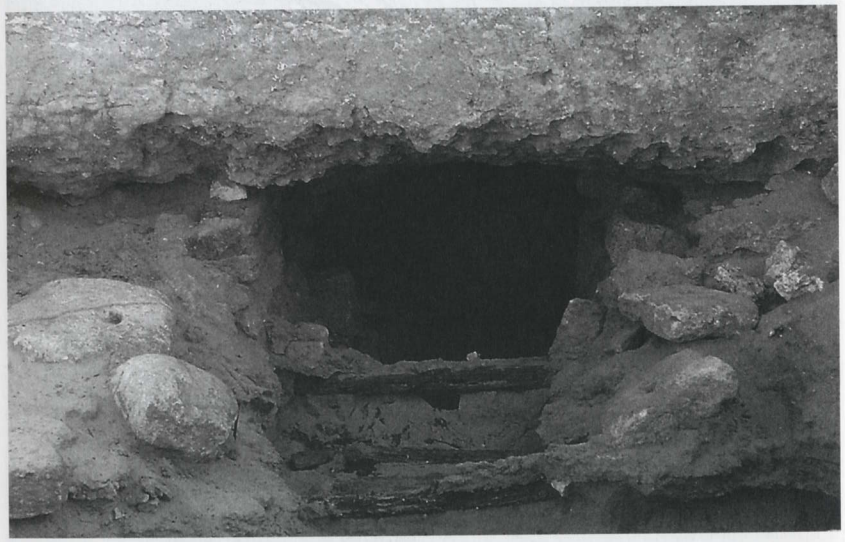

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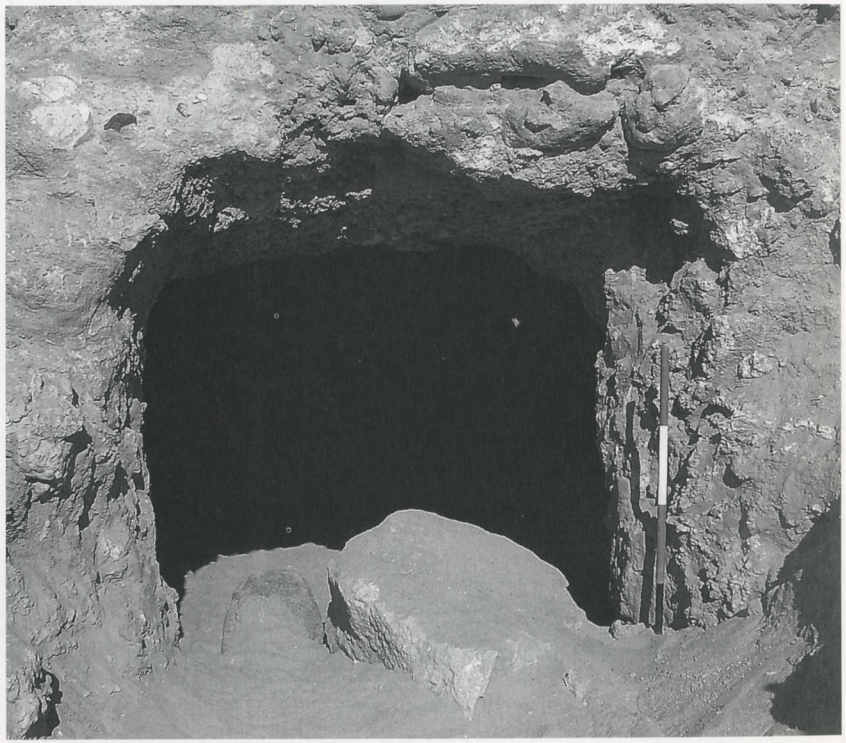

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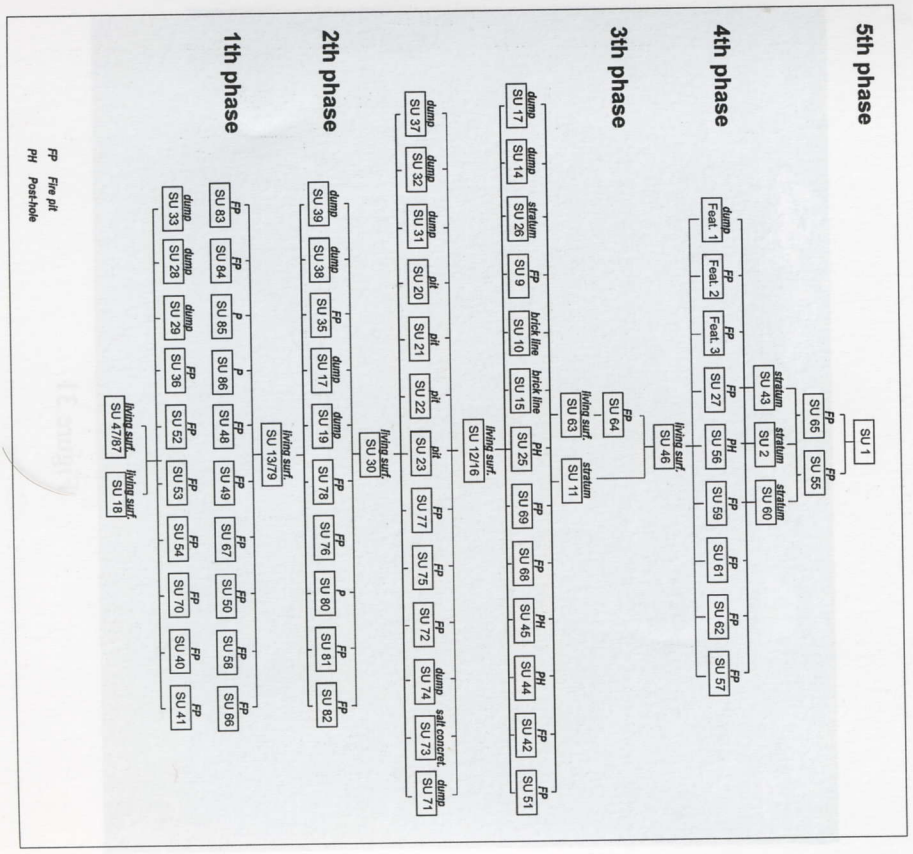

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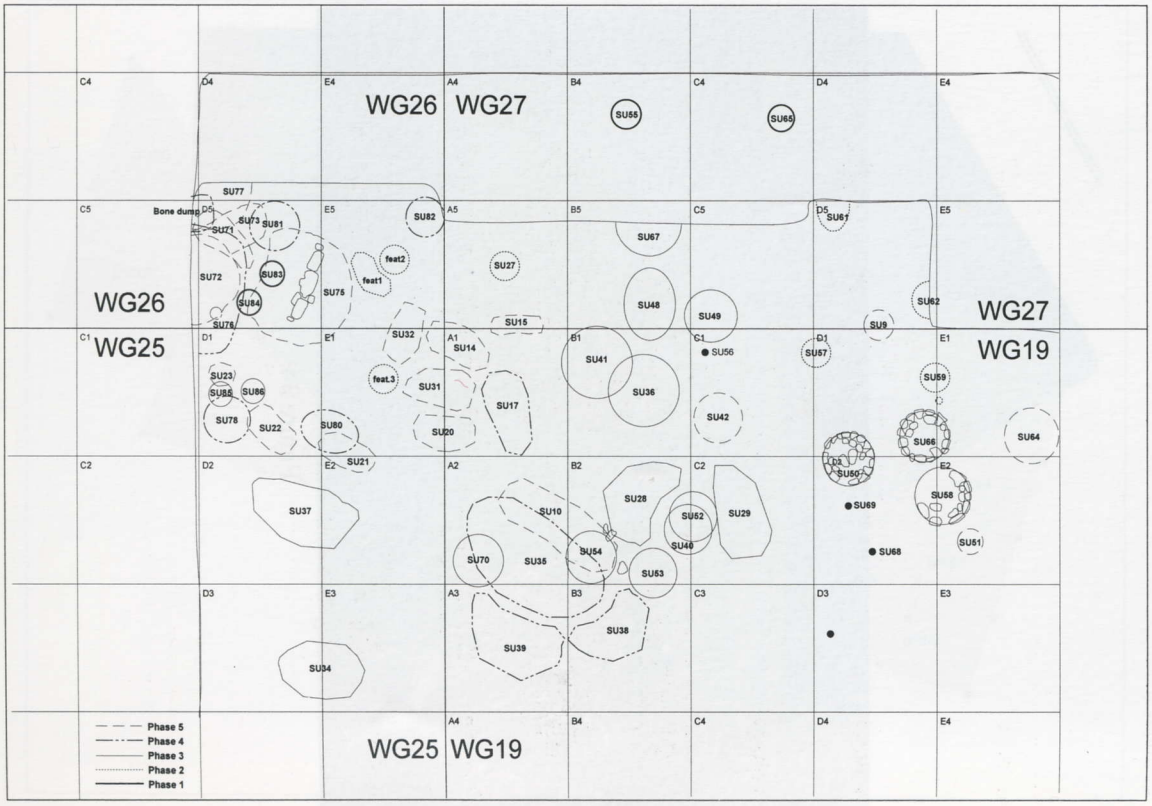

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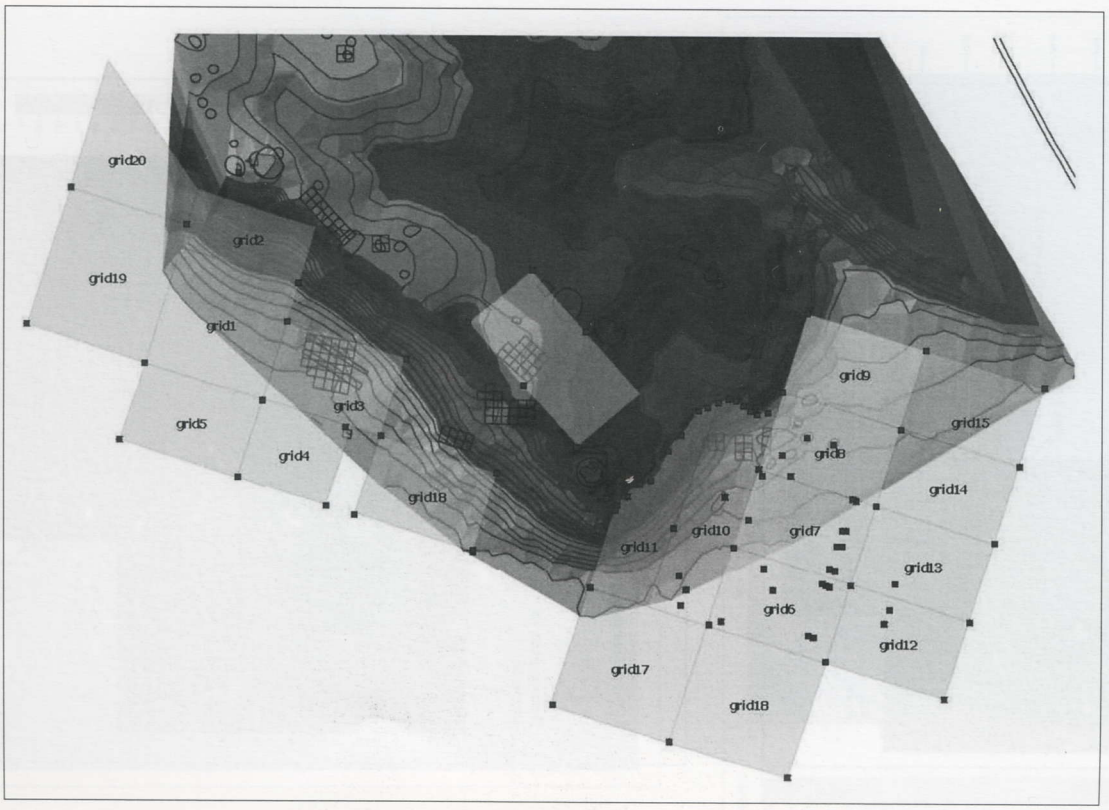

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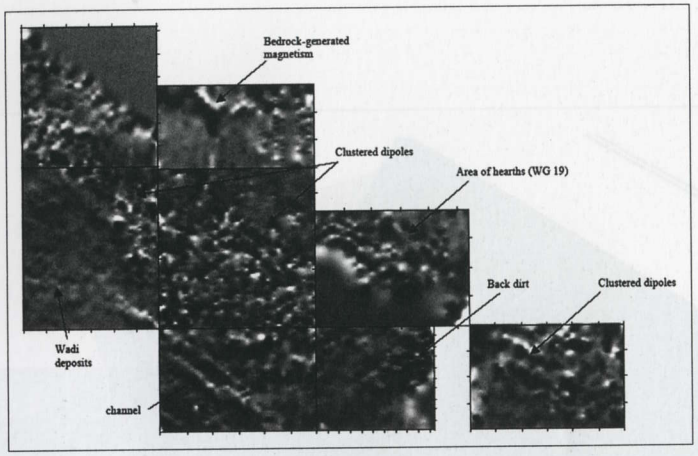

