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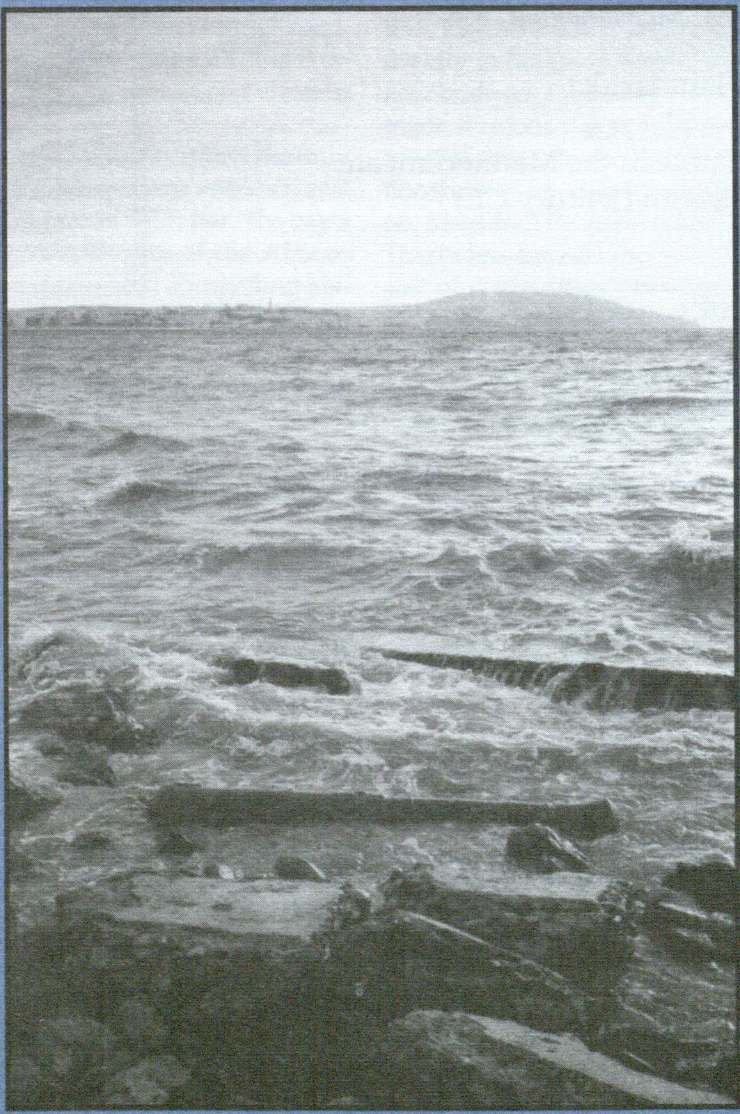

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On the cover: Several of the cannon cast with the mark, "Trafalgar 1777," that have fallen into the sea from a land fortification on the eastern shore of Tangier Bay, Morocco. In the background is the port of Tangier. Photo: A. Trakadas.

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Editor: Christine A. Powell

On the Shores of the *Maghreb-el-Asqa*: The 1999 Survey of Tangier Bay, Morocco

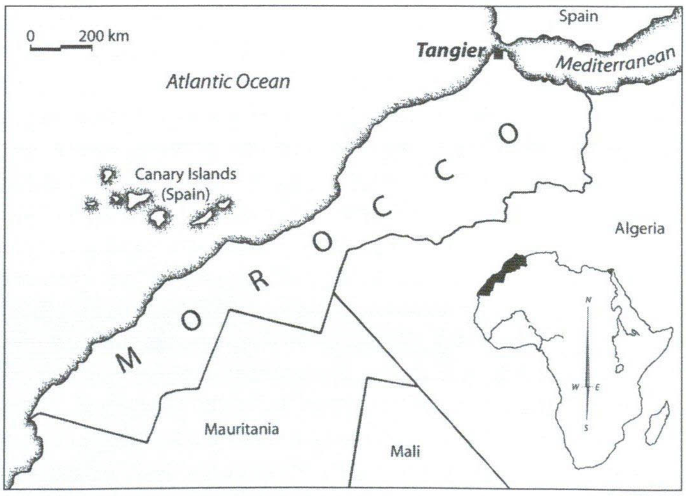
Athena Trakadas and Stefan Claesson (NOAA Nancy Foster Scholar)

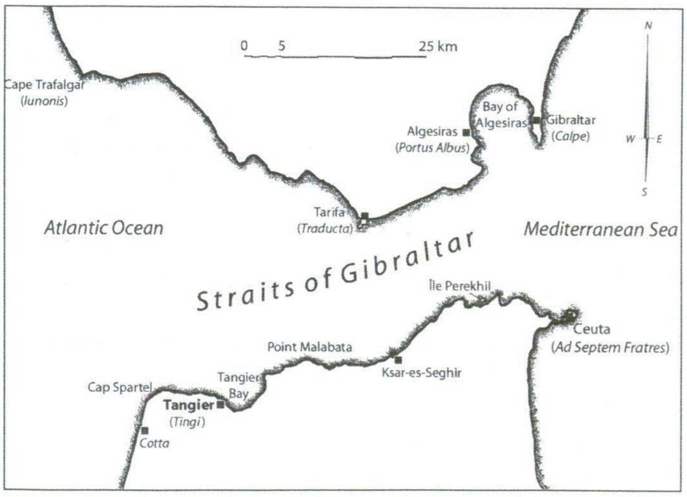
The strong westerly current and alternating winds that pass through the Straits of Gibraltar have threatened ships since ancient times. Separating the African and European continents by just thirteen kilometers, these narrow waters represented the western-most limit of the Mediterranean world to the ancient Greeks. The Atlantic Ocean was, as Pindar sang, "...the trackless sea beyond the Pillars of Herakles, those witnesses to the furthest limit of voyaging." Past the notorious gateway were the Elysian Plain, the entrance to Hades, and the ends of the earth. Many ships, however, eventually did combat the obvious navigational dangers of the fifty-seven kilometer-long Straits. The first accounts we possess of the passage are of mariners from the eastern Mediterranean searching for bounty from the western coasts of Africa and Iberia. Later, during Post-Medieval times, European powers sought control of the Straits in order to dictate lucrative trading concessions for their vessels in the Mediterranean and western Africa.

Semi-circular Tangier Bay, Morocco, offers the only protected anchorage to ships at the western entrance and along the southern coast of the Straits of Gibraltar. The bay's strategic position on the northwestern tip of the African continent has imparted a complicated but compelling history upon the port of Tangier. It was once called by Samuel Pepys, "the most considerable place the King of England hath in the world," and this position has made the surrounding waters an ideal venue for a maritime survey (fig. 1). In the summer of 1999, INA undertook a three-month-long underwater survey of Tangier Bay and neighboring coasts (fig. 2). We had the cooperation and assistance of the Kingdom of Morocco's archaeological department, Institute National des Sciences d'Archéologie et du Patrimoine (INSAP).

History

According to Greek myth, Tangier—ancient Tingi—was a product of Herakles' eleventh labor of gathering golden apples from Hera's tree in the Garden of the Hesperides (thought to be near ancient Lixus). Upon his labor's completion, Herakles killed a Libyan king, Antaeus, and founded the city in honor of Tingis, Antaeus' widow and Herakles' new bride (cf. Pliny, *NH* V.3). Hanno the Carthaginian, who made a colonizing voyage through the Straits to the west coast of Africa in the late sixth century BCE, does not mention the city. He claims instead to have founded Thymiaterion, identified by some scholars as Tingi. Mythology aside, Tingi's less-fanciful foundation appears to have been the result of cooperation between foreign immigrants and the indigenous population of the region.





Maps: A. Trakadas

Fig. 1 (left). *Morocco, on the northwest coast of the African continent.*

Fig. 2 (right). *The INA survey area of northern Morocco, including the Straits of Gibraltar and the southern Iberian Peninsula.*

From the eighth century BCE, the ancient autochthonous populations of northwest Africa, called variously and collectively Libyians, Ethiopians, Mauro sioiand b rbaroi(from which are derived the terms Moors and Berbers, respectively), were subjected to the constant presence of foreigners. The first immigrants to the region were Phoenician, who, in search of murex-shell sources for their famed dye, established themselves along the Atlantic coast of Morocco just south of Cap Spartel, as well as further south, at Lixus and Mogador. The varied grave goods of these first settlers indicate that they were relatively wealthy and remained in contact with the eastern Mediterranean, but were more strongly associated with the Phoenician populations who had settled in the southern Iberian Peninsula.

By the end of the fifth century BCE, the Phoenician and indigenous populations of the Cap Spartel area had coalesced on the western bluff of Tangier Bay and settled on the city's present site. Tingi's earliest mention is in Hecataeus of Miletus' now-fragmentary *Periegesis* (ca. 500 BCE), indicating that the city had rapidly become a known port, even to those in the eastern Mediterranean. Indeed, Tingi's position adjacent to the coast's only protected bay certainly facilitated sea-borne trade. It allowed the city to become a major component in a Phoenician-dominated commercial circuit around the Straits of Gibraltar that included Gades (Cadiz), Calpe (Gibraltar), Sexi (Almunecar), and Baria (Villaricos) on the southern Iberian coast, as well as Lixus and Mogador on the Moroccan Atlantic coast (fig. 3).

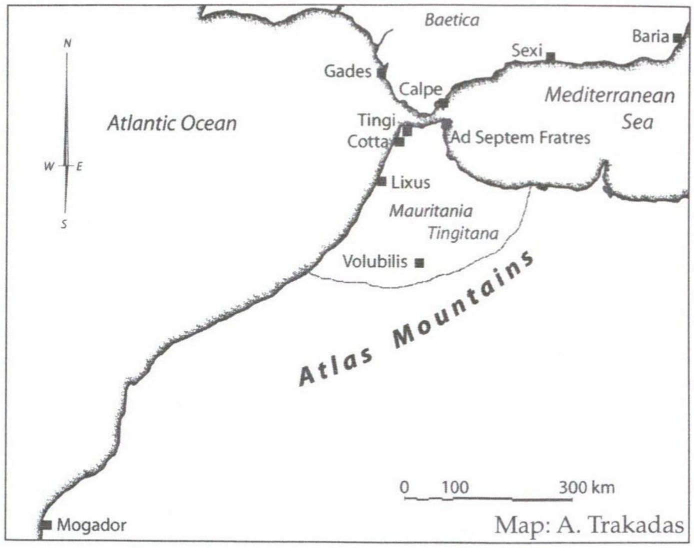


Fig. 3. *Earlier Phoenician sites and the later Roman cities of* Mauritania Tingitana.

The scant presence of Punic ceramics indicates that over the next few centuries, Tingi enjoyed relative autonomy from Carthage. The Roman destruction of that former Tyrian colony in 146 BCE did not seem to affect Tingi, and the local production and circuit trade continued unmolested. However, as Rome began to assert itself more strongly in Iberia and North Africa, it also sought to control the Straits of Gibraltar and its major southern port. As a reward for having chosen his side in the war against Antony, Octavian made Tingi a Roman colony in 38 BCE. Roman influence—visible in material goods, city planning, and government—readily penetrated Tingi, and rapidly spread south into the hinterland. From the city of Volubilis in the foothills of the Atlas Mountains, Romanized Berber puppet kings nominally ruled for a time, but desire for full control of the region and its resources soon led to complete Romanization. The last Berber king, Ptolemy, was killed at the behest of Claudius, and the area northwest of the Atlas Mountains was fully annexed by the Emperor in 43 CE. As the major port of a hinterland with no navigable rivers, Tingi became the capital of the western-most Roman African province, *Mauritania Tingitana*. Later, Volubilis became the seat of the Roman governor who ruled over a diverse population of Berber tribes, and the descendants of Phoenician settlers and Carthaginian refugees.

Over the next two centuries, *Mauritania Tingitana* was a relatively productive, but by no means wealthy, Roman province. It was even characterized by Pliny as somewhat of a backwater. The thirty Roman cities (described accurately by Ptolemy, *Geography* 4.1) and *villae rusticae* of the province produced wine, grains, olive oil, figs, dates, and carobs. The Atlas Mountains produced lead and copper, and provided exotic animals for Rome's Forum. The sea was also exploited, and centers that produced *garum* (fermented fish paste) and *salasmenta* (salted fish) were uniformly established along the Atlantic and Mediterranean coasts. From Tingi, these goods were exported locally and throughout the Empire.

However, the native Berber populations seemingly were never comfortable under Roman rule, and began what was to be an almost constant series of uprisings against foreign hegemony. By 250 CE , the Berber raids on Roman cities and farms throughout *Mauritania Tingitana* had so hindered the provincial administration that Volubilis was abandoned, and Roman citizens fled north to seek refuge in Tingi. By the beginning of the fourth century, these raids around Tingi, as well as throughout other North African provinces, forced the Emperor Diocletian to institute drastic military reforms. As Tingi was the remaining Roman city of the province, the legion *Comitatus Tingitanae* was stationed at several small *centenaria* (frontier forts) that were quickly built along the *limes* (defendable ditches and barriers) that now isolated the peninsula. Despite these measures, the protection of the remaining territory from the perpetual raids of malcontented Berbers proved too costly and time-consuming for the Empire. The military presence was gone by the mid-fourth century, and the administration of the port was conducted from southern Iberia, making Tingi a marginal part of the province of Baetica.