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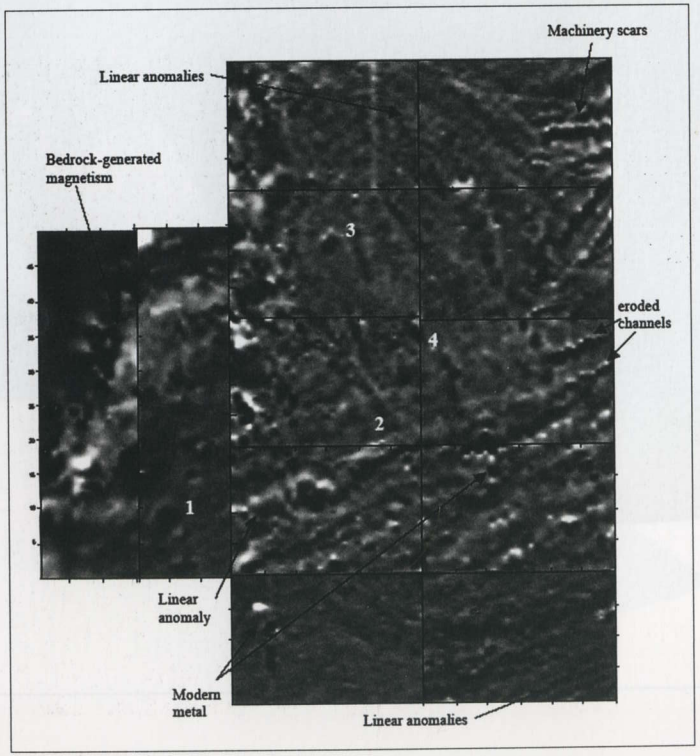

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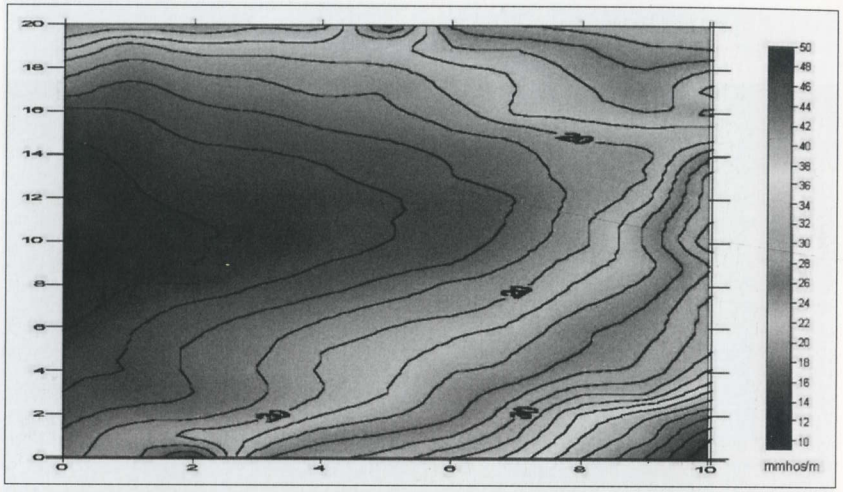

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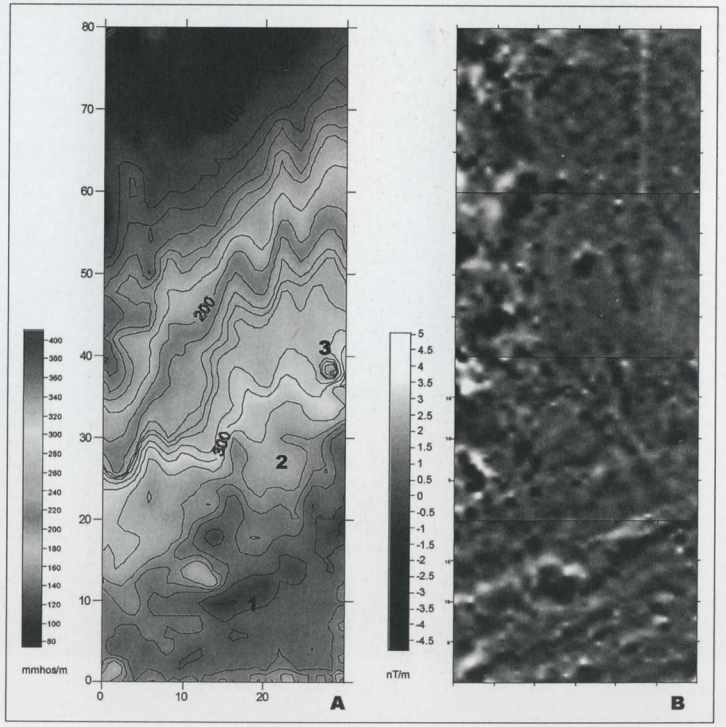

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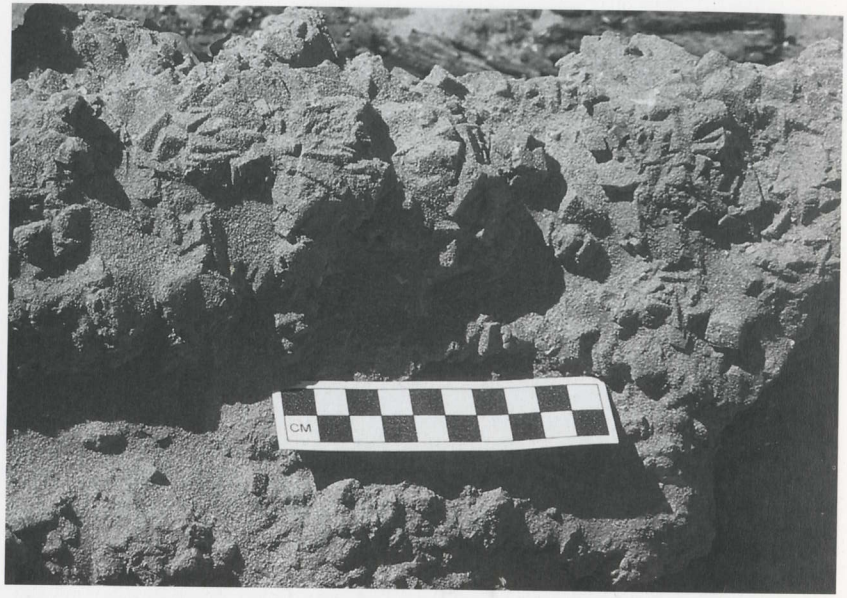

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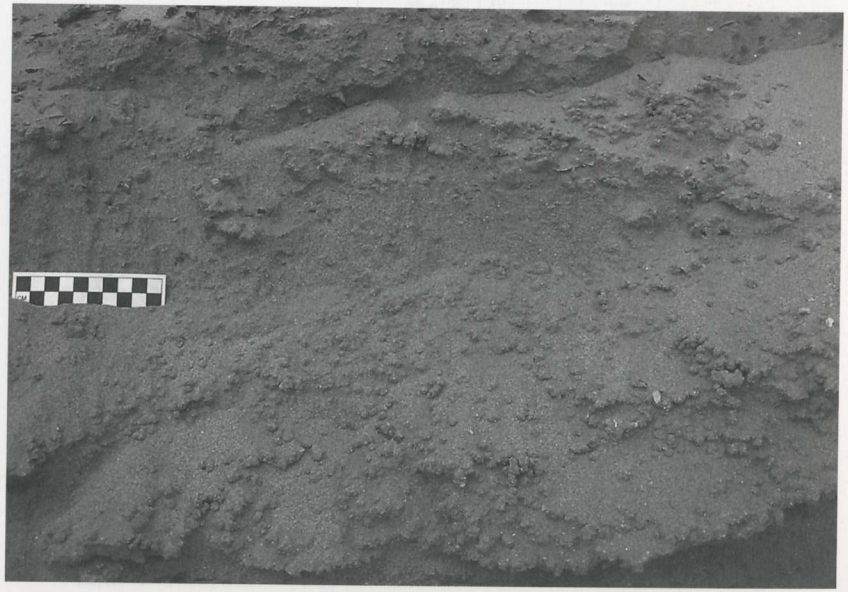

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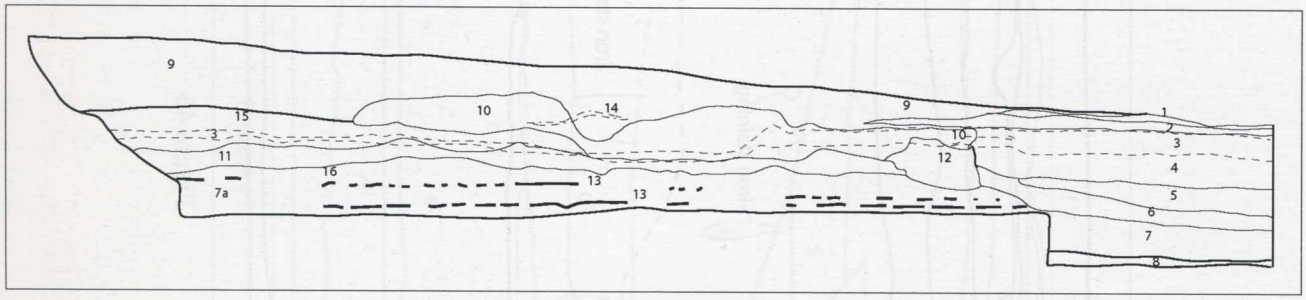

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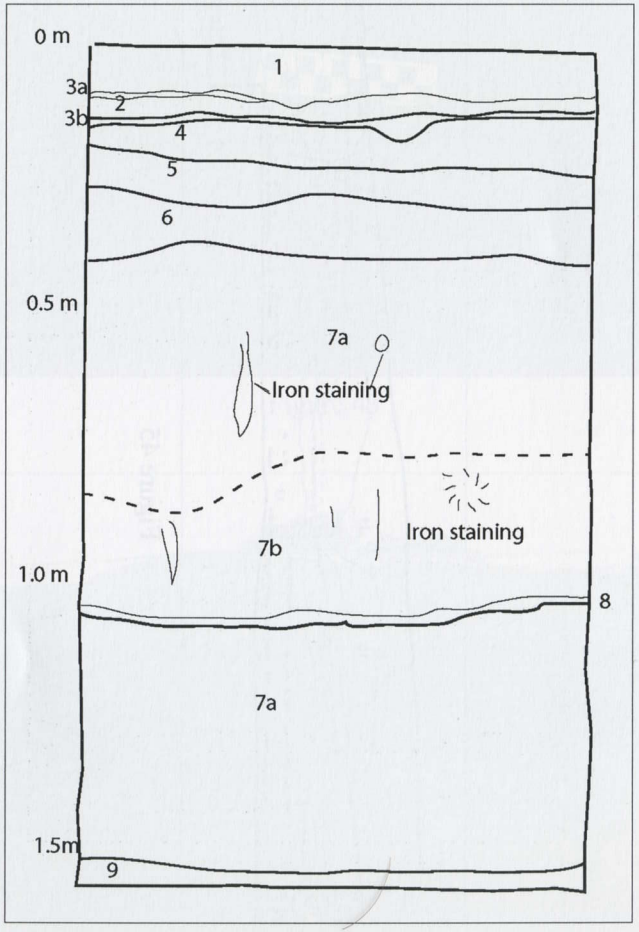

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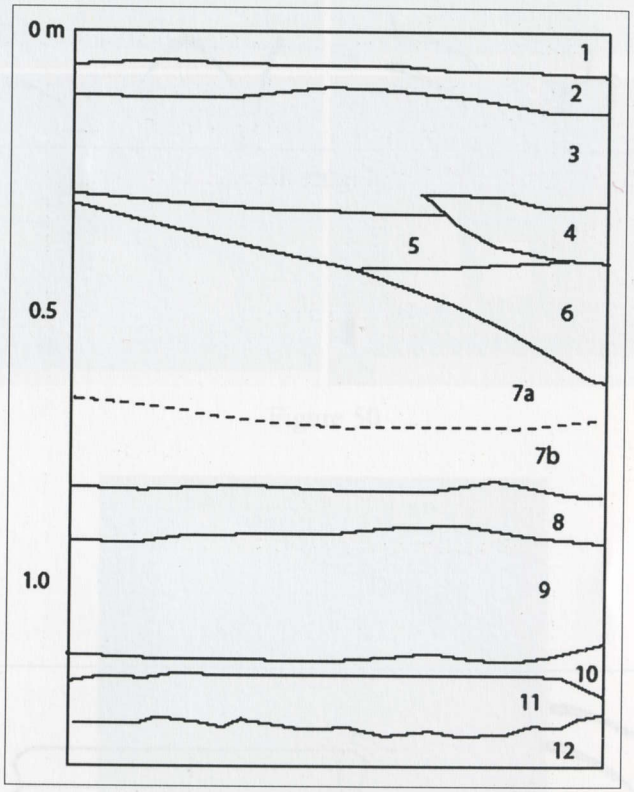