Tingi was all but ignored by the emerging Byzantine Empire in the east and the Vandalic forces that crossed the Straits on their way to seize Carthage in 439 CE—Geiseric occupied Ad Septem Fratres (Ceuta) instead. However, the Visigoths, who had by now settled in southern Iberia, periodically raided both Tingi and Ad Septem Fratres. Emperor Justinian's re-conquest in 533–34 of the former Roman North African provinces led Belisarius' forces to temporarily occupy Tingi and Ad Septem Fratres as bases from which to attack the Visigoths across the Straits.

In 683 CE, less than a half-century after the Prophet Muhammed fled to Medina, the first Muslim Arabs from Egypt and Tunisia penetrated west of the Atlas Mountains. They explored the area they called the *Magreb-el-Asqa* ("the furthest west;" later corrupted to "Morocco"). By 698, the ruling Islamic Umayyed Dynasty of Damascus had appointed Ibn Nusayr, a Tunisian Muslim, governor of what is now northern Morocco. In the last year of his military campaign of 705–709, Ibn Nusayr managed to occupy Tingi and gave it the Arabic name of Tangier. In 711, an army of Arab Muslims and a few local Berber converts, under the leadership of the newly appointed Tangierian governor Tarik ibn Ziyad, sailed across the Straits to conquer the fragmented Visigothic forces still in Iberia. Landing at Calpe, modern Gibraltar (a corruption of Jebel Tarik, later named in Ibn Ziyad's honor), Muslim forces soon spread through the peninsula, reaching the Pyrenees by 732.

The Church had never penetrated extensively west of the Atlas Mountains under the Roman or Byzantine Empires, and the fervent Christianity common in other North African provinces had never greatly appealed to the heterogeneous population of *Mauritania Tingitana*. The sudden emergence of Islam into the region in the late seventh century likewise created neither enthusiasm nor opposition among the native population. Despite the rapid spread of Islam in the Iberian Peninsula in the eighth century, the

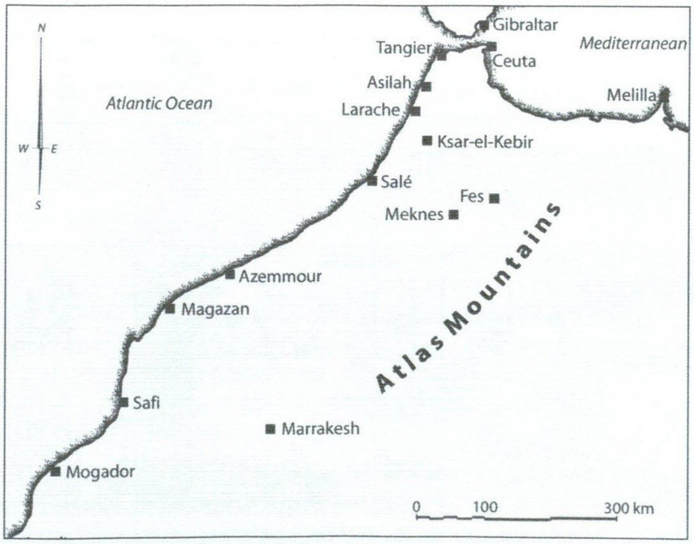


Fig. 4. *The cities that emerged under Berber self-rule and Arab and Portuguese intervention in the* Maghreb-el-Asqa.

Berber tribes were slow to convert to the religion, but it eventually garnered favor throughout the *Maghreb-el-Asqa*. Althought conversion of the Berber populations to Islam was important to the region's Arab governors, the newest invaders immediately realized and focused upon exploiting the potential wealth of the region. Southern Atlas Berber tribes, who traded with the indigenous groups of the Sahara and Niger regions, began to funnel the lucrative trade of slaves and gold north. By the 730s, the Arab governors of Tangier regularly conducted profitable slave-raids south of the Atlas Mountains.

Much as they had against the Romans, the Maghrebi Berber tribes soon rebelled against the Arab invaders. The Sufrite Kharijite tribe, during a series of rebellions that began in the north in 739-40, occupied Tangier, killed the Arab governor, and installed their own government. Simultaneously, another Islamic Berber group, the Sunnite Idrissides, established themselves at Volubilis, and from there controlled the Atlas foothills. Beginning what was to be a continuous tradition of Berber-led Islam in Morocco, the Idrisside Dynasty had firm control of the Maghreb by 810. For the next several centuries, no one native tribe was able to establish a lasting hegemony over the region (fig. 4). Rather, many different Berber dynasties established indigenous control of the entire Maghreb from their capitals of Fes, Marrakesh, and Meknes in the foothills of the Atlas Mountains.

The inter-dynastic instability of Berber rule, combined with the promise of wealth from the trans-Saharan trade, soon attracted other foreign interests to the Maghreb. Over the next six centuries, European powers endlessly vied for political and economic control of the region. Already in the twelfth century, the ambitious Genoese had visited Ceuta, and by 1162 had sailed as far as the Atlantic coastal city of Salé. A Genoese contingent failed to capture the port of Ceuta in the mid-thirteenth century, but through their persistence, managed to gain certain key commercial trading privileges in North Africa. Ugalino and Vadino Vivaldi attempted a more permanent Genoese settlement on the sandy western coast in 1253, but no lasting trade concessions were established.

Genoese trade waned within the next century, and continued only at a marginal level along the Atlantic coast of the Maghreb in the early fourteenth century. Eventually, more forceful European powers sought to exploit the region. Before its firm interest in the New World and the Indies, Portugal's expansionist policy was focused almost wholly upon North Africa. A Portuguese fleet successfully captured Ceuta in 1415, but in their attempt to occupy Tangier in 1437, lost Crown Prince Fernando to the defending forces of the Berber Wattasid Dynasty. The Portuguese refused to surrender Ceuta in return for the prince, and in 1447, Henry the Navigator led another attempt for Tangier. Badly defeated, Portugal was forced to cede Ceuta to the Wattasids in exchange for Prince Fernando in 1448, eleven years after his capture.

From the mid-fifteenth to mid-sixteenth centuries, Portugal invested a considerable amount of manpower and finances to obtain forced trading concessions in Morocco. Other foreign entities, as well as Portugal, were constantly involved in engagements with the Berbers, who themselves were embroiled in a civil war between the Wattasid and Saadian tribes. The comprehensive struggle, referred to as "the Hundred Years War for Morocco," saw the Berber tribes, Portugal, Spain, and briefly even the Ottoman Empire vie for control of the Maghreb. Portugal re-captured Ceuta in 1450, only to have it stripped away by its emerging competitor, the Kingdoms of Castille and Aragon, soon to become Spain. While Spain moved east and occupied the Mediterranean city of Melilla (later to be challenged by Ottoman forces), Portugal sought to take control of the Straits of Gibraltar, and occupied Ksar-es-Seghir in 1458 (fig. 2). A fleet led by Afonso V in 1463 intended to land at Tangier, but thwarted by the loss of numerous ships in the Straits due to storms, changed course and re-conquered Ceuta. In 1470, Afonso again attempted to take Tangier. Storms forced his fleet away and down the Atlantic coast where he attacked Arzila instead. The inhabitants of Tangier finally abandoned the city to Portuguese forces in 1472.

Portugal rapidly established a series of coastal fortresses at Ceuta, Ksar-es-Seghir, Tangier, Asilah, Larache, Azemmour, Mazagan, Safi, Mogador, and Agadir that allowed its traders access to goods from the interior of the continent. The resulting trade in slaves, copper, wheat, barley, cattle, horses, honey, wax, indigo, lacquer, textiles, ebony, rhinoceros horns, and gold, initially created immense wealth for Portugal. However, the strong Berber Saadian tribe, contrary to the Wattasid tribe, sought to expel all foreign interests from Morocco. Berber raids suddenly made the maintenance and defense of the coastal forts too costly for the Portuguese Crown, which desired to remedy the situation and thereby preserve its trading wealth.

The Hundred Years War for Morocco concluded in 1578, when King Sebastian of Portugal attacked the Saadian Dynasty's forces. Against the wishes of his uncle, King Philip II of Spain, and the advice of his primary Maghrebi ally, the Wattasid ex-Sultan al-Mutawakkil of Morocco, Sebastian landed at Larache with some eight hundred ships and seventeen thousand troops. Marching inland fifty kilometers to a desolate plain near Ksar-el-Kebir, the Portuguese forces encountered the Saadian Sultan Abd-al-Malik and forty thousand horsemen. Seven thousand Portuguese soldiers were annihilated, and Sebastian, al-Mutawakkil, and Abd-al-Malik were killed in what became known as "the Battle of the Three Kings." The expedition cost the Portuguese Crown over half of its annual budget, and the subsequent ransoming of troops drew every last cruzado from the families of Portugal. Because of this crushing blow, Portugal abandoned most of its Atlantic coastal fortresses, but managed not to cede its last possession, Mazagan, until 1769. Essentially, however, the Saadian Dynasty had succeeded in expelling all major uninvited foreign interests from Morocco.

In 1661, the Portuguese, who still controlled the south coast of the Straits of Gibraltar, gave Tangier to Charles II of England as part of the dowry of Catherine of Braganza. Unlike its predecessors, England was not interested in the goods from the interior of the African continent. Rather, it sought to protect India-bound ships and trade interests in the Mediterranean from the corsairs who plied the Barbary coasts. England invested considerable energy and money into colonizing Tangier, in order to "keep the place against all the world, and give the law to all that trade in the Mediterranean" (Sir John Lawson, Commander-in-Chief of the British Navy 1659-64) (fig. 5). However, in 1684, the city was aban-

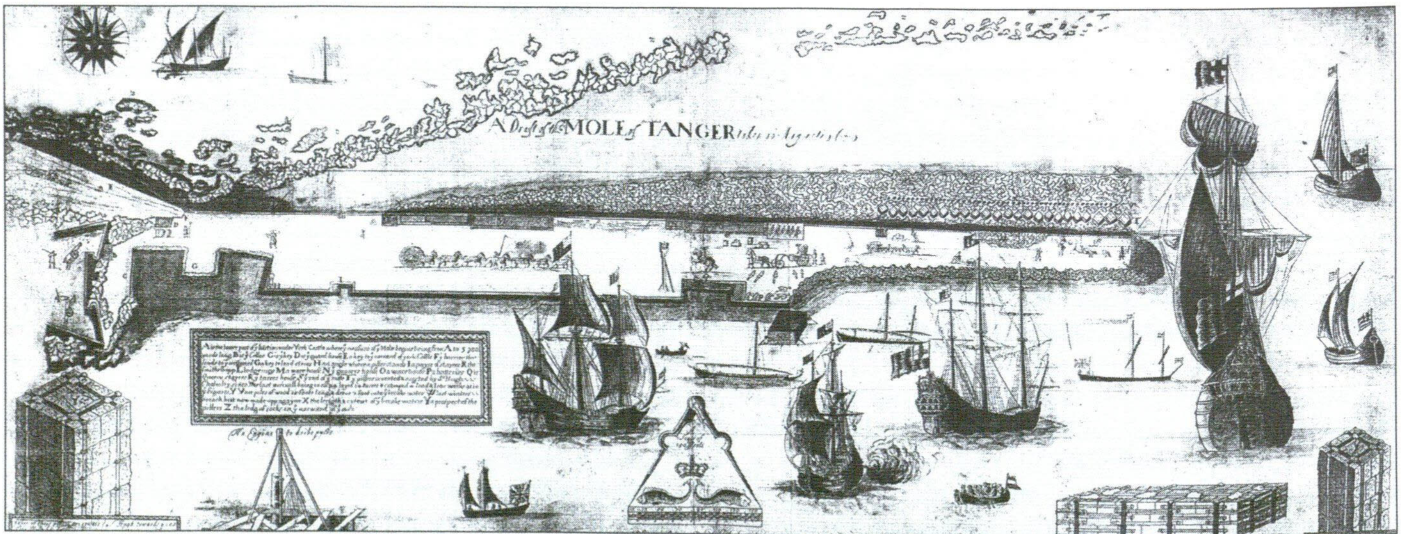


Fig. 5. *Wenceslaus Hollar's drawing of Tangier's wide mole built by the British during their brief occupation of the port. Looking north across the Straits, a portion of Tangier's fortified walls is visible in the left of the picture, as well as a detail of the mole's composite structure. From E. M. G. Routh, 1912.*

doned by the British due to constant and bloody Berber attacks on its garrison and citizens alike. When the British forces left, they razed the port's mole and city fortifications they had worked twenty years to build. As other European powers still sought Tangier as a trade and military port, the English did not want their competitors to profit from their toil. Eventually, Britain succeeded in occupying Gibraltar in 1704, from which it managed and continues to manage its Mediterranean interests.

The next century was a period of relative internal political stability for the region, but increased corsair piracy along Morocco's shores drew heavy criticism from practically all of Europe as well as the United States. Through collective international diplomatic action, Morocco was forced to end its piratical practices in 1818 and abolish the infamous Salé Rovers. However, piracy continued for decades on a reduced scale. Despite a brief respite from foreign attacks, Tangier was still the object of desire for competing powers. A French fleet unsuccessfully bombarded Tangier in 1844, and in 1860, a Spanish legion marching west from Ceuta was stopped from taking the city by a British fleet that had filled Tangier Bay.