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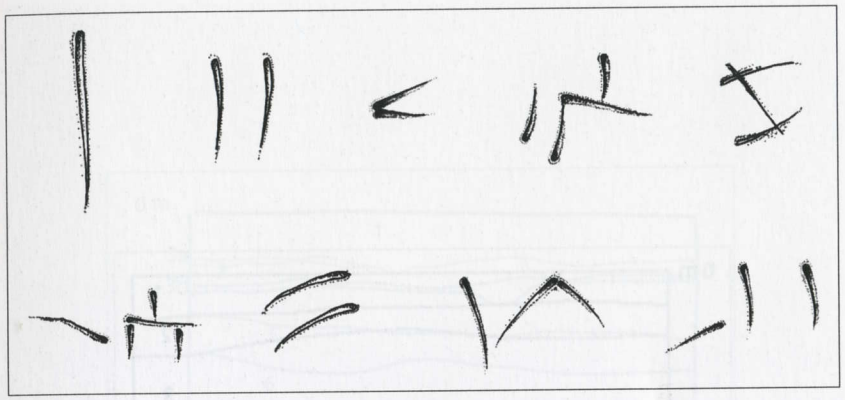

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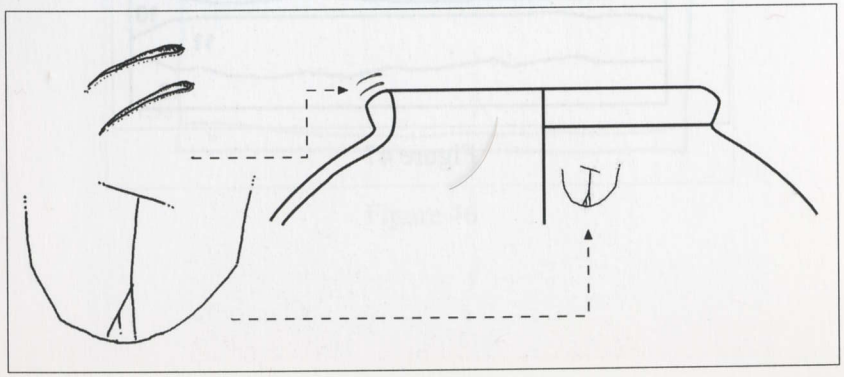

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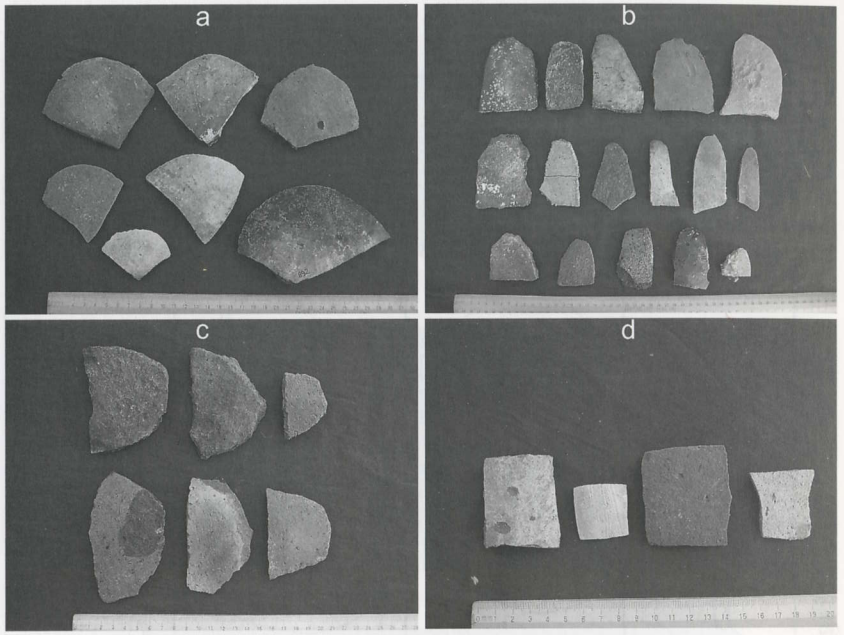

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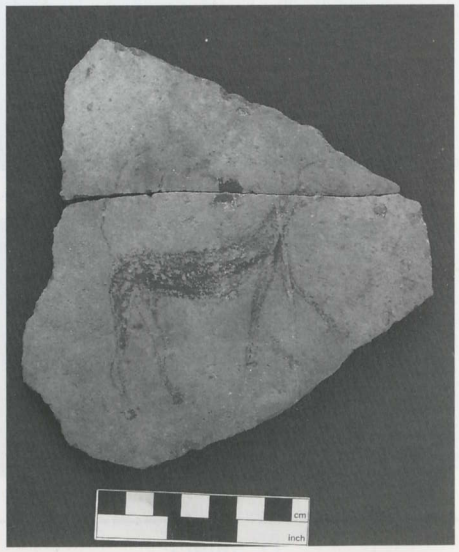

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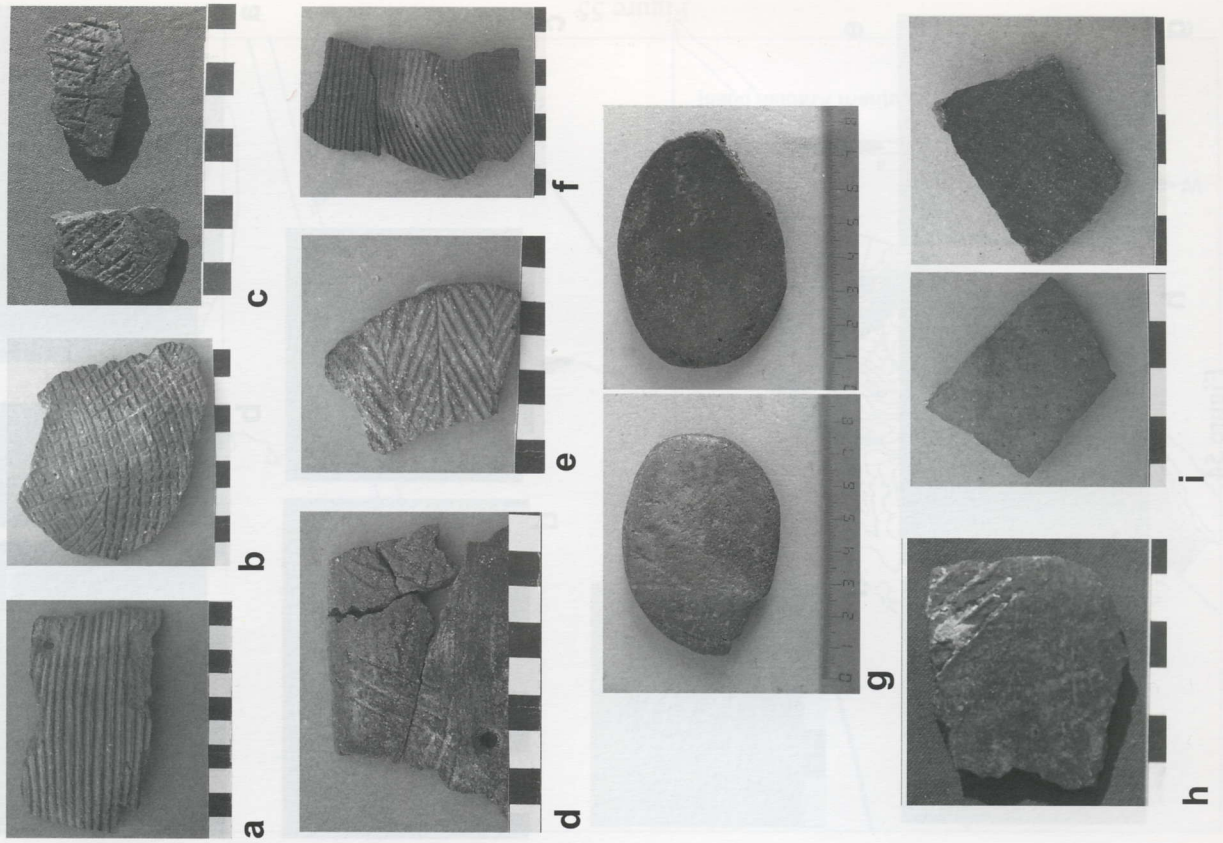

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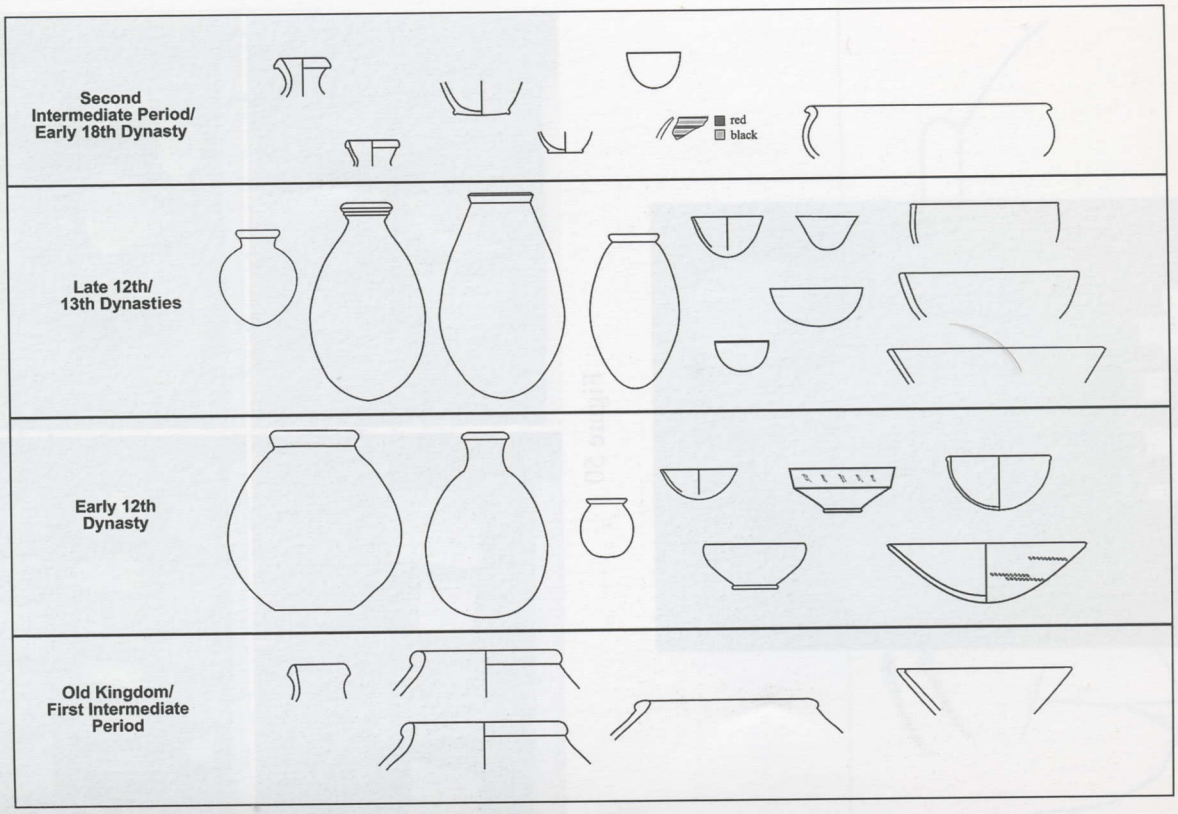

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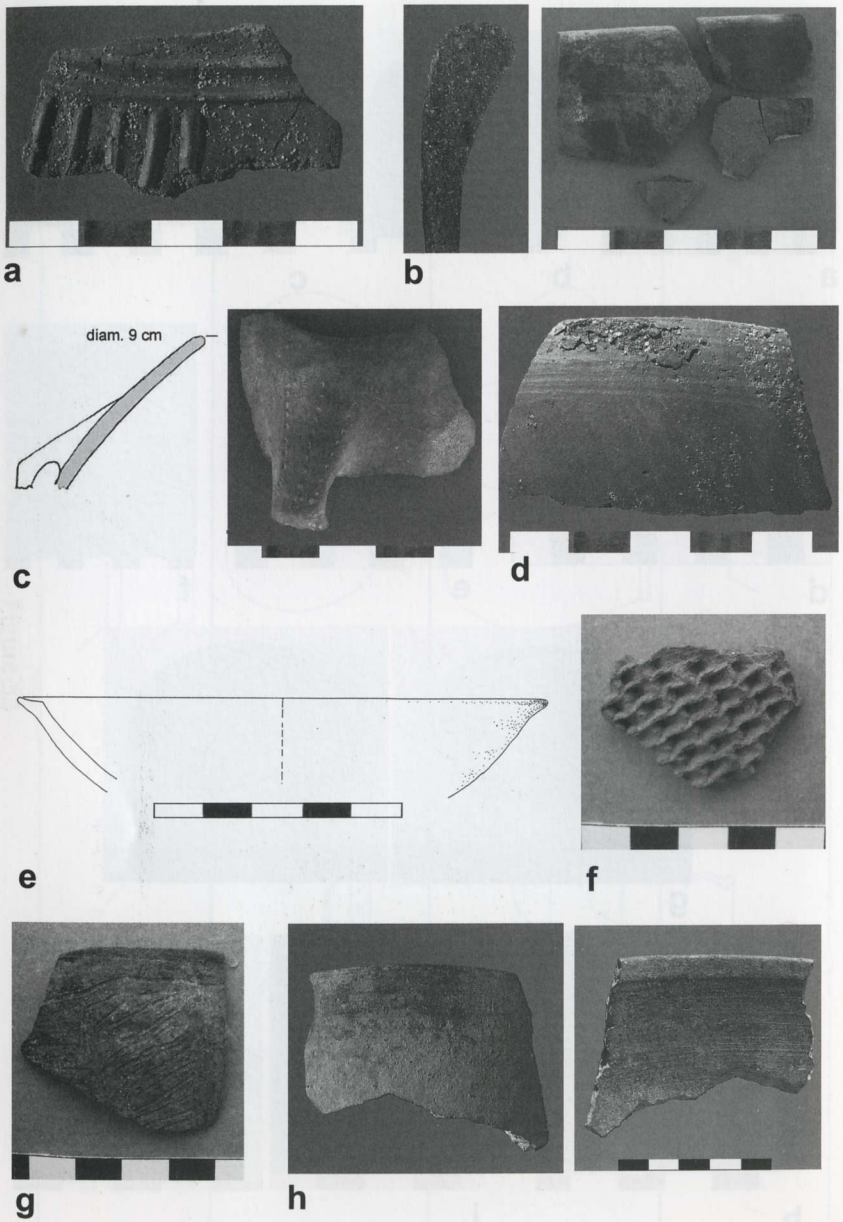