In an attempt to prevent further foreign attacks on its shores, as well as to control internal strife, Morocco's Sultan offered the country as a protectorate to the United States in 1871. The U.S. refused. Finally, in 1912, France and Spain agreed to joint administration: France's protectorate was along the Atlantic coast, and Spain occupied the eastern section of the country, including the Tangerian peninsula. Tangier, due to its strategic location, was made an international free port, a position which rapidly brought immense wealth to the city. This political situation continued until 1956, when the protectorates were nullified with the emergence of the strong Cherifian dynasty, led by Muhammed VI since July of 1999.

Research Objectives and Methods

Despite the history of Morocco's coasts, underwater exploration of the region has been minimal. In the early 1960s, Jacques Cousteau discovered an almost complete Roman wreck at a depth of three hundred meters while surveying the Straits in a submarine for placement of an underwater pan-Gibraltarian pipeline. More scholarly but perfunctory underwater surveying around the Tangierian Peninsula also began at this time, conducted by Michel Ponsich, the former Inspecteur des Antiquités of Morocco. Ponsich's few publications of both terrestrial and underwater surveys and excavations, as well as historic documents and charts reviewed in the Tangier American Legation Museum's library, provided valuable information used in determining the focal areas of INA's survey.

The primary intent of the INA project was to identify ancient and historic shipwrecks and ship-related material along Morocco's Tangerian peninsular coasts through remote sensing, test excavations, and limited recovery of artifacts. The project's priorities were to identify specific geographical areas for their shipwreck potential and periods of historical significance. This required recording underwater environments (including currents, winds, and ocean bottom type), and determining the extent of preservation of any underwater shipwreck remains. Although a majority of the effort took place within the confines of Tangier Bay, Morocco's Gibraltarian and northern Atlantic coasts were also examined.

The survey's operations were based on RV *Robo*, INA Director George Robb Jr.'s twenty-meter Hatteras yacht. Outfitted for maritime archaeological surveying and diving, *Robo* was docked at the Tangier Yacht Club's marina in the Port of Tangier. In addition, a five-meter RIB-Novurania, a rigid-hulled inflatable boat, was used to conduct separate dive operations in Tangier Bay. INA Director George Robb, Jr., INA members Brett Phaneuf (Project Director), Stefan Claesson (Project Archaeologist), Athena Trakadas (Divemaster and archaeologist), as well as the crew of *Robo*, all participated as divers on the survey. Complimenting the team were the survey's Moroccan members: Drs. Elarbi Erbati and Abdelatif Elboudjay (INSAP), several Moroccan navy divers, and a local Tangierian coral diver. Brett Phaneuf and George Robb, Jr. operated the remote-sensing equipment.

The general approach to the survey was two-fold: remote sensing equipment (including a side-scan sonar, magnetometer, and gradiometer) was first used to map the ocean floor and identify potential shipwreck sites. Divers then performed underwater surveys or small test excavations in order to determine the significance of the anomalies detected through remote sensing. Areas in which it proved too difficult to operate remote-sensing equipment were examined solely by visual surveys. Sites previously identified by the surveys of Ponsich, and other potential sites found by local apnea divers (breath-holding free divers) were examined first, when possible. In order to document and map more effectively the anomalies and sites, the coastline was divided into distinct geographic sections. Artifacts subsequently recovered were catalogued by region, specific site identification, and assigned artifact number (e.g., LEO-021-01). An unused portion of the Tangier Kasbah Museum (which occupies the site of the city's Roman baths) served as a laboratory space for the project. Artifacts recovered on dives were catalogued, conserved, documented and stored here, and continue to be maintained by the museum staff.

Throughout the survey, several types of remote sensing equipment were used. Initially, a MarineSonics side-scan sonar was used to provide an image of the ocean bottom, while a Geometrics prototype port/starboard tandem gradiometer was towed with the sonar in order to detect magnetic anomalies. This towing arrangement was very effective in providing real-time images of the ocean floor on a computer screen while at the same time displaying magnetic variations detected by the gradiometer on an adjacent screen. The visual image, combined with the magnetic signature of an anomaly, aided in the immediate determination of potential underwater sites and dive locations.

The effectiveness of this system was offset by the cumbersome simultaneous deployment of three tow fish and cables. This difficulty, and initial operational problems with the gradiometer's computer software application, led us to abandon the system for a MarineSonics "MagScan" side-scan sonar and magnetometer coupled into a single tow fish. This system was wholly sufficient for our survey, and produced essentially the same results as the separate gradiometer and sonar, but was slightly less sensitive and accurate in the mapping of magnetic anomalies.

After initial remote sensing data was collected, subsequent diving surveys were conducted in pairs, and all dives were done on Nitrox—an oxygen-enriched breathing mixture allowing longer dives. When examining an identified "hit," marked by D-GPS (differential Global Positioning System), marine metal detectors were used. These were particularly useful when the anomaly in question was buried under the sea floor (fig. 6). Contact with *Robo* was maintained by diver-to-boat remote intercom, which in light of the strong prevailing currents and tidal surges typical of the region, assisted in maintaining the safety of the survey's dives.

Photo: M. Claesson

Fig. 6. *Athena Trakadas, left, and RV* Robo *crew member Craig Jones, right, prepare to dive with marine metal detectors on a remote sensing "hit" in Tangier Bay, while captain Cristian Swanson looks on.*

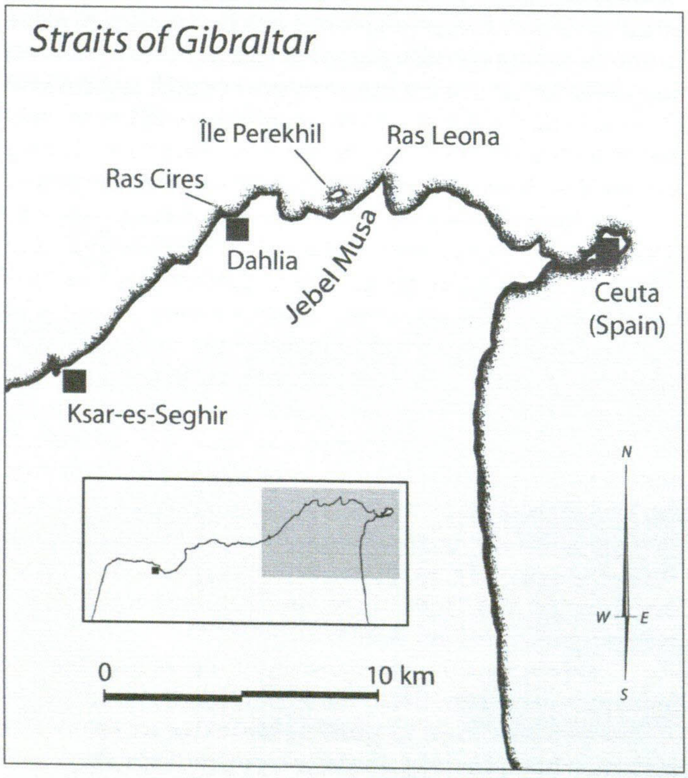


Fig. 7. *The survey regions of Ras Leona, Île Perekhil, and Ras Cires (Dahlia) in the Straits of Gibraltar.*

Survey Regions

Ras Leona and Île Perekhil: The easternmost survey region was designated as Ras Leona and Île Perekhil in the Straits of Gibraltar (fig. 7). Ras Leona is a promontory that forms the seaward extension of Jebel Musa, the highest peak on Morocco's northern coast and sometimes identified as the southern column of the Pillars of Herakles (the other candidate being Monte Hacho at Ceuta). In the shadow of Jebel Musa and 1.5 kilometers due west of Ras Leona, is Île Perekhil, the sole island in the Straits. The island is difficult to see upon approach, as its own sheer cliff face blends in with the topography of the surrounding mainland. A narrow but shallow channel on the leeward side of the island is an ideal spot for ships to anchor and wait for favorable winds in the Straits. It is one of the few spots along the coast where a vessel can remain hidden from sight. These neighboring sites are isolated, and the area's remote location seems to have deterred any coastal development or major disturbance of the underwater sites investigated.

A dive reconnaissance was first conducted at Ras Leona's point. This revealed the most interesting underwater environment of the survey project. Unusual rock pillars and

Photo: A. Trakadas

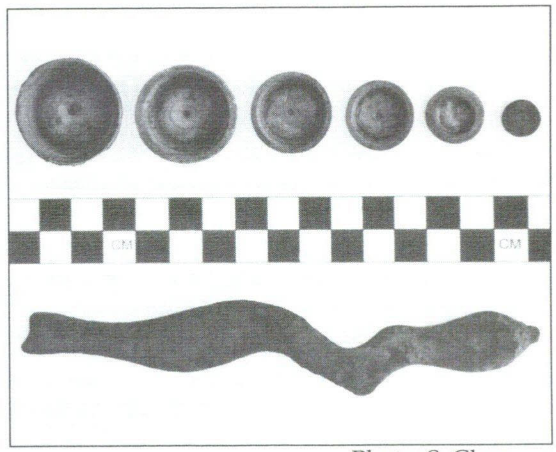


Photo: S. Claesson

Fig. 8 (left). *One of the cannons from the late-eighteenth or early-nineteenth century British shipwreck at Ras Leona.*

Fig. 9 (right). *Set of nested weights (top) and firearm side-plate (bottom) from the British shipwreck at Ras Leona.*

large boulders at this promontory, as well as good visibility and active marine life, made for an interesting survey of the site of a shipwreck identified as a late eighteenth or early nineteenth-century British ship-of-the-line. Scattered amongst rocks on a very steep cliff face and extending beyond thirty meters depth, were approximately twenty-five to thirty large cannon, 3.15 meters long with bore diameters of fifteen centimeters (fig. 8). The recovery of a set of nested weights and a serpentine-shaped firearm side-plate marked with a British "Broad Arrow" verified the nationality of the shipwreck (fig. 9). However, due to the underwater topography and depth of the site, no hull remains were located during our investigation. Archival research indicates that this most likely is the shipwreck of the HMS *Courageux*, which sank in 1796. The 74-gun vessel broke its moorings at Gibraltar, drifted south across the Straits, and eventually foundered at Ras Leona.

Île Perekhil was the site of a British observation outpost during the World Wars. No terrestrial survey was conducted. However, a deteriorated cement dock on the island and numerous late nineteenth and early twentieth-century stoneware beer bottles (stamped "Gibraltar") found scattered in the surrounding waters testify to its recent occupation. A World War II British naval vessel reportedly had wrecked in the narrow channel that separates Île Perekhil from Ras Leona. However, as the wreck site is purported to be at sixty meters depth, and therefore beyond the dive limits of our survey, its exact location was not confirmed.

At the western tip of Île Perekhil, between the island and a small rock pinnacle that is exposed at low tide, a Roman shipwreck was discovered in the 1960s. Our first reconnaissance dives immediately located many pottery fragments scattered to a depth of thirteen meters. Numerous coarseware body sherds and a few small, worn rim fragments were found, but none very large or clearly diagnostic to lend themselves to certain identification. Several two-handled jars with a cylindrical body, long rod-like handles, and a short spike—similar to Dressel 1A amphoras, but possibly of local manufacture—were previously recovered here in the 1960s. Although these suggest a *terminus post quem* of the mid-second century BCE for the wreck, no similar types were found during our survey. The underwater accumulation of rocks and boulders at the base of the island's western cliff face indicated that some artifacts might have been gradually covered by rockslides.

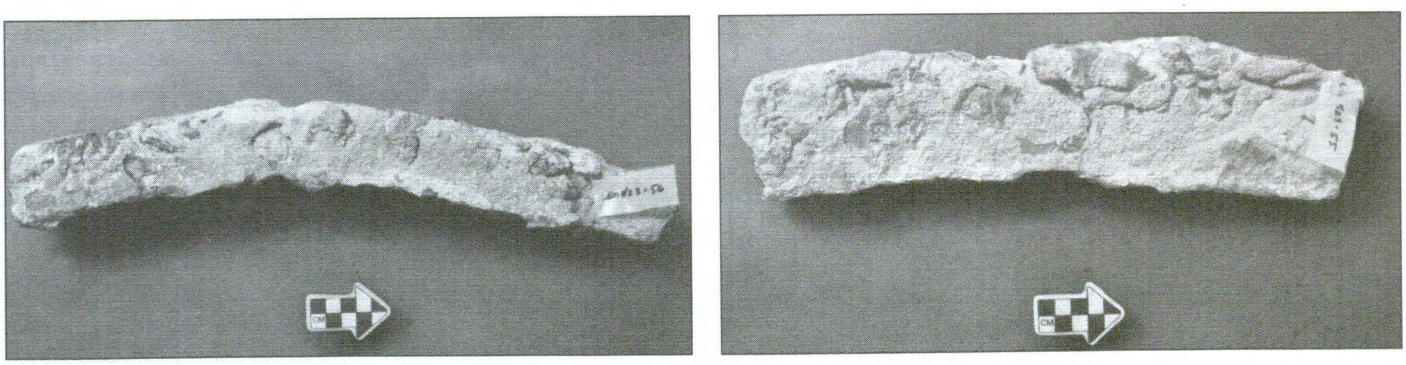


Fig. 10. *The two complete lead bars with quartz inclusions found off Île Perekhil: the larger piece viewed from above (left); the smaller, wider piece in profile (right).*
Photo: S. Claesson

Despite the lack of diagnostic ceramics, two complete and one partial small lead bars with numerous quartz inclusions were recovered (fig. 10). The two complete pieces differ in size and shape, although they are generally rectangular in profile and slightly curved throughout their length. They are similar in shape to Type II anchor stock cores, but their non-trapezoidal sections and lack of distinguishing features suggest that they do not belong to an anchor. However, their shape and quartz inclusions also make identification as lead ingots tenuous.

Ras Cires (Dahlia): Five kilometers to the southwest of Île Perekhil, the fishing village of Dahlia encircles a small bay adjacent to the rocky promontory of Ras Cires (fig. 7). The shallow bay, although exposed to the prevailing westerly current and the occasional westerly winds of the Straits, might have been attractive to ships in search of a slightly protected anchorage along the formidable coast. During our initial attempts to anchor here, we noticed submerged rocks just off the point of Ras Cires, and postulated that these might have caused problems for unsuspecting ships.

Midway through the survey season, subsiding currents and a slack tide allowed us to conduct dives from *Robo* around the submerged rocks off the Ras Cires promontory. During the initial dives, a few scattered, very coarse amphora rim fragments, as well as some glazed and incised late Islamic pottery sherds (ca. sixteenth century) were collected. Many iron fasteners (approximately twenty centimeters in length) were also found, as well as fragments of copper-alloy sheeting, which may have belonged to an early nineteenth-century ship that had foundered on the rocks. Further dives, however, revealed no more material, but the surrounding sandy sea floor was not investigated thoroughly.

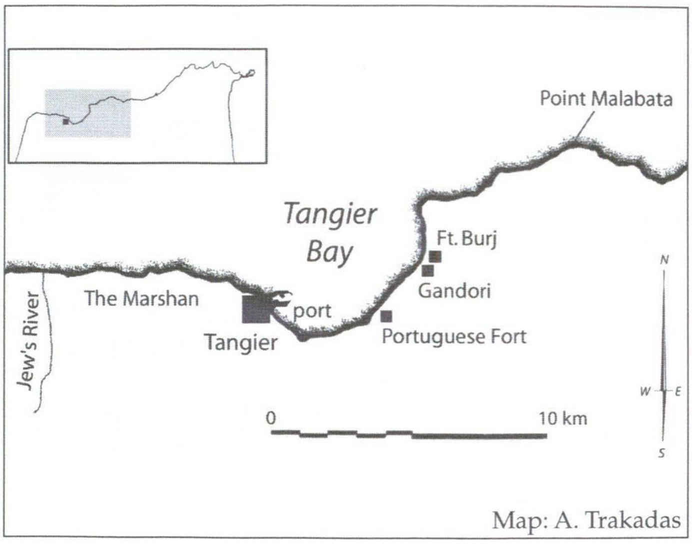


Fig. 11. *The survey regions of Point Malabata, Tangier Bay, and the Marshan.*

Point Malabata and Environs: When remote sensing was a priority with *Robo*, diving reconnaissance in and around Tangier Bay was conducted from the five-meter RIB-Novurania, with assistance from the Tangier Gendarme's boat. With the more maneuverable and lighter craft, we took the opportunity to survey areas in which it was difficult for *Robo* to operate; therefore, we focused upon the transitional waters at the east entrance of Tangier Bay to Point Malabata in the Straits (fig. 11). When we surveyed the area, we decided that although the several hundred-meters-long, sloping rock shelves are oriented north-south underwater, the strong westerly current of the Straits dictated drift dives east along the coast. Our survey team felt that these topographical and hydrographical factors, in addition to the site's proximity to Tangier Bay, might have caused some vessels to founder here; however, after several days of investigation, we failed to locate any shipwreck material.

Photo: A. Trakadas

Fig. 12. *View of the port of Tangier looking east to Point Malabata from the* kasbah.

Tangier Bay: Survey work in Tangier Bay itself, although appealing, proved difficult because of natural and human produced environmentally restrictive factors. As Tangier is the main working port of northern Morocco, marine traffic is heavy, including large car ferries that sail hourly between Spain and Tangier, Moroccan Navy vessels, and numerous fishing and large cargo ships (fig. 12). Small-scale fishing activity within the confines of the bay also hampered the survey, and on one occasion, a poorly marked fishing net was caught in *Robo's* propellers.

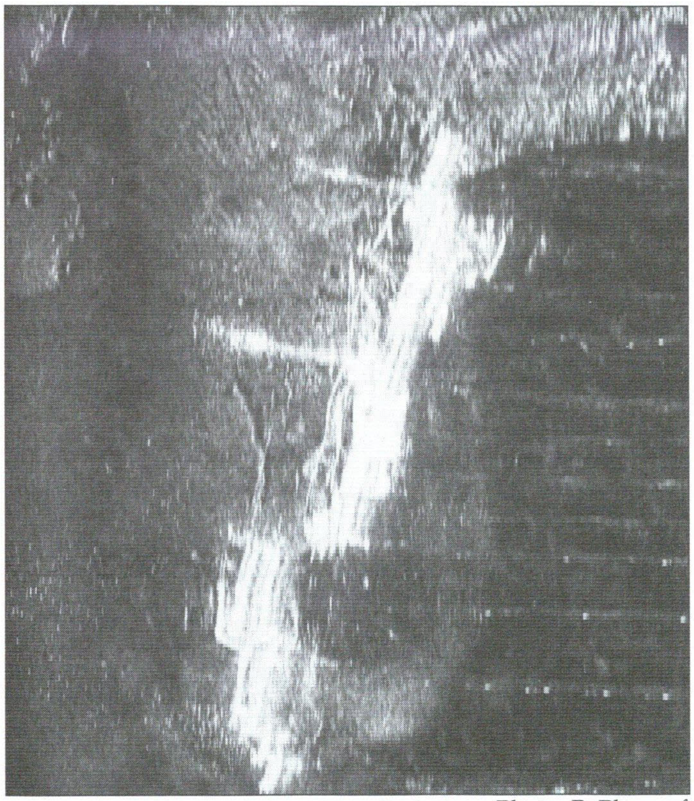
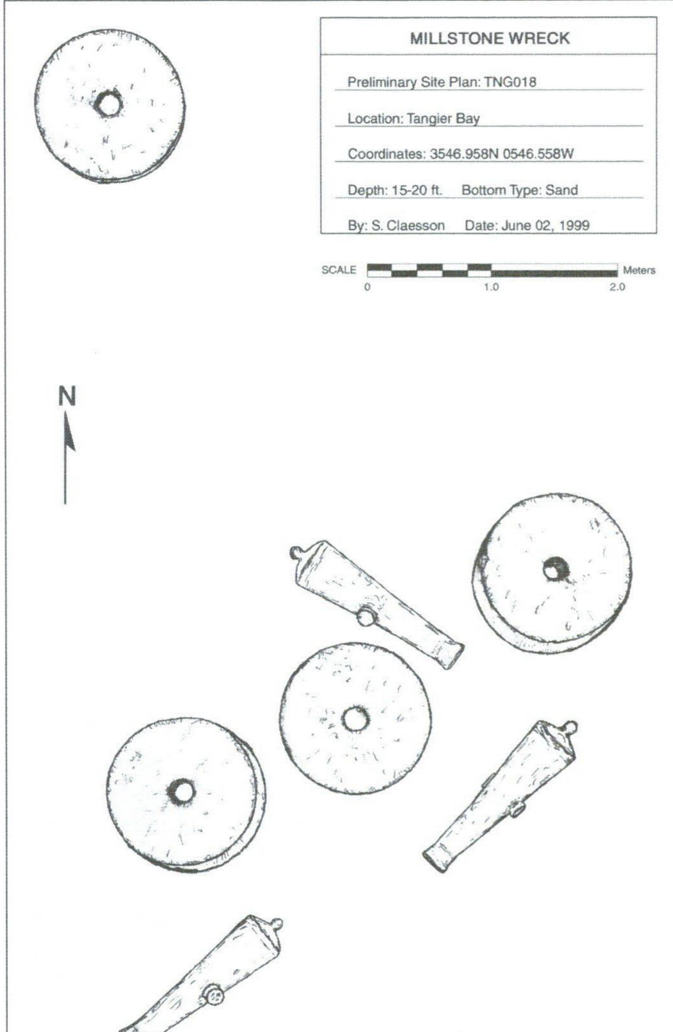


Photo: B. Phaneuf

Fig. 13. *Sonar image of the "Cement Wreck" at the entrance to Tangier's port.*

Fig. 14. *Plan of the "Millstone Wreck" in Tangier Bay.*

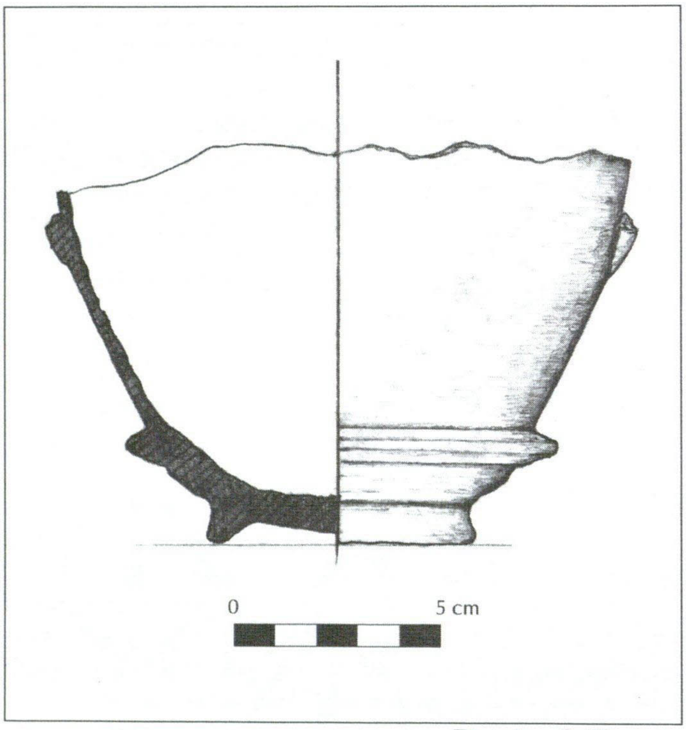


Drawing: S. Claesson

The seafloor of a large portion of Tangier Bay is sandy, particularly near the southern shore and areas that are close to watershed outlets. Most of the rivers that flow into the bay are impeded by waterfront development and are now nothing more than small, perennial streams. Nevertheless, sediment transport and deposition within the bay are still dramatic due to the Atlantic current entering the western Straits. At the east and west sides of the bay, the seafloor transforms from sand to large sporadic rock outcrops covered with kelp. In addition, numerous cables and pipelines cross the bottom of the bay. These factors greatly inhibited the correct interpretation of the remote sensing data.

Just at the entrance to the port, we initially tested our remote-sensing equipment on the wreck of a modern cargo ship that had been overloaded with its freight of cement (fig. 13). This wreck, along with that of a German U-boat, and another modern cargo ship that ran aground near Cap Spartel, reminded our survey crew of the difficulties still experienced by modern vessels in and around the Straits.

One of the first sites examined by the survey team was a known historic shipwreck in the southeastern shallows of Tangier Bay, almost directly in front of a late-fifteenth-century Portuguese fort (fig. 11). Local Moroccan apnea divers helped locate this shipwreck site, of which four millstones and three cannon were visible (fig. 14). This very shallow site (five meters maximum depth), called the "Millstone Wreck," was contaminated with a great deal of modern debris, and the strong tidal surge continually stirred up the sandy bottom during the documentation dives. Many iron concretions were discovered during the brief investigation, but only a few glazed red-ware sherds and small ballast stones were recovered from the wreck site. Since neither hull fragments nor diagnostic artifacts were found that could help identify the vessel's nationality or period of use, the light armament can only suggest a tentative date of the first half of the nineteenth century for



Drawing: S. Claesson

Fig. 15. *The fourteenth-century glazed Islamic bowl found in the eastern shallows of Tangier Bay.*

Fig. 16. *The stone anchor recovered in front of the mole of Tangier.*

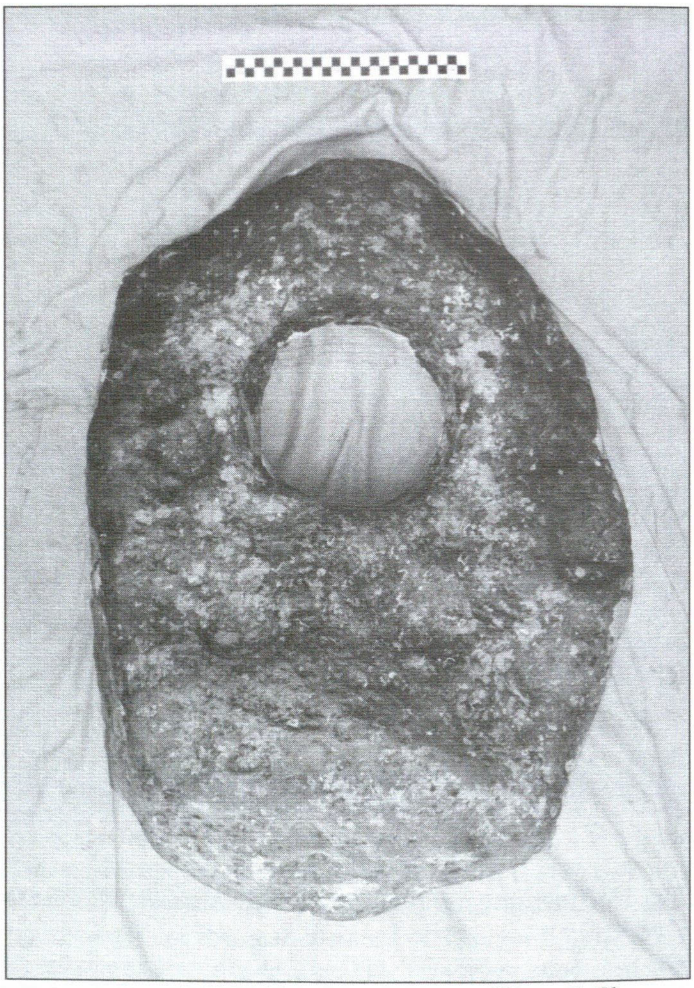


Photo: S. Claesson

their manufacture. Apparently, we were fortunate to catch a glimpse of this site, as the constantly shifting sands of the bay usually keep it covered.