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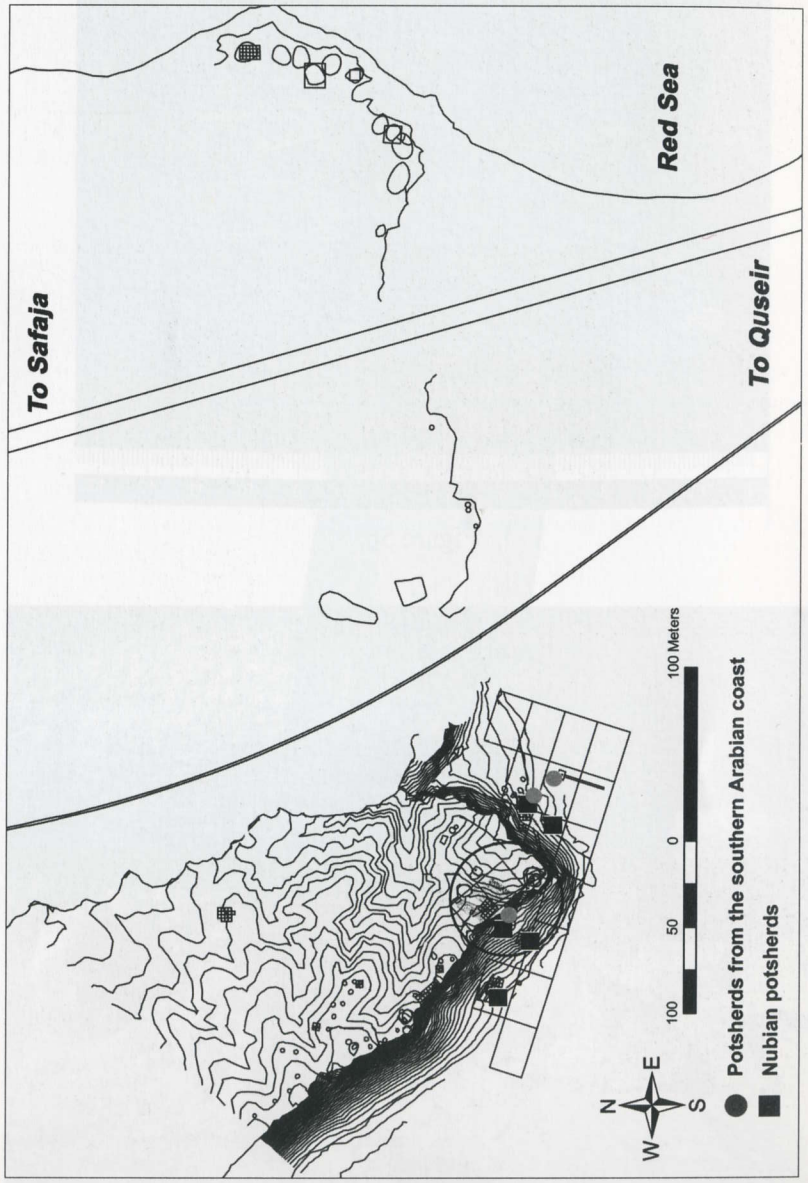

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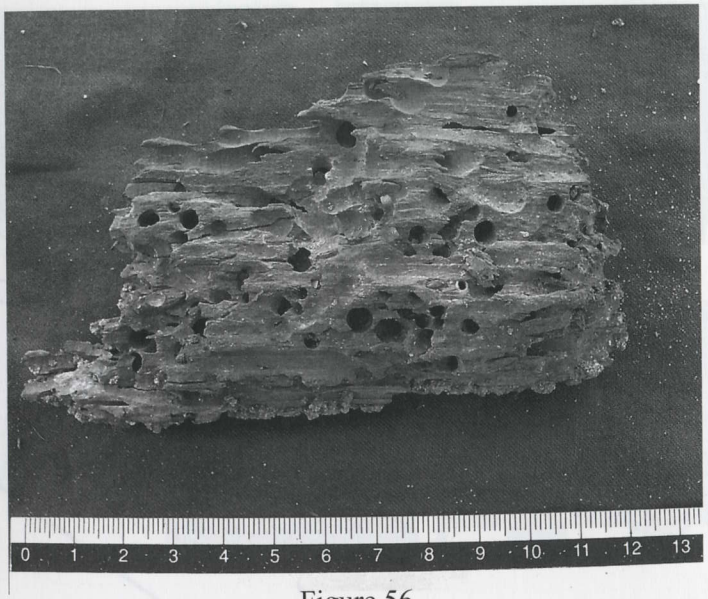

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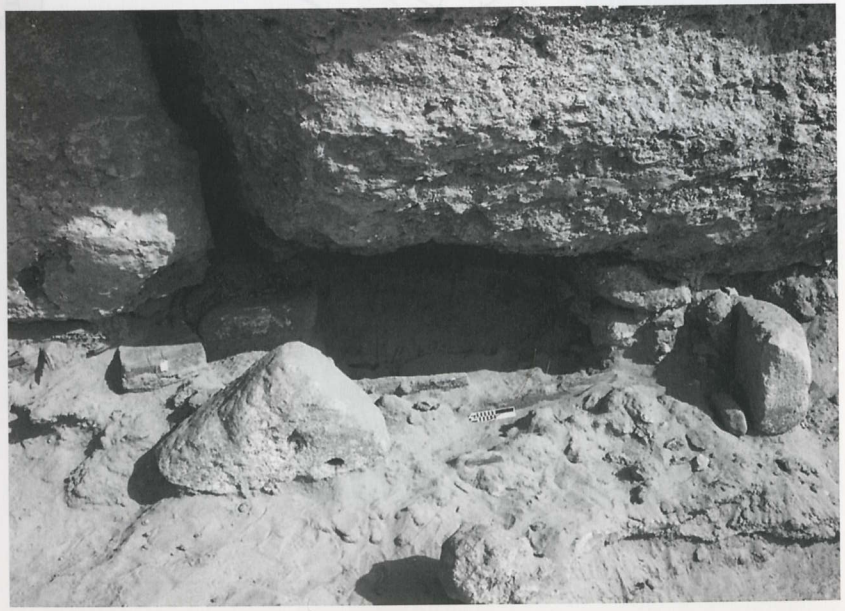

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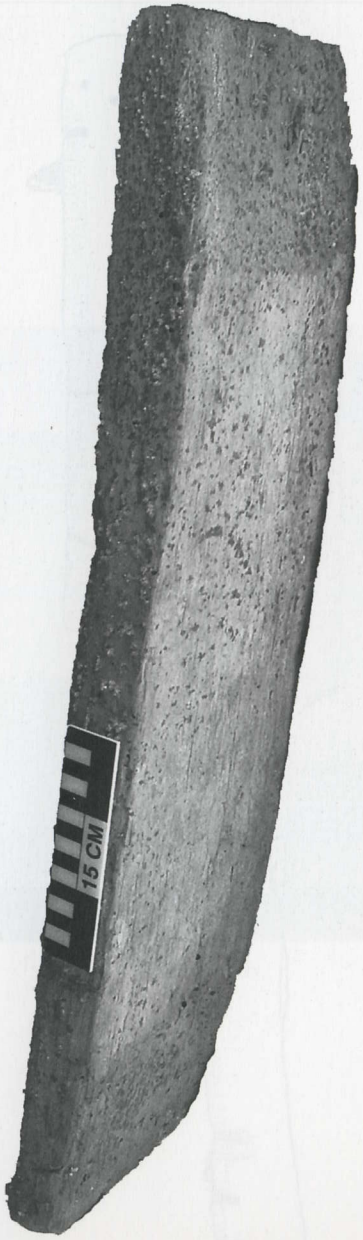
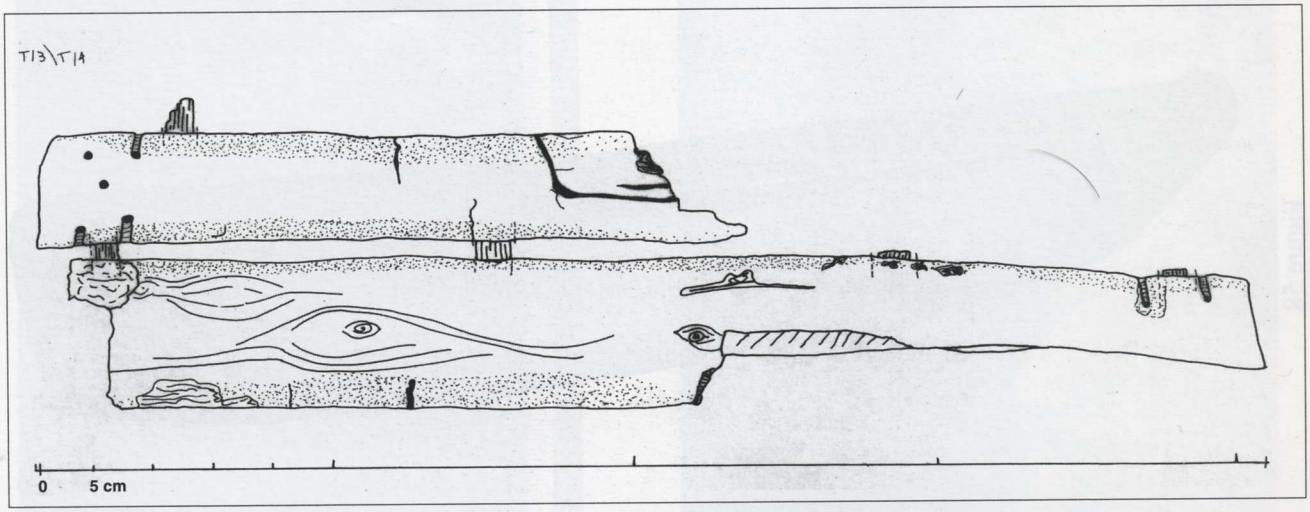


Figure 58

Figure 60



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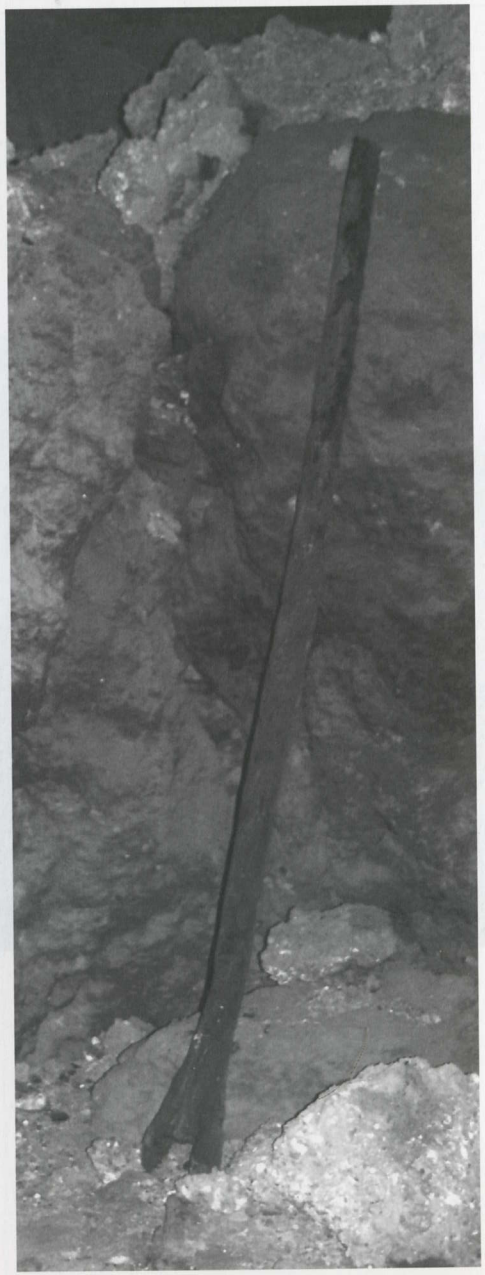

Figure 61

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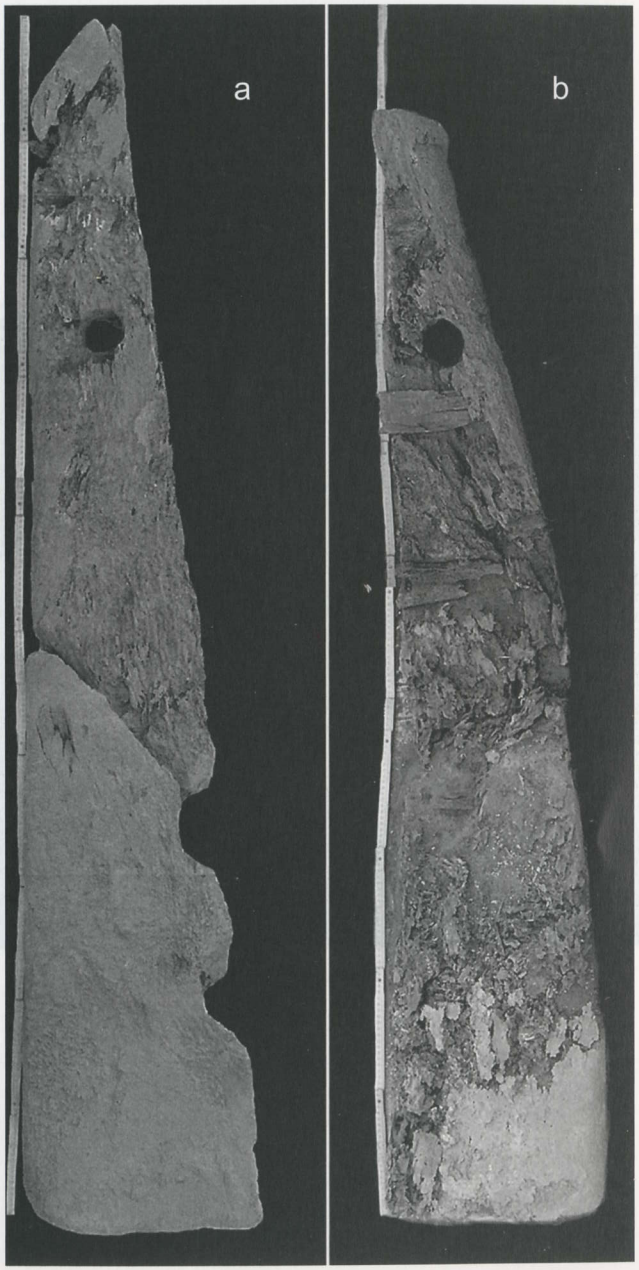
Figure 64



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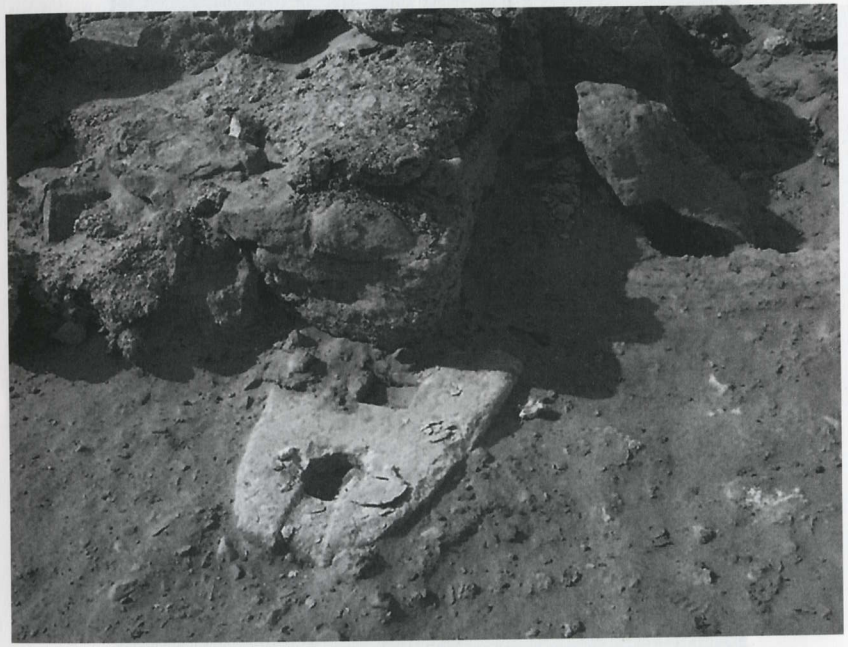

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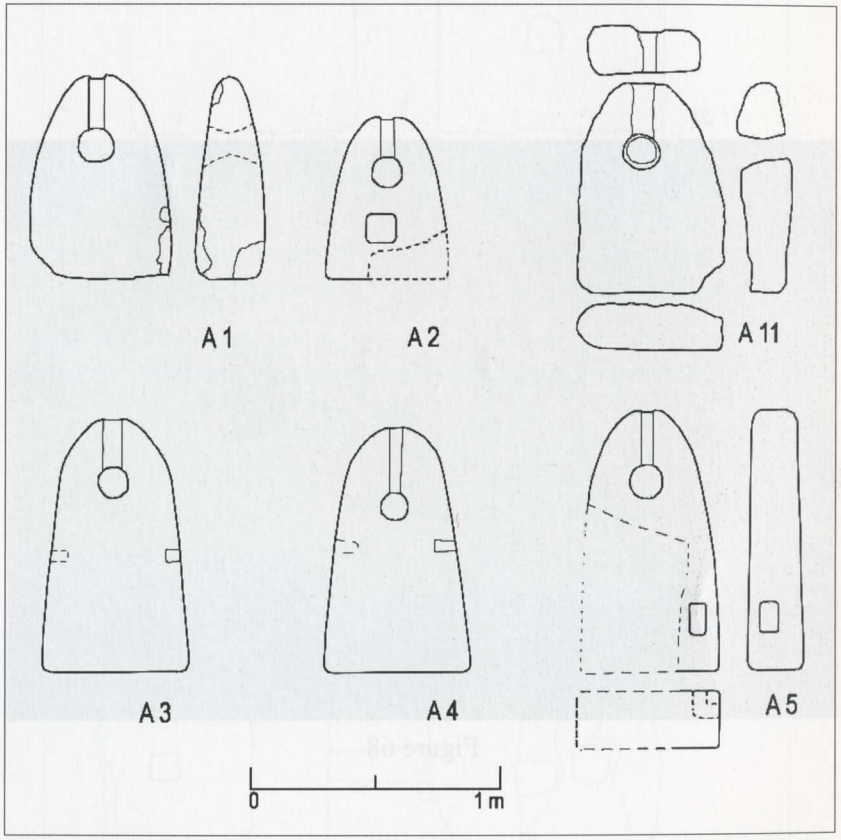

Figure 67

Figure 68

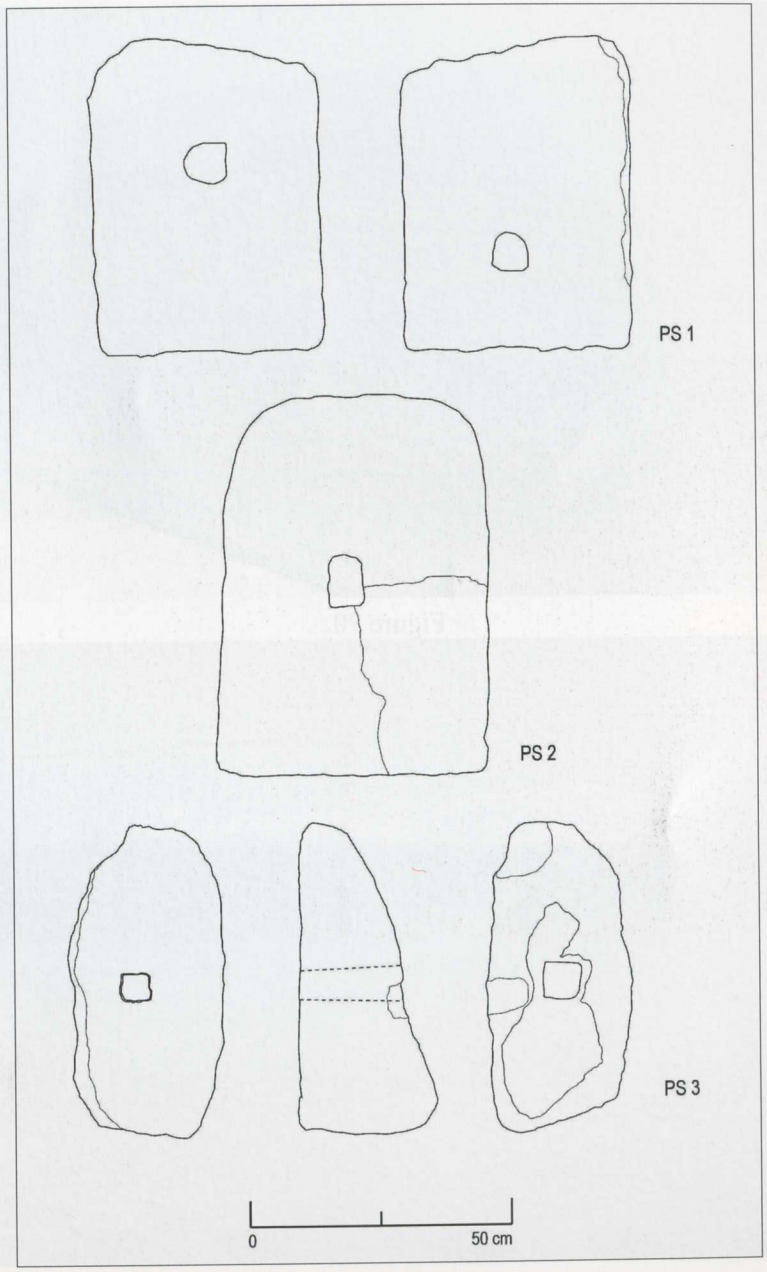

Figure 69

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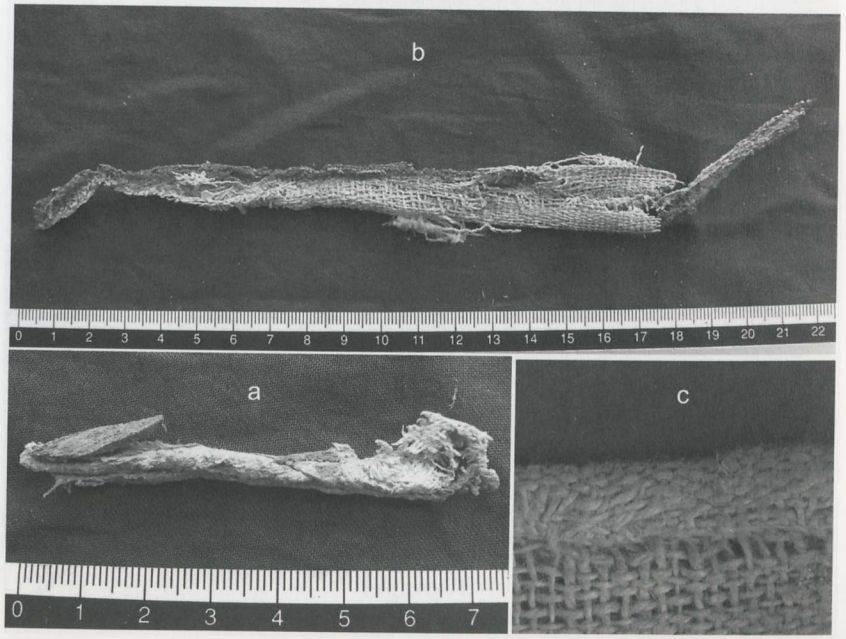
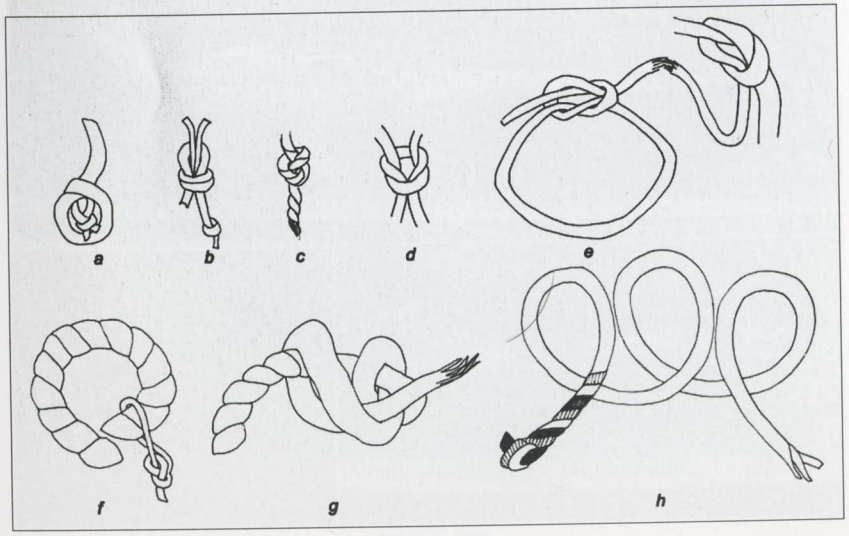