One kilometer to the northeast of the "Millstone Wreck" site, local apnea divers claimed the existence of another shipwreck. The prospective area was just off-shore from the site of a late Roman (ca. third century CE) *centenarius* called Gandori. Two scattered wrecks, identified as a second-century BCE Graeco-Italic wreck and a first-century CE Roman Baetican wreck, were reported in the general area by Ponsich in 1964. Although sonar runs and several diving surveys located no artifacts in the immediate area, further offshore, in fifteen meters of water, remote sensing data indicated an anomaly approximately fifteen meters long and four meters wide. After divers measured a baseline through the long axis of the anomaly, small test trenches were dug at two-meter intervals in the sandy bottom. In the middle trenches, a large scatter of burnt animal bones, mainly goat, was found immediately below the surface. Amongst these fragments, a nearly complete, fourteenth-century Islamic bowl with white-slip exterior was found (fig. 15). Further test trenches revealed no more artifacts but a large metal pipe, which most likely had caused the remote sensing equipment to register the large anomaly.

The eastern shore of Tangier Bay, often labeled as "Old Tangier" on historic maps, was surveyed first by foot. Here, a small Portuguese tower called Fort Burj is located just north of the Roman *centenarius* site of Gandori, and further north along the shore, directly facing Tangier, is another small installation that has now subsided into the sea. The site consisted of a low brick wall and at least five cannon, three of which bear the casting mark, "Trafalgar 1777" (see cover). A lone cannon was found half a kilometer further north in a few meters of water, but no other ship-related material was present in this area.

The Marshan: The survey also investigated the western approach to Tangier Bay (fig. 11). This area included, from east to west, the seaward face of the port's modern mole, the area directly in front of the *kasbah* on the Marshan plateau, and the region known as Jew's River (where several bloody battles between the English and Berbers were fought in 1662 and 1682). Since the port, as well as a series of artificial moles, has been in the same location since historic and possibly ancient times, expectations of locating ship-related material were high. During a drift dive in front of the mole, a large (approximately thirty-five kilogram) single-holed stone anchor was located at a depth of seventeen meters and recorded in situ. Two more similar, single-holed stone anchors were subsequently located in the same area and recorded. One was recovered and is now at the Kasbah Museum (fig. 16). Although a few small, irregularly-shaped, single-hole stone anchors have been found in the waters around Ceuta, these larger, regular types correspond more closely to several examples found off the southern and eastern Iberian coasts.

In the same vicinity as the stone anchors, a dive to investigate a remote-sensing anomaly located a medium-sized lead anchor stock (fig. 17). This stock was recovered and transported to the Kasbah Museum for conservation and documentation. Simple in design, with a crossbar in the shaft hole, the lead piece is a fine example of a Type IIIC anchor stock. The medium size stock (1.15 meters long) is of a type that was widely used in the western Mediterranean in antiquity. Similar finds are distributed off the shores of Italy, Tunisia, France, both the Atlantic and Mediterranean coasts of Spain, Portugal, as well as near Ceuta. However, since the stock lacks inscription or decoration and is an isolated find, only a broad date from the mid-second century BCE to first century CE can be assigned to the artifact.

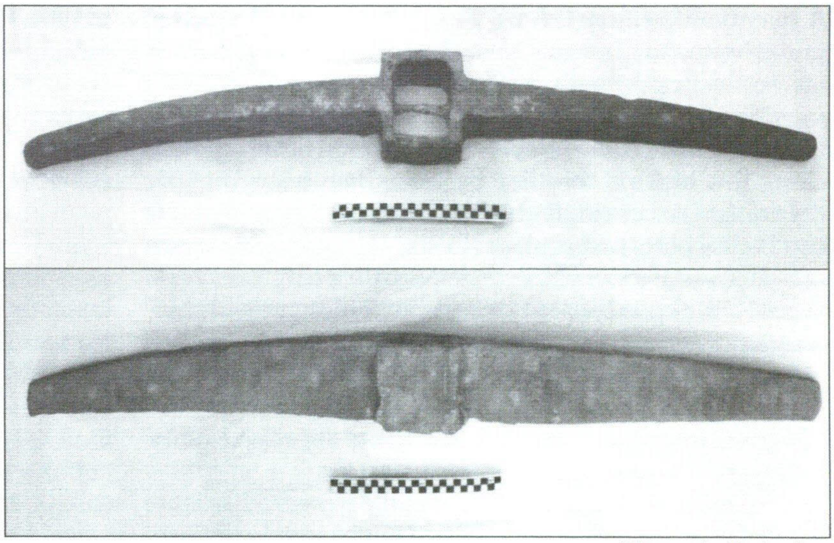


Photo: A. Trakadas

Fig. 17. *The Type IIIC lead anchor stock found in front of the mole of Tangier.*

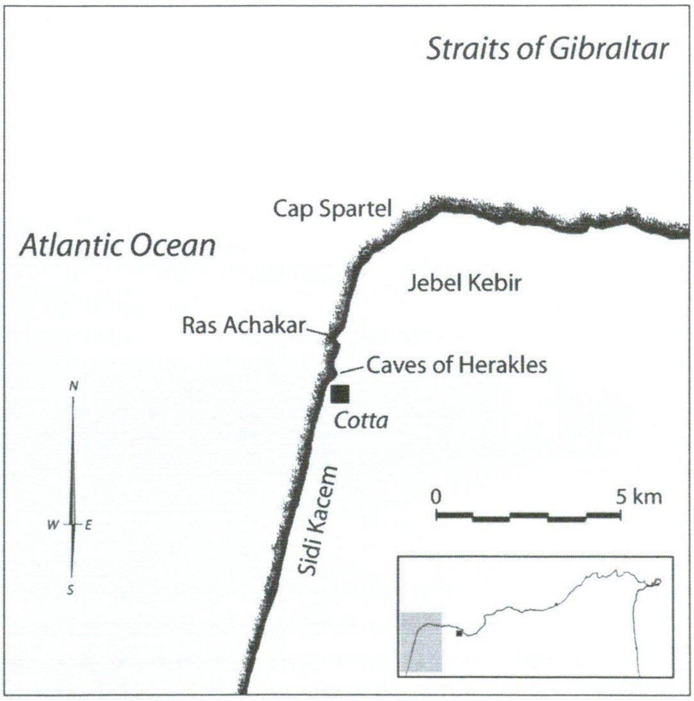


Fig. 18. *The Atlantic coast survey region.*

Cap Spartel and the Atlantic Coast: Cap Spartel, called *Ampelusium* (Cape of the Vines) by the Romans, and identified as *Soloeis* in Hanno the Carthaginian's *Periplus*, is the promontory that separates the Atlantic Ocean from the Straits of Gibraltar (fig. 18). The large rock plateau that forms this northwestern-most promontory of Africa, called Jebel Kebir, extends for several kilometers along the Atlantic coast south of Cap Spartel. Ras Achakar, the site of the earliest Phoenician tomb excavated in Morocco (dated to the late eighth century BCE), marks the southern extent of Jebel Kebir. It is along the southern face of this plateau that the first Phoenician colonists settled in Morocco. From Ras Achakar, a sandy beach extends south to another rock bluff above the sea, the so-called "Caves of Herakles." The natural caves in this bluff were first occupied during the Paleolithic era, and were in use almost continually. Most recently, they were a quarry for millstones during the last century.

Adjacent to the bluff of caves, but separated by a small perennial stream, is the archaeological site of Cotta. This was originally a murex-dye installation built on the beach by the local Phoenician population during the fourth century BCE. Cotta was modified at the beginning of the second century CE into a standardized Roman *garum* and *salasmenta* production center, complete with its own temple and residential quarters. After the Romans refurbished it, Cotta was comparable in size and production to Lixus, further to the south on the Atlantic coast.

It was quickly apparent from the numerous ship timbers scattered along the wide beach of Sidi Kacem, south of Cotta, that there is a very high probability of shipwrecks buried beneath the sands of Morocco's Atlantic shoreline.

A twentieth-century fishing vessel and a second wooden mid-nineteenth century vessel, approximately twenty meters in length, with internal iron banding and heavy framing, were located during a low tide survey of the beach.

Several other modern wrecks have been reported along this historic coastline by tunny-fish boats that ply the waters. Accordingly the first dives of the survey were conducted here. Just south of Cotta, offshore of the beach of Sidi Kacem, a steel-hulled vessel with a cargo of World War II-era jeep axles provided our first glimpse of a shipwreck in Moroccan waters. Interestingly, fragments of an older, wooden ship were discovered beneath the modern hulk; determining the date and nationality of the older site, however, was obviously hindered by the deposition of the more modern wreck.

Dives were also conducted in the waters adjacent to the Caves of Herakles and Cotta. Unfortunately, investigation offshore of these two rich terrestrial archaeological sites revealed nothing more than large quantities of modern fishhooks and line sinkers. The active sediment transport might contribute to artifacts being easily buried under the sandy seafloor; however, as the area is popular with beach-goers and local fishermen, smaller artifacts can be easily removed.

During the last week of our survey, we decided to investigate a shipwreck just at the point of Cap Spartel on the Atlantic coast, reported by Ponsich to contain forty lead ingots, dated to ca. 100 BCE–50 CE. The waters here, however, proved too treacherous for us to investigate, so we instead anchored between Cap Spartel and Ras Achakar, in the hopes that the submerged rock outcrops might reveal some shipwreck related material. At the base of the promontory Ras Achakar, a scatter of "Roman period" amphoras exposed at low tide were reported by Ponsich in 1964. During our survey, no trace of ceramics was found around the rocks, above or below water.

However, earlier remote-sensing information from the area indicated metallic anomalies clustered several hundred meters offshore. Here, a large rock outcrop, approximately five hundred square meters, protrudes above an otherwise sandy sea bottom. Five Type IIIC lead anchor stocks (similar to the one recovered in front of the Tangier mole), two sets of Type IIA lead cores for wooden anchor stocks, and one isolated lead anchor collar were discovered. These were concentrated along the north side of the outcrop at twenty-five meters depth, and amongst many modern anchors. One set of the Type IIA lead anchor cores and the lead collar were recovered and documented, and are now in the Kasbah Museum (figs. 19 and 20).

The Type IIA lead cores are the earliest pieces, now known from the Tektaş Burnu excavation to have been in use in the eastern Mediterranean as early as the third quarter of the fifth century BCE (see *INA Quarterly* 26.4, 9). The Type IIIC anchor stocks, like the one previously recovered by the survey, suggests a *terminus ante quem* of the end of the first century CE. These ancient anchor parts indicate that the rock outcrop was possibly an anchorage for ships associated with the site of Cotta, or even with settlements in the vicinity of Ras Achakar. The strong northerly current here—our three-minute dive safety stops on the anchor line were conducted in a horizontal position— combined with prevailing northerly winds, also suggests an anchorage for ships waiting to enter into the Straits of Gibraltar. The distribution of historical and modern anchors in the area confirms that these transitional waters still affect many ships.

Fig. 19. *One of the lead cores from a Type IIA anchor stock pair recovered near Ras Achakar.*

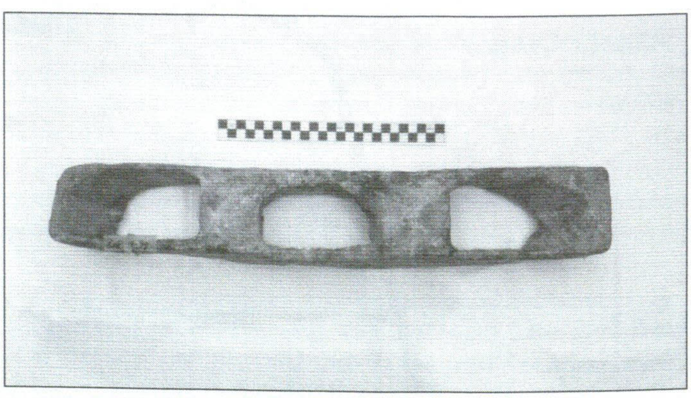


Fig. 20. *The lead anchor collar found near Ras Achakar, recovered from the site that came to be known as the "Roman anchor farm" by our crew.*

Photos: A. Trakadas

Conclusion

Even though preliminary in nature, the 1999 INA survey of Tangier Bay and the Tangerian peninsular coasts of Morocco did not disappoint in revealing the magnitude of the region's varied maritime history. The artifacts recovered or surveyed by the project reflect that these waters had considerable significance in the Roman, Islamic, Portuguese, and British maritime quests for control of the region's trade. They also testify to the region's significance as a major passageway between the Mediterranean Sea and Atlantic Ocean.