Figure 73

Figure 74



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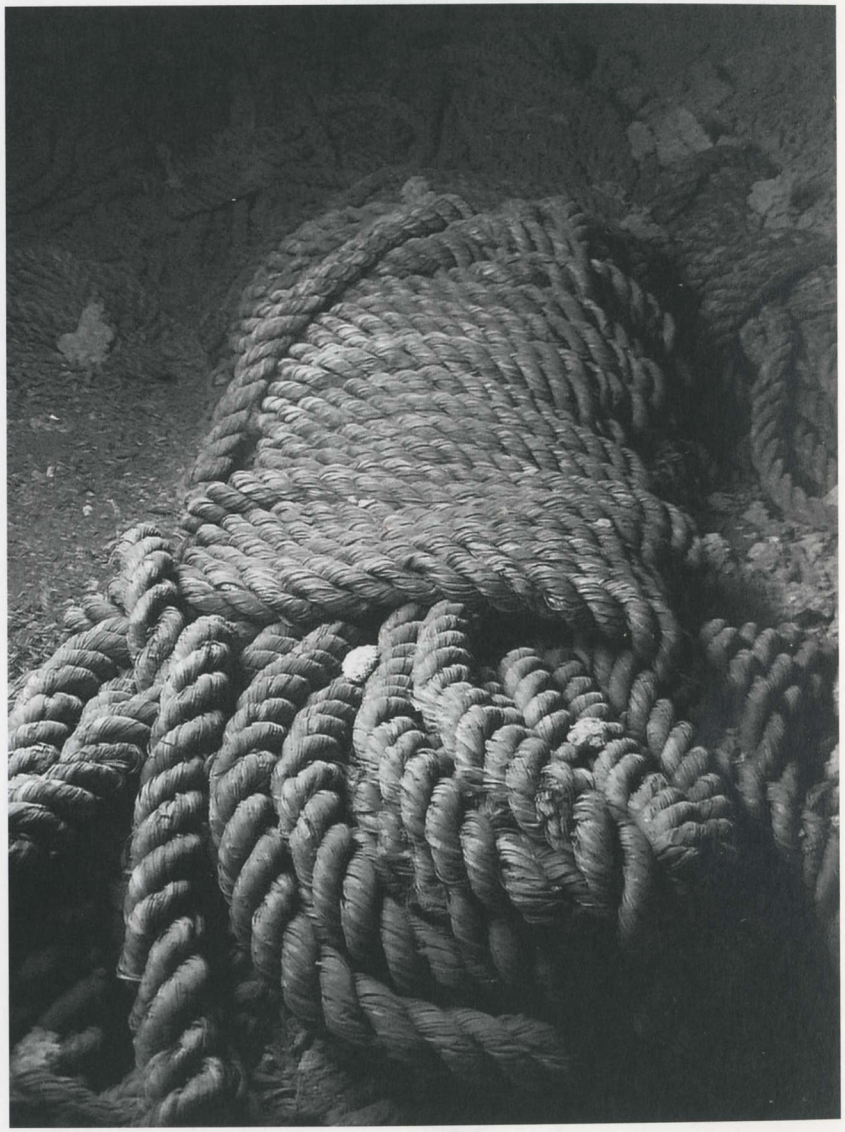

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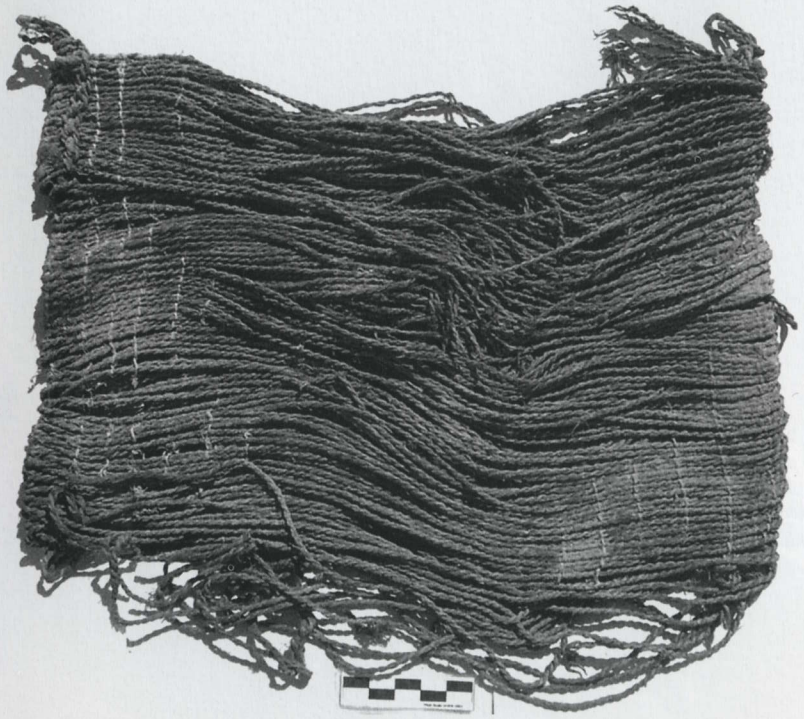

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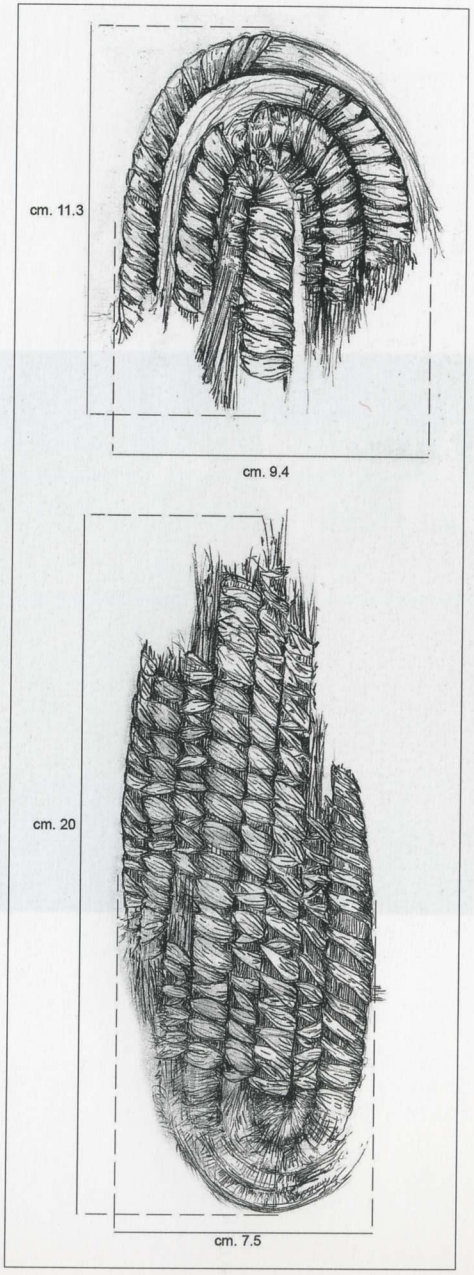

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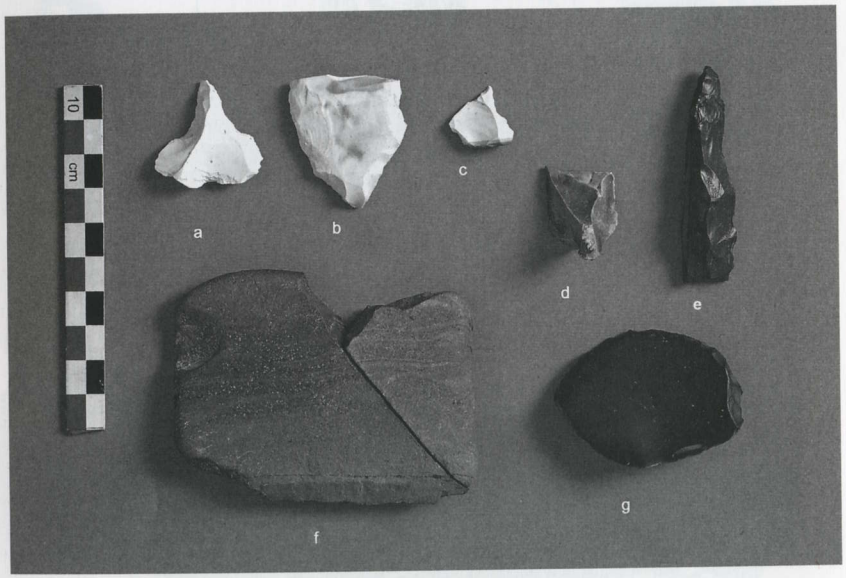

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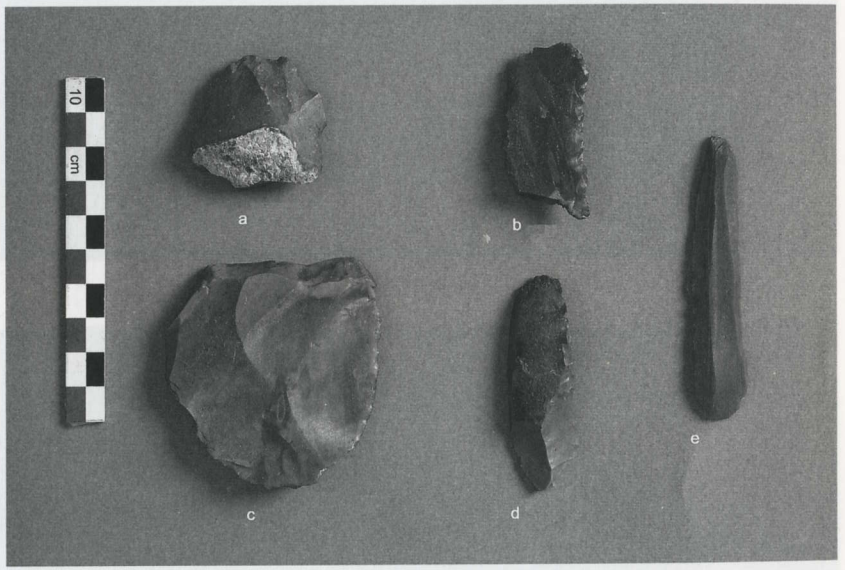

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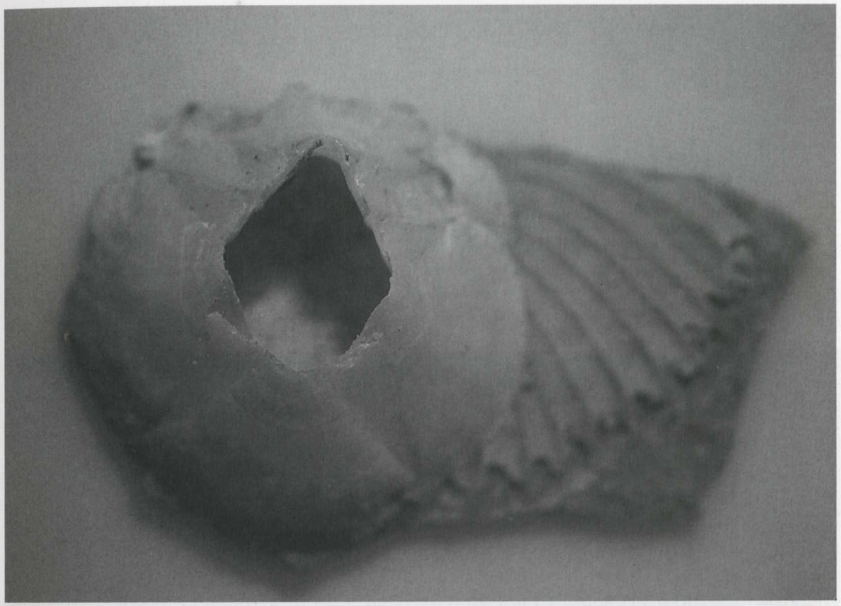