By conducting many kilometers of remote sensing runs in and around Tangier Bay, and by diving on a majority of sonar and magnetometer "hits," we were able to establish a general and relatively clear picture of local maritime history. The survey allowed us to determine which areas have had continuous or isolated significance during ancient and historical times. The promising survey areas warrant more rigorous investigation in the future. We can defer working in areas relatively devoid of shipwrecks and ship-related materials.

Since Ponsich's pioneering but only cursory underwater investigations some thirty years ago, the INA survey in 1999 was the first systematic underwater investigation in Moroccan waters that also included remote sensing. The enthusiasm shown by the Moroccan archaeological authorities of INSAP, despite their current lack of resources, promises future cooperation and survey possibilities, not only in the Tangier region but elsewhere. The maritime archaeological potential that awaits the country is prodigious.

Acknowledgments: The 1999 INA survey would not have been possible without the cooperation and support of our hosts, the Kingdom of Morocco and INSAP. Our deepest gratitude is expressed to them and their archaeological representatives, Drs. Elarbi Erbati and Abdelatif Elboudjay. The Tangier Gendarmerie and the always-cooperative Moroccan divers who participated in the project—Benzekri, Rashid, Ahmed, and Ahmed Meshbahi—all made working in Tangier with its idiosyncrasies much easier. Additionally, the crew of *Robo*—Cristian Swanson, Craig Jones, and Kevin Milligan—admirably navigated the Moroccan waters, worked the remote sensing equipment, and dived at a moment's notice. Many people assisted in the terrestrial logistics of the project. Dr. Muhammed Habibi, director of the Tangier Kasbah Museum, generously furnished an exotic location for a conservation lab and a final home for all the recovered artifacts. The staff of Hotel Chellah cheerfully tolerated the crew's extended residence for over three months. Thor and Elizabeth Kuniholm, directors-in-residence of the Tangier American Legation Museum, repeatedly provided us with not only a breath-taking, *kasbah* roof-top view of the Straits, but also inestimable and lucid advice about working in Morocco. They also allowed access to the Legation Library's materials that proved invaluable in making this survey work. Patrick Lize's archival research for the RPM Nautical Foundation regarding HMS *Courageux* was also very helpful. Most especially, however, we would like to extend thanks to INA Project Director Brett Phaneuf, who conceived the project, and then worked several years in establishing the contacts instrumental to its success, and to INA Director George Robb, Jr., who not only lent financial support, the boat, and diving equipment, but also was above all completely dedicated to the project. *M'saha!*

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The 2000 Reconnaissance Project in Butrint, Albania

Elizabeth Greene
INA Research Associate

Illyrian woodlands, echoing falls
Of water, sheets of summer glass
The long divine Peneian pass,
The vast Akrokeraunian walls...

Tennyson, *To E.L.,*
On his travels in Greece

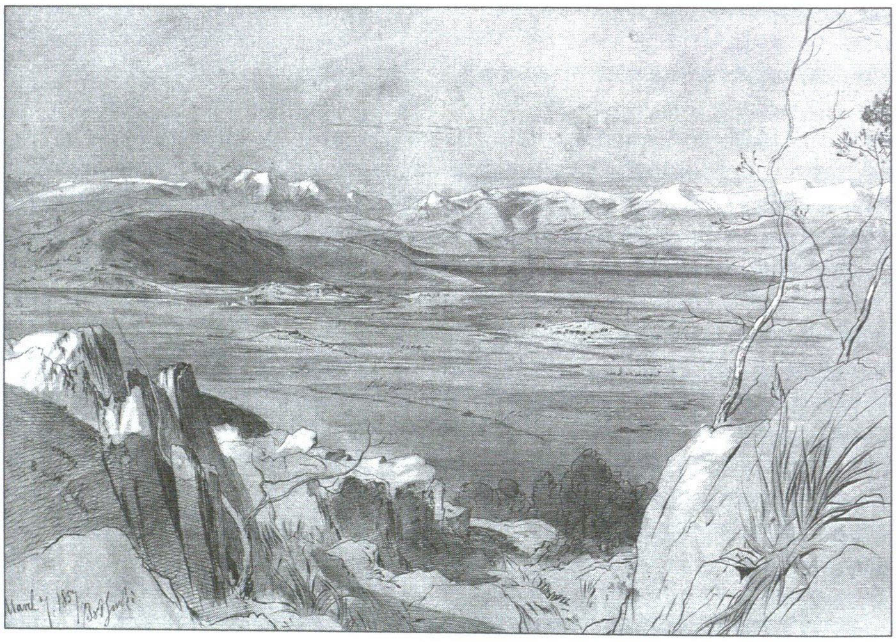


Fig. 1. *Edward Lear watercolor of Butrint dated March 7, 1857 (courtesy of the Butrint Foundation).*

Following in the footsteps of E.L.—Edward Lear, who painted the scenic region around Butrint in 1857—the Institute of Nautical Archaeology (INA) recently conducted a brief reconnaissance of the area (fig. 1). The project was included in the protocol for the Anglo-Albanian excavations of the Late Antique and Byzantine phases at Butrint. It had three primary goals: to support the Byzantine Butrint project by investigating underwater areas of archaeological interest to the team, to investigate reported shipwreck sites and artifact scatters in the coastal region from Dema Wall to Cuka e Aitoit, and to determine the logistics for future underwater survey efforts in this area (fig. 2).

INA had long planned to work in Albania, and had scheduled an initial survey in 1996. Political troubles in the region prevented this, as well as the possibility of INA's return to Albania until June 2000. The current stability of the country bodes well for future research. Our only trouble came from fishermen using dynamite, who occasionally confused the bubbles from our scuba equipment with those of the fish they sought. A surface snorkeler solved this problem easily. All other arrangements—from the acquisition of permits to the identification of survey locales—were organized with the assistance of Auron Tare, the current director of the Butrint National Park.

The Historical Significance of Butrint

Designated by UNESCO in 1997 as a World Heritage Site in Danger, Butrint served as a critical Ionian port throughout antiquity (fig. 3). According to legend, the Trojan Helenus, son of King Priam, founded the city in the twelfth century BCE when he sailed westward after the fall of Troy. Land excavations reveal pottery dating to the eighth century BCE, when the local Chaonian tribes controlled the port.

By the seventh or sixth century, Corcyra (modern Corfu) ruled Butrint, which provided access for the islanders to a trading port on the mainland. During the fourth century, the port town was developed into a larger urban center, with an expanded harbor, fortified acropolis, sanctuary, theater, and agora. A few centuries later, the Illyrian conquest of Corfu and the coastal region around Butrint effectively blocked Roman access to the Straits of Corfu. The impact of this conquest on Roman trade with the East led to an immediate reaction; in 229 BCE the Romans took Butrint and Corfu, freeing the seas from Illyrian piracy.

In Roman times, the coast of modern-day Albania served as the site of various battles between Julius Caesar and Pompey during the civil wars. Caesar himself describes being shipwrecked in a storm while sailing along the Acroceraunian Mountains on the coast north of Butrint. After the civil wars, the city was developed as a colony for the veteran soldiers of Caesar. Butrint was expanded with an aqueduct, baths, and enlarged harbor. Due to its position as a vital way station for journeys and trade by land and sea, it continued to prosper under Roman and Byzantine rule.

Archaeological evidence suggests a gradual abandonment of the city during the sixth and seventh centuries CE, but by the ninth century, literary sources show Butrint under Byzantine control. In 1084, the Normans led by Robert Guiscard tried to seize Butrint, but were defeated in a large-scale naval battle in the bay. Over the next few centuries, control over Butrint, Corfu, and the straits that separate the mainland from the island switched hands frequently. The most notable struggles were those between the Venetians and Ottoman Turks in the fifteenth through eighteenth centuries, which culminated in the rise of Ali Pasha of Tepelene.

Fig. 2. *Southern Albania from the Dema Wall to Cuka e Aitoit, the parameters of the 2000 reconnaissance project (after Ceka 1999).*

Ali Pasha's castle at the mouth of the Butrint channel stands as a marker of the final stage in Butrint's active history.

The nineteenth and early twentieth centuries brought a series of British hunters, travelers, and artists, including Edward Lear, as well as the beginning of archaeological research in the region by Albanian and Italian teams. Currently, an Anglo-Albanian team directed by Dr. Kosta Lako and Prof. Richard Hodges is carrying out excavations on the Late Antique and Byzantine phases of Butrint. At the same time, the site of Butrint and its environs are being developed and preserved as a National Park under the management of Auron Tare.

Concerned with the preservation of the cultural heritage of Butrint on land and sea, Tare invited INA to return to Albania in the summer of 2000. To this end, a small team of INA archaeologists visited Butrint and Saranda with plans to investigate the evidence for seafaring activity in Butrint and its surrounding coastal areas. Our aim was to obtain a preliminary sense of the region and to determine the logistics for future research.

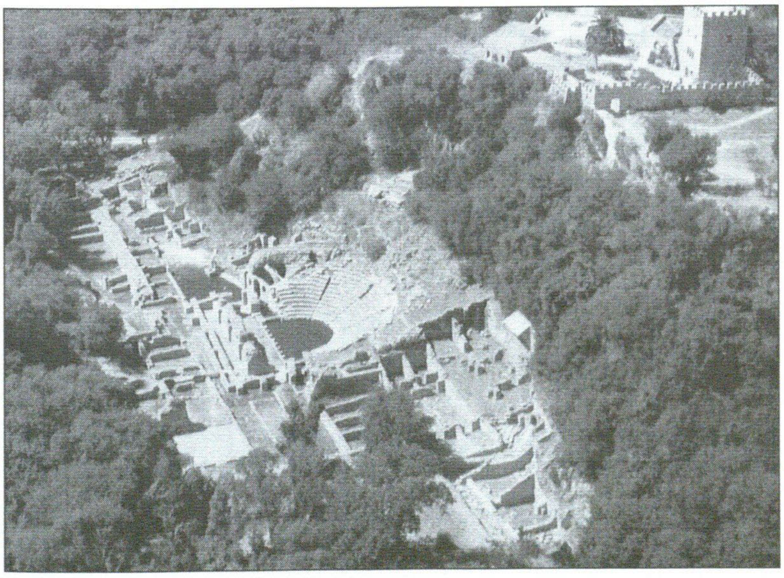


Fig. 3. *Aerial view of the land site of Butrint (photo courtesy of the Butrint Foundation).*

Butrint and the Southern Coast

In late May, project Divemaster Dick Rinkes and I flew into Tirana where we were met by Dr. Iris Pojani, a representative of the Albanian Ministry

Photo: E. Williams

Fig. 4 (above). *Saranda in modern Albania served as the base for an investigation of ancient Albania.*

Fig. 5 (right). *Auron Tare, Dick Rinkes, and Eli Williams prepare to investigate one of the areas along the coast south of Butrint identified by local fishermen.*

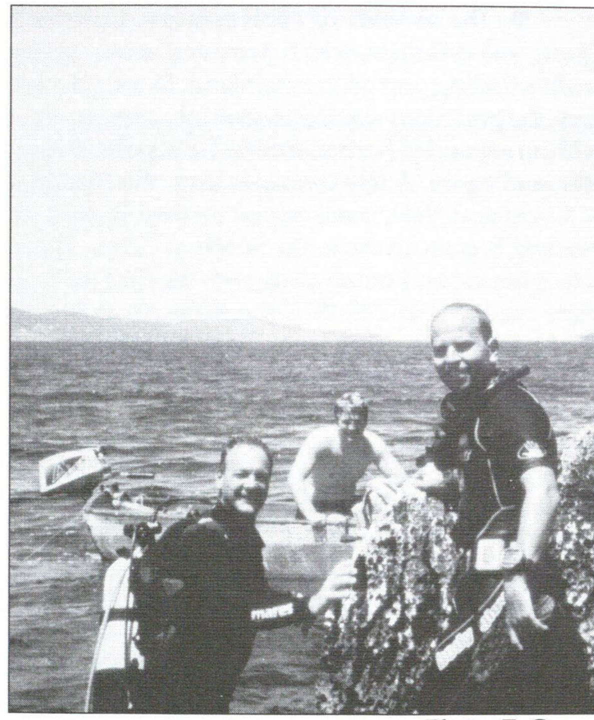


Photo: E. Greene

of Culture and the director of the Packard Archaeological Center. Modeled after the British and American institutes in Greece and Rome, the Packard Center was designed to support interaction between Albanian and foreign archaeologists. The Center also houses a newly established rescue archaeology unit that works with the Albanian Institute of Archaeology to protect and record the nation's cultural heritage in the face of new building projects. In addition to visiting the Packard Center, we needed to collect the dive gear, tanks, and compressor that were stored in Tirana when I left the country in 1996. Despite the political disturbances in the intervening years, our gear survived safely in the International Qendra Stefan, run by Chris Dakas. After two days of preparation, we headed south.

In Saranda (fig. 4), Dr. Pojani introduced us to Auron Tare, whose villa—formerly owned by Enver Hoxha, Albania's post-war Communist leader—served as our base for the project. The day after our remaining team members (Danish archaeologist Bjørn Lovén and Princeton University student Elisha Williams) arrived, we drove twenty kilometers south to Butrint. Here, Sally Martin, the project manager for the Anglo-Albanian excavations, showed us around the archaeological site and explained the areas where the land team hoped to benefit from underwater survey. After coordinating our plans with Dr. Kosta Lako, our representative from the Albanian Institute of Archaeology, we were prepared to begin.

At the site of Butrint, the team investigated the Vivari channel in search of foundations for a bridge or aqueduct structure, remains of which have been excavated on land. Although we found evidence of artificial structures—probably the piers of the bridge—the poor visibility in the water (less than a half meter) combined with a strong current to make further identification of these structures impossible at the time. Fishermen report that the channel becomes much clearer during the months of July and August, when structures can be seen from the surface of the water.

Visibility was somewhat better in the water of Lake Butrint around the site of Diaporit, where the Anglo-Albanian team is currently excavating a Roman villa and bathhouse, as well as a later basilica. We searched for remains of building or quay structures in the water around the site. With a snorkeling survey in the shallow water, we found occasional worked stones that confirm the rising levels in Lake Butrint since Roman times. Future survey work in the channel, lake, and bay of Butrint will be difficult without the use of sonar, as the poor visibility does not allow for the clear identification of structures or artifacts by divers. Strabo's description of Butrint as a city on the mouth of the *Pelodes Limen*, or "Muddy Harbor," is as valid today as it was in antiquity.

During our investigation of reported shipwreck sites and artifact scatters, the team focused on the coastal region south of Butrint and Ksamili Bay. The locations investigated were brought to our attention by Tare, who learned of the areas through personal exploration and discussions with local fishermen (fig. 5). South of Butrint, we accompanied fishermen to regions where they reported finds of ceramic artifacts. The team found scattered fragments of Greek, Roman, and Byzantine pottery on virtually every dive we conducted (fig. 6). Additionally, the remnants of a modern shipwreck were discovered in the region in association with Late Roman or Byzantine

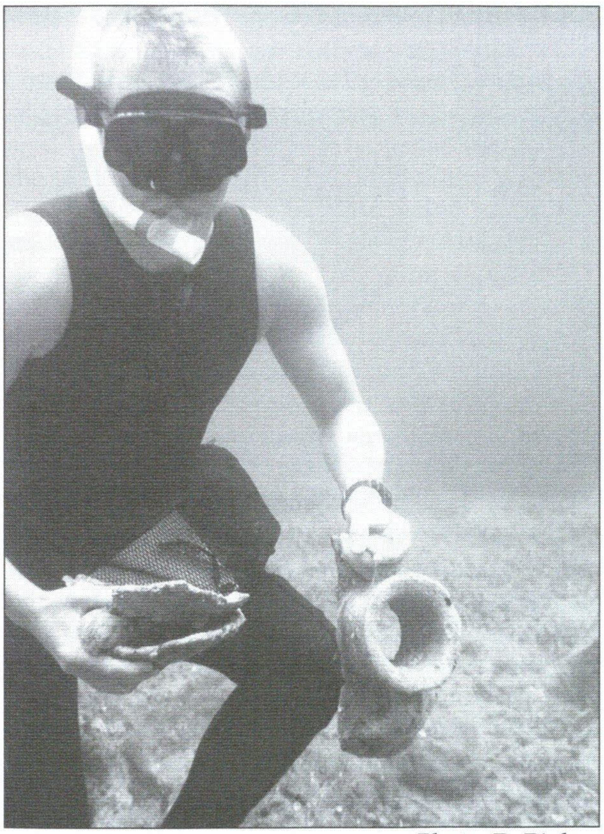


Photo: D. Rinkes

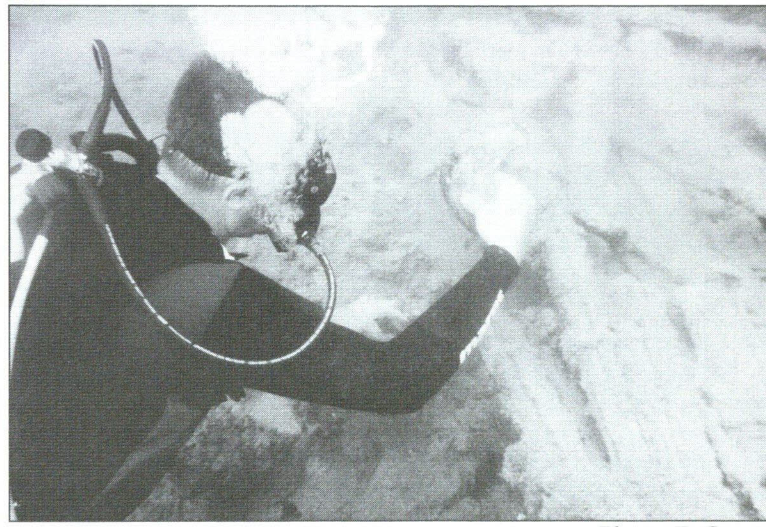


Photo: E. Greene

Fig. 6 (left). *Bjørn Lovén collects samples from a large scatter of amphora fragments pointed out by fishermen.*

Fig. 7 (above). *Dick Rinkes investigates the metal remains of a modern wreck.*

pottery and a shallow copper bowl (figs. 7). Along with the metal remains, we found blocks of TNT that offer a possible cause for the vessel's destruction. The earlier pottery suggests the presence of a second wreck in the same vicinity.

On one of our expeditions with the local fishermen, we were told of a large group of amphoras that looked "as if they were tied together with string." We investigated the area where the fisherman said he had seen this pottery, but have not yet discovered it. Amphoras arranged in a row seem to suggest the cargo of a shipwreck, but could be little more than ceramic vessels used by fisherman as octopus traps. Only future survey in the region can reveal the answer to this question. Further investigation is certainly warranted by the fact that we discovered ceramics or hull remains on every dive we conducted.

This detail is even more striking in light of the reality that we made only three day-trips to the coastal region south of Butrint. At times I felt like Edward Lear, who described some of the trials of his travels. On January 6, 1857, "No boat was there, & it turned out that none had come so Frank could not get to the party at the head of the lake, & we walked back in the rain. I bought a lamb for the sailors, from some shepherds for 20*d*." Although we drank coffee instead of eating lamb when our boat did not arrive, we shared Lear's experience with the regularity of Albanian fishing boat schedules. For future survey in the south, we plan to acquire our own small vessel.

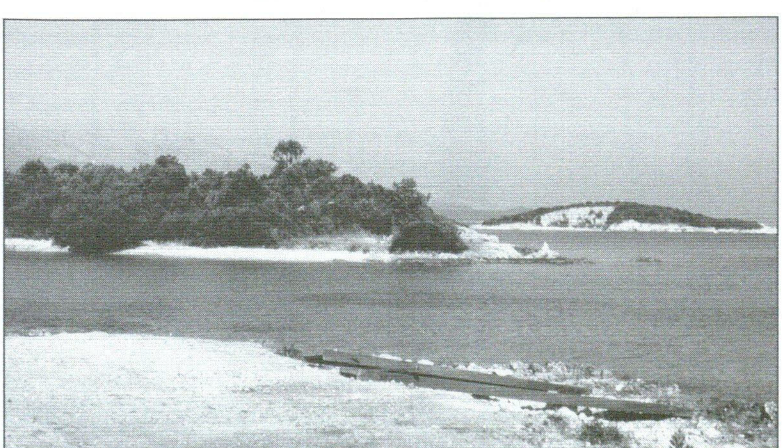


Photo: E. Greene

Fig. 8. *A view of Ksamili Bay.*

Ksamili

On the days that we did not set out with the fishermen, we investigated the waters of Ksamili, a small town just north of Butrint that served as a base for the Anglo-Albanian land archaeologists (fig. 8). According to Strabo's description of harbors along the Ionian coast (*Geog*. 7.7.5), there is a place called Poseidium that lies between Onchesmus (Saranda in antiquity) and Buthrotum

Fig. 9, 10 and 11. *Yellow and green glazed ceramics (left), slip-decorated wares (center), and an intact spice container (right), all from an early modern wreck in Ksamili Bay (Photos: E. Williams).*

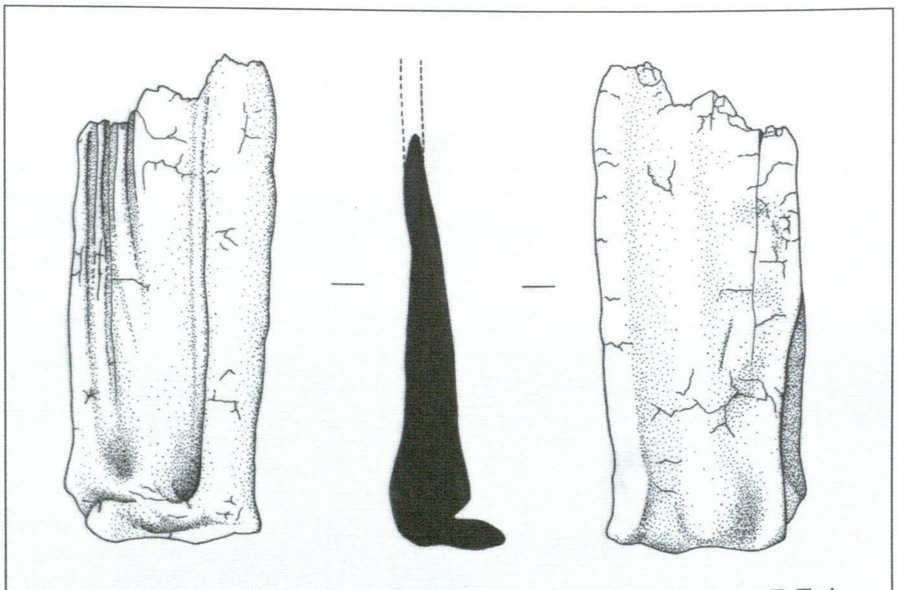
(ancient Butrint). Local legend places a sanctuary of Poseidon, the Greek deity of the sea, on one of the four small islands that protect the harbor at Ksamili, making it a prime candidate for Strabo's harbor. Tare, an avid swimmer and snorkeler, had spent years in the bay and was able to point out various sites that he thought would be of archaeological interest.

In Ksamili Bay, Tare led us to a significant scatter of pottery, including an assortment of green and yellow-glazed ceramics, some with plastic floral motifs, as well as some unglazed, slip-decorated wares, and an intact spice container (figs. 9, 10, and 11). Dutch archaeologist Joanita Vroom dated these finds to the late nineteenth century CE. The artifacts probably formed the cargo of an Italian ship bringing pottery to Greece or Albania for common household use. Although no hull timbers remained in the shallow water, the heavy concentration of artifacts suggests a shipwreck.

Just off the northern shore of Ksamili Bay, we found a concentration of pottery dating from the fifth to second centuries BCE, as identified by Bjørn Lovén and Paul Reynolds. The pottery includes roof tiles, coarseware amphora fragments, and a few sherds of black glaze ware and decorated pottery. The ceramics originate from Attica, Campania, Chios, Cos, Knidos, Mende, and Thasos. This chronological range, the variety of wares, and the close proximity of the scatter to the shore, suggests a submerged settlement site rather than a shipwreck, perhaps the result of rising water levels over time.

Further surveying in the center of Ksamili Bay and around the small islands revealed occasional finds of broken pottery, primarily Late Roman and Byzantine, confirming the early usage of the region as a harbor or safe haven for ships. The locations of all finds in Ksamili and along the southern coast were marked by a hand-held global positioning system. Diagnostic pottery samples were raised for documentation and returned to the ocean at the end of the reconnaissance season. Until the creation of a conservation facility designed to preserve waterlogged artifacts, nothing will be raised permanently from the sea floor.

Fishermen in Ksamili provided an additional resource for archaeological information. They report that the



Drawing: E. Twigger

Fig. 12. This fragment of a Late Classical terracotta figurine was shown to us by a local fisherman.

waters of Ksamili Bay, an attractive location for Albanian and foreign tourists, have already been explored by divers. One afternoon, a resident of the town brought a collection of artifacts for our examination that a friend had discovered in the bay. The objects included various items from the nineteenth-century wreck mentioned above, as well as the lower half of a terracotta figurine, representing a female leg draped with cloth (fig. 12). Although our contact reported that this figurine had come from a larger deposit of artifacts, he was unable to point out its exact location.

As well as being a key survey area, certainly worthy of future investigation, Ksamili Bay also served as our base for introductory lectures and practical exercises in nautical archaeology for the Albanian students participating in the Anglo-Albanian excavations at Butrint. I presented three lectures on the history and methods of shipwreck archaeology to a group of fifteen students from the newly developed archaeology program at Tirana University. In addition, our team offered the students a practical introduction to scuba skills. Part of our commitment to the future of nautical archaeology in Albania includes forming a core of native archaeologists, trained in maritime techniques, whose cooperation in upcoming survey and excavation work will be critical.

Building for the Future

It is my belief that the coastal regions north and south of Butrint should be the focus of future shipwreck survey seasons. The poor visibility in Lake Butrint, Butrint Bay, and the Vivari Channel makes survey by divers impractical, though sonar survey might yield fruitful results. Numerous finds were discovered in regions north of Butrint such as Ksamili and we hope to explore more of the coast between Butrint and Saranda, especially in light of the recent development of hotels and cafes along the road between the two regions. The geography of the coast south of Butrint is perhaps the most promising for the existence of shipwrecks and the likelihood of their discovery. That there is no coastal road south of Butrint means little traffic and development and therefore fewer possibilities for looting. To date, only fishermen have access to these regions and virtually all speak of ceramic discoveries. The pottery scatters seen during the reconnaissance project establish the presence of seafaring traffic in the region throughout antiquity. In the summer of 2002, we plan to investigate the coast as far south as Ishulli Tongo. For the future, we hope to continue north from Saranda towards Porto Palermo (ancient Panormus) and Oricum, both important harbors in antiquity. Currently, I am working with Auron Tare, Richard Hodges, and the Albanian Institute of Archaeology to develop a protocol for INA activity in Albania over the next five years.