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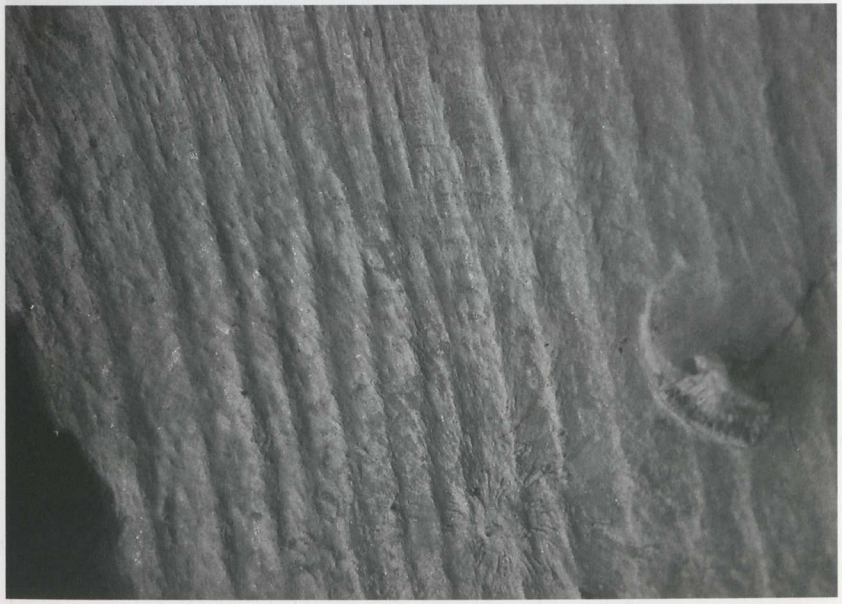
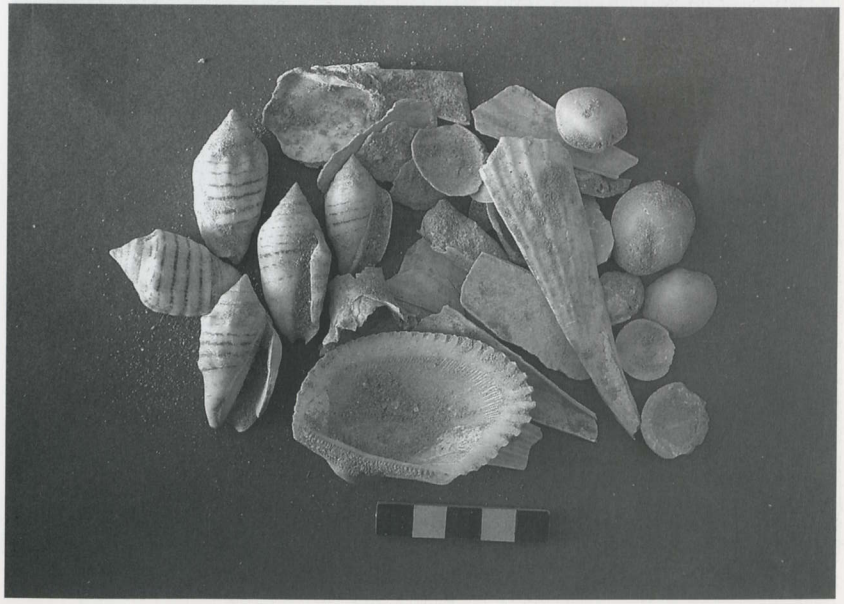


Figure 82

Figure 83



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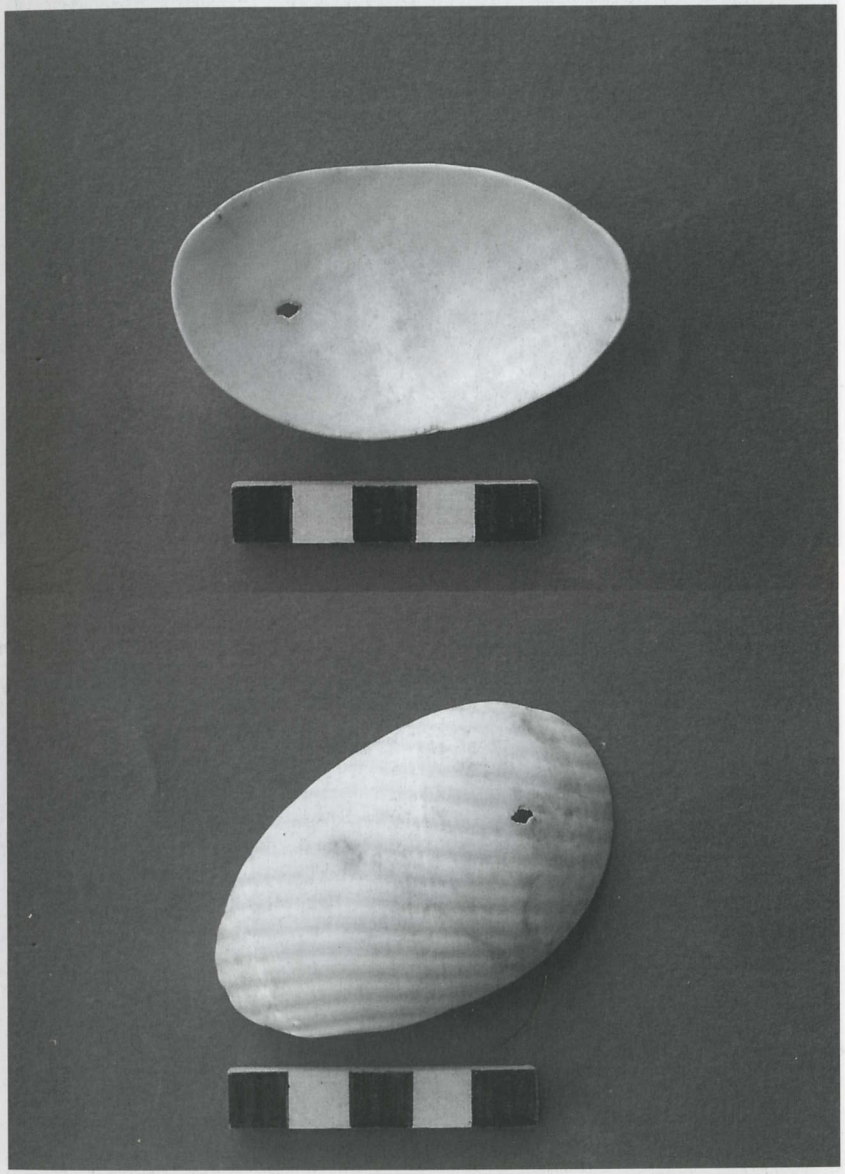

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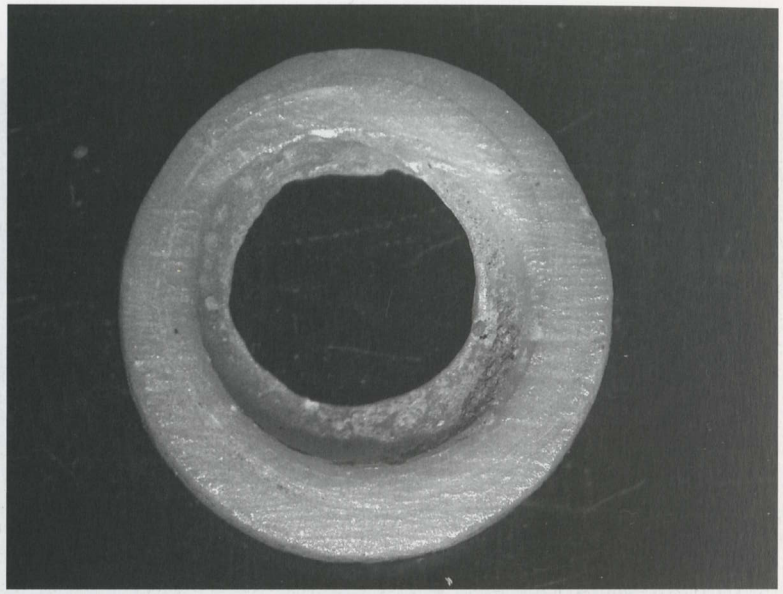

Figure 86

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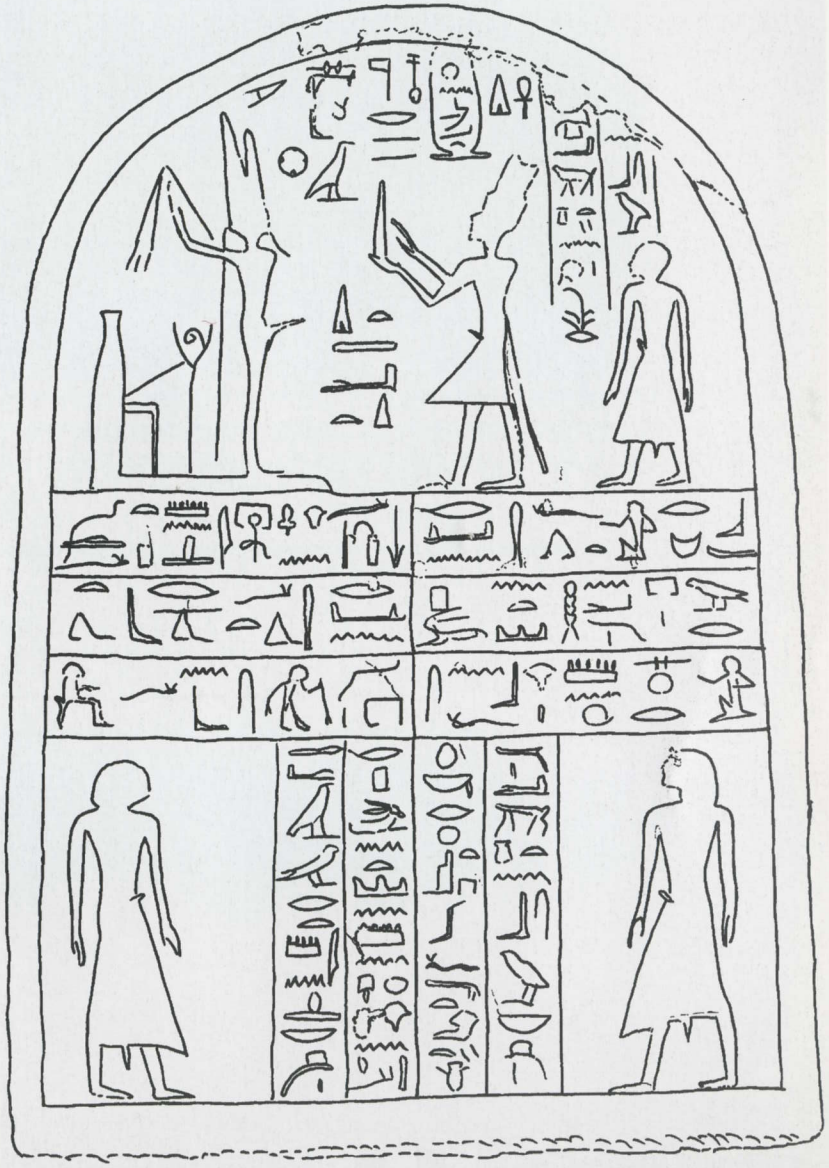
Figure 90



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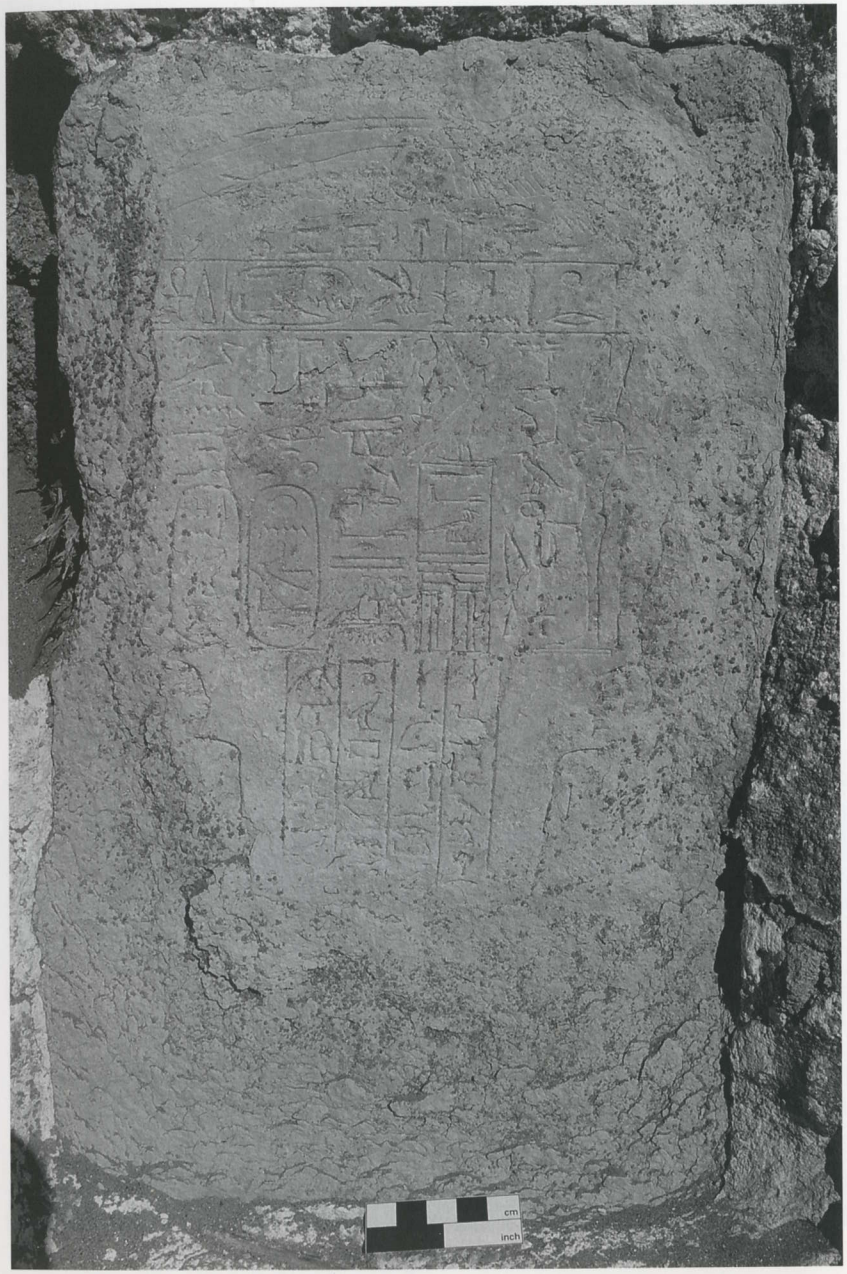

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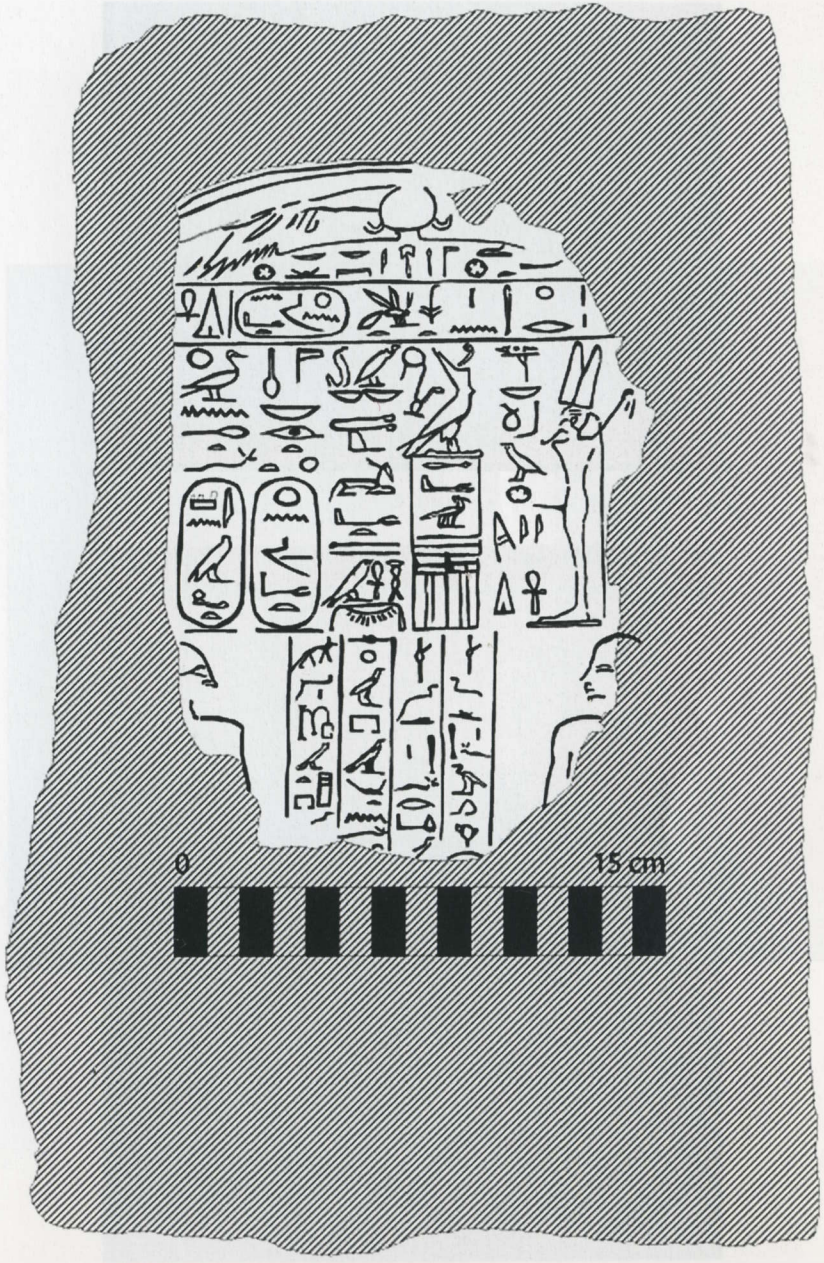
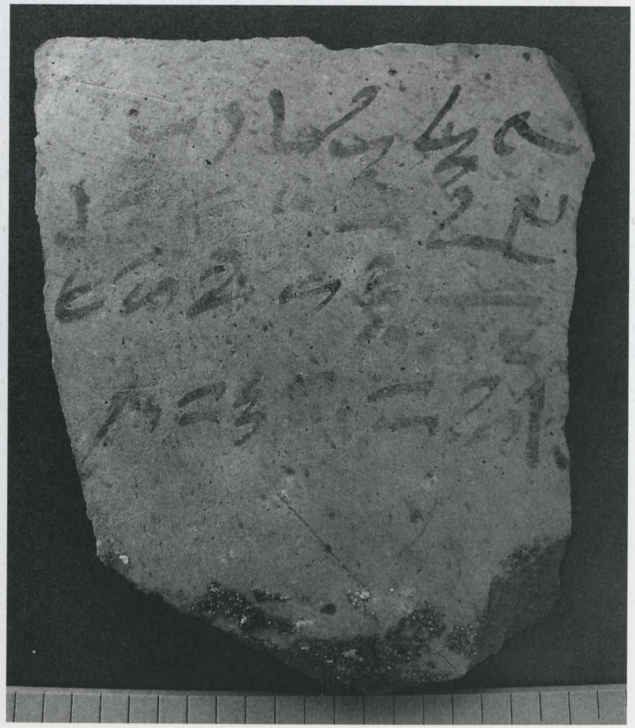


Figure 93

Figure 94



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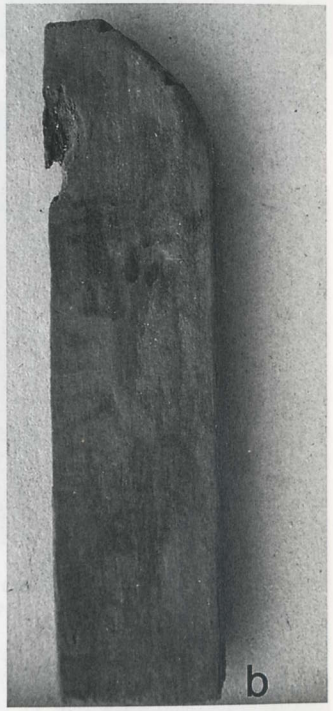

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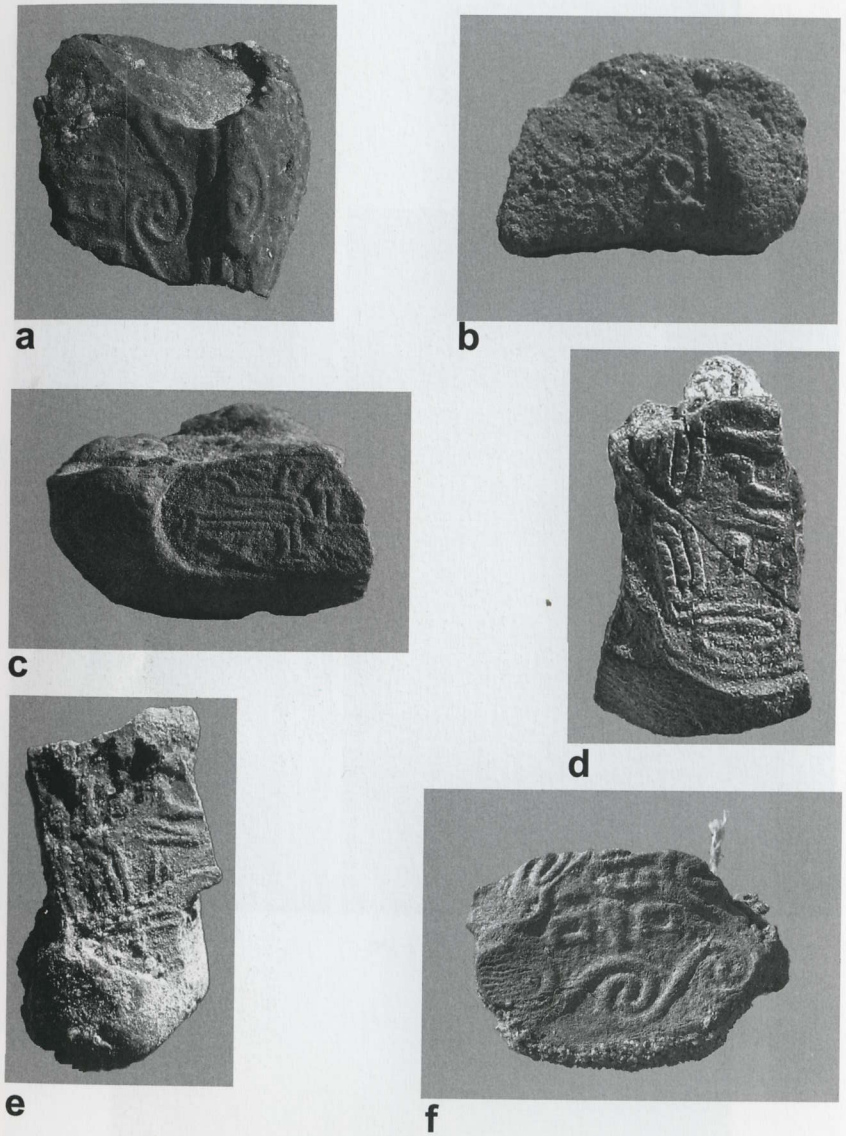

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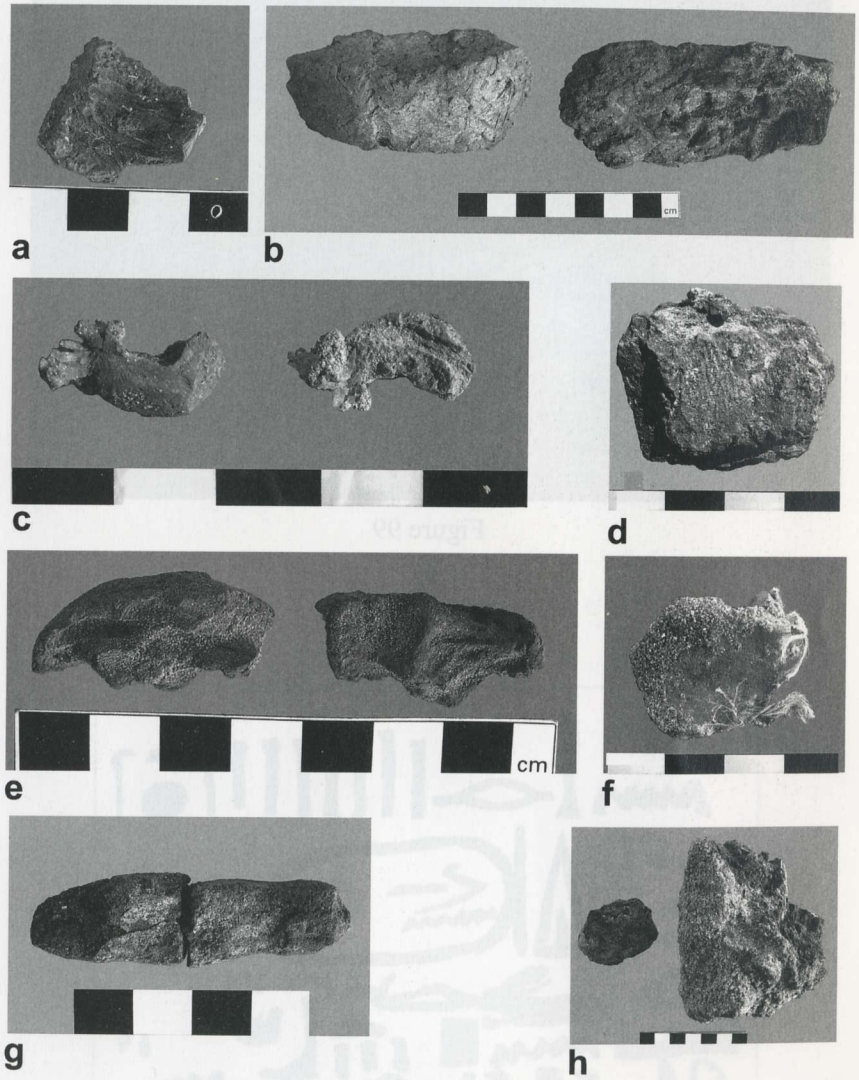

Figure 98

Figure 99

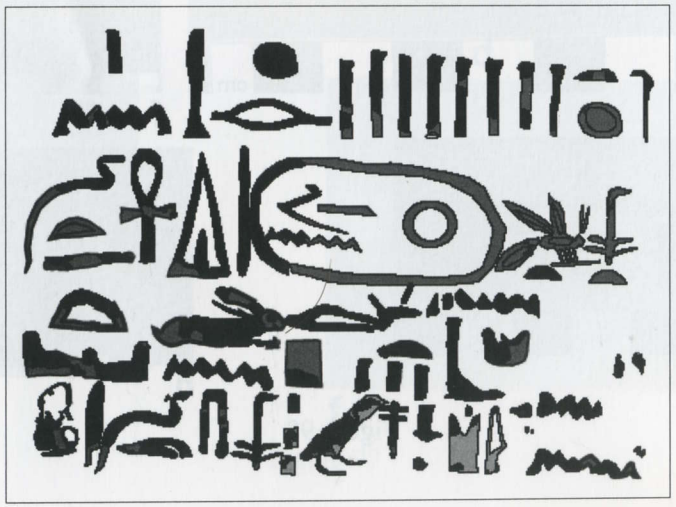

Figure 100