Unlike many of the regions where INA has undertaken shipwreck surveys, such as Turkey and Egypt, the Albanian coastline offers a daunting trial. In Turkey, sponge divers have revealed to INA the location of numerous shipwrecks including those at Uluburun and Bozburun. In Egypt, the tourism industry has created a great market for scuba diving. Professional divers have explored much of the Red Sea and have given information about the location of shipwrecks, such as the Sadana Island site. INA can benefit from no such information in Albania. No diving industry exists and even fishing was discouraged under the Communist regime. The recent development of small-scale fishing in the south—by trawlers, dynamite, and spear fishermen—has provided some useful data, but there is little local lore about the specific location of wrecks underwater. This dearth of information presents a challenge, but there is a key advantage: the unexplored nature of the southern Albanian coast offers an unparalleled opportunity for future discovery.

Acknowledgements: For the funding to carry out this reconnaissance project, I am grateful to the Institute of Nautical Archaeology as well as to the Department of Classics, the Program in the Ancient World, the Program in Hellenic Studies, and the Council for Regional Studies at Princeton University. Ani Tare, Chris Dakas, Richard Hodges, Sally Martin, and Iris Pojani provided practical assistance without which the project would have been impossible; Joanita Vroom, Paul Reynolds, and Bjørn Lovén assisted with pottery identifications. Dr. Kosta Lako represented the Albanian Institute of Archaeology and offered constant support to our team. Thanks are also due to my team members Dick Rinkes, Bjørn Lovén, and Eli Williams.

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Photomosaics in Underwater Archaeology

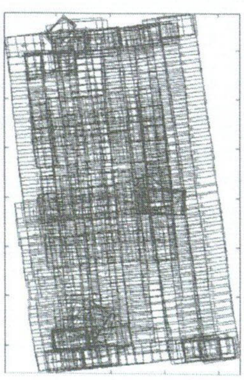
Sarah Webster, Oscar Pizarro, and Hanumant Singh

For an archeologist working on an underwater site, visibility is limited except in the clearest of waters. Light attenuates quickly, and at depths where natural sunlight cannot reach, artificial lights can illuminate only a small part of the wreck at any single time. Often, even a single object of interest cannot be photographed in one picture. With these limitations, the ability to piece together many smaller photographs of a site to get an overview picture is extraordinarily useful for layout information and site planning. Photomosaics offer a composite view of objects—or entire sites—too large for a single image by merging several overlapping pictures. Originally, mosaics were performed manually using darkroom techniques, a long and labor-intensive task. The advent of inexpensive computational resources and effective image processing techniques, together with the ever increasing amount of digital imagery, has made the use of digital mosaics the option of choice. It offers unmatched flexibility, ease of manipulation, and facility in using complementary image enhancement algorithms.

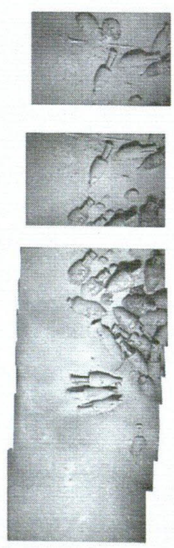
Understanding these issues is fundamental for an effective use of mosaics in underwater archaeology, as well as in other oceanographic applications.

Mosaicking Procedure

The basic procedure for the production of mosaics from underwater imagery follows these steps: (1) Record the area of interest with overlapping images; (2) Correct for lighting; (3) Align/warp the images; (4) Mosaic the images by merging and reducing seam effects. For example, the individual images in figure 1 were taken in strips over the site. Each strip, or trackline, was mosaicked together first, and then the strips were merged with each other. This is a typical process in the production of photomosaics.



Ste p 1 Vehicle operators conduct a carefully planned survey over the area of interest to ensure sufficient coverage and overlap in the imagery. Image footprints are projected on the area of interest to allow operators to choose individual images for use in the mosaic.

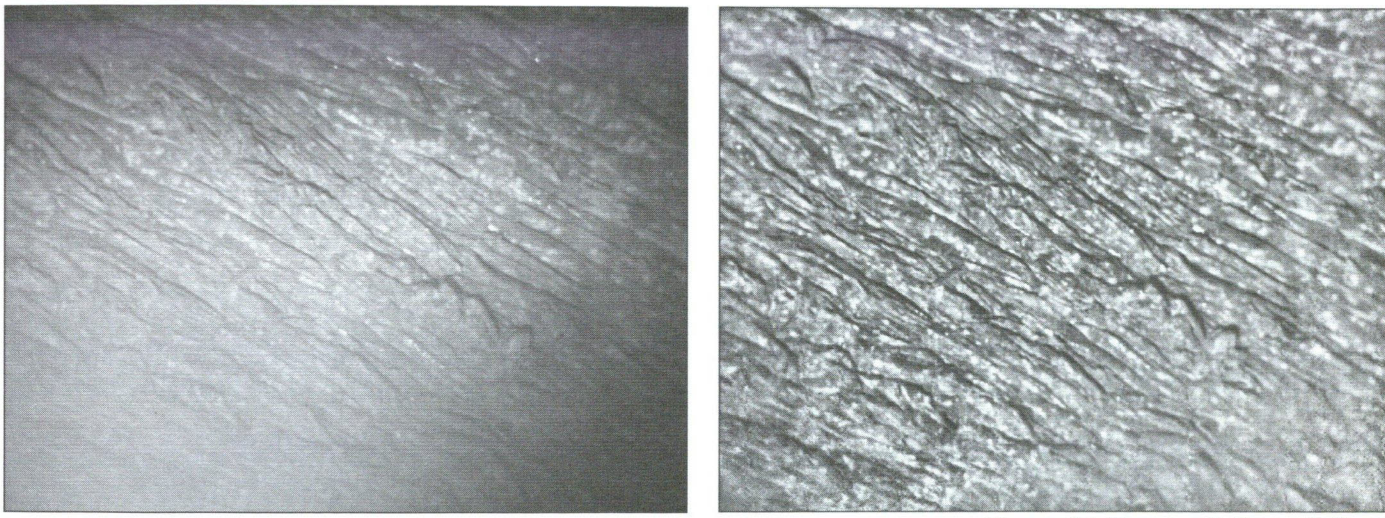


Step 2 Individual images are processed to remove lighting and other artifacts. These images are then merged into single strip mosaics by indentifying common features in successive images.

Step 3 Individual strips are then mosaiced together using a technique similar to that used in Step 2.

Step 4 Ongoing work focuses on understanding and improving the quantitative nature of the mosaicing process.

Fig. 1. *The process of producing photomosaics.* Photo: H. Singh



Photos: M. Cormier, B. Ryan, H. Singh

Fig. 2. *The use of corrective equalization on imagery acquired at a geological site in the East Pacific Rise that was non-uniformly lit. Original imagery (left) and equalized version (right).*

Deep sea mosaics are generated from images obtained using robotic devices like the remotely operated vehicles (ROV) *Jason* and *ABE* (Autonomous Benthic Explorer), or towed vehicles like *Argo*. If possible, a grid approach is used to survey the area of interest. Vehicle speed and the rate at which images are acquired are adjusted to ensure adequate overlap between successive images along the direction of motion. The parallel tracklines are spaced so that the successive paths overhang one another across the direction of motion. The overlap assists the mosaicking process by providing sufficient corresponding points between successive images, thereby allowing the accurate connection of one to the next. At least a forty-percent overlap between successive images is desired, although less than twenty percent makes mosaic production very difficult and inaccurate.

Mosaicking Algorithms

The advent of inexpensive computational resources and image processing techniques now allows us to generate photomosaics on computers in an automatic or semi-automatic fashion. Many commercial processing programs, for example VideoBrush Photographer (www.videobrush.com) and IRAS/C from Intergraph (www.intergraph.com) use feature-matching algorithms. VideoBrush performs most of the mosaicking automatically, with relatively little input. IRAS/C offers more control: users identify corresponding points, choose the warping algorithms to align images and decide where to draw the seam. The second program requires more input, which means more time to perform the task. Results also depend on how well the operator chooses corresponding points. The fully automatic package is preferable because of time and ease of use, but is only effective when the overlapping images have uniform lighting, slight perspective changes, and sufficient features for the computer to match.

Using an underwater vehicle with precise navigation allows the preplacement of images before constructing the mosaic. This puts the images in the right place with respect to each other. Preplacement helps prevent large area distortions and limits spatial inaccuracies. This is particularly useful for large-area mosaics (hundreds of images) and feature-poor areas. It is possible to create mosaics from photographs taken by divers as well; in such cases, it is necessary to have enough matching features in successive pictures to assemble the mosaic.

Difficulties of Mosaicking

Lighting: Since sunlight attenuates considerably in the first few meters underwater, artificial lighting sources are required to image at all but very shallow depths. The concentrated light source, together with attenuation, can cause very uneven lighting throughout the field of view. Corrective procedures (for example, adaptive histogram specification) can compensate for most of this effect if the optical sensors have enough dynamic range (fig. 2). Even with histogram specification, image borders will tend to be darker. As the mosaic is constructed, these darker edges can appear as shadows that are easily misinterpreted as changes in elevation of the terrain (fig. 3).

An additional problem with artificial lighting is that the shadows cast by a moving light source also move from image to image. The changing shadows confuse the matching algorithms because most mosaicking programs assume a uniform and stationary light source.

Range, resolution, and perspective: When taking images, there is a trade off between coverage and resolution. As photographs are taken further away from the target, each one covers a larger area. This requires fewer images for the final mosaic, which saves time and could mean less distortion. Images taken from afar, at a higher altitude, also show less change in perspective as the

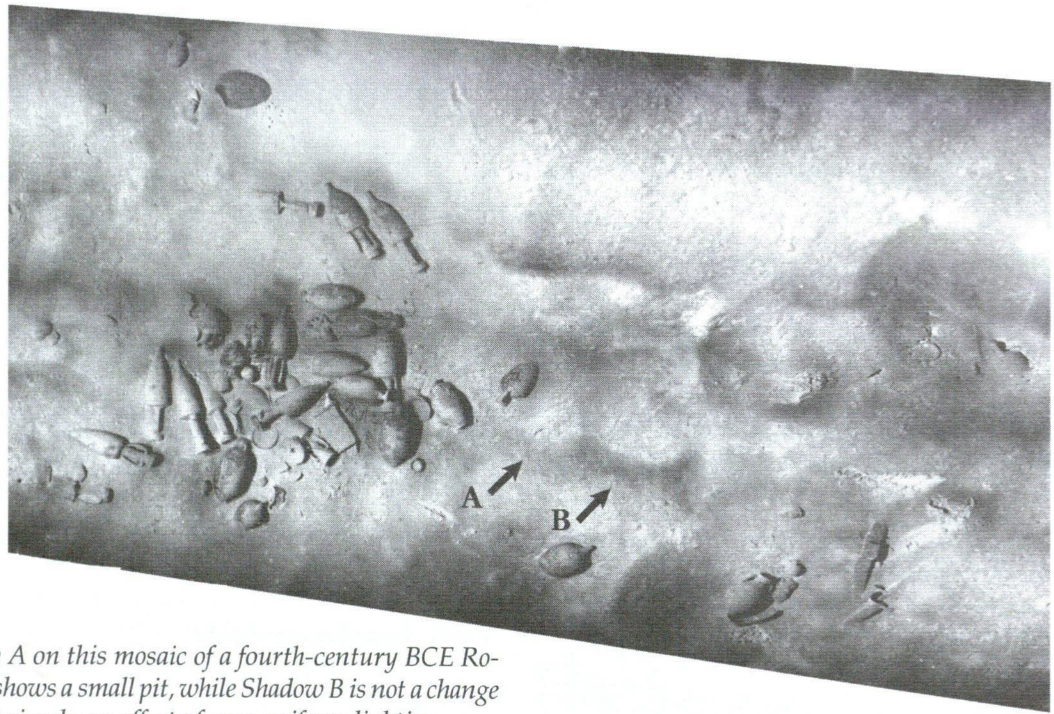


Fig. 3. *Shadow A on this mosaic of a fourth-century BCE Roman shipwreck shows a small pit, while Shadow B is not a change in elevation but simply an effect of non-uniform lighting.*

Photo: H. Singh

camera moves, and less change in perspective requires less warping of the images in the mosaic. The big drawback in high altitude images is in the loss of resolution as each pixel corresponds to a larger area. There is also greater light attenuation, which results in darker images, and noticeable backscattering from particles in suspension. Overall, the images tend to become grainy and noisy (contaninated with random visual elements) as the distance from the target increases (fig. 4).

In photographing closer to the target, each individual image will contain more detail and less backscatter, but the mosaic must be constructed of a larger number of images. Another problem when photographing three-dimensional objects or structures from closer distances is the change in perspective from one image to the next, resulting in distortions in the mosaic.

Camera Motion: Two mosaics of the modern oceanographic research vessel RV *Northern Horizon*, created automatically using VideoBrush, illustrate several of the issues involved. In figure 5 the images were collected by keeping the camera in place and rotating it. Notice how the bow and stern of the ship appear smaller than the midsections, and how the process results in the bending of the ship to match successive images. Another method for acquiring images is to keep the camera at a fixed distance with a fixed orientation, while translating it parallel to the object of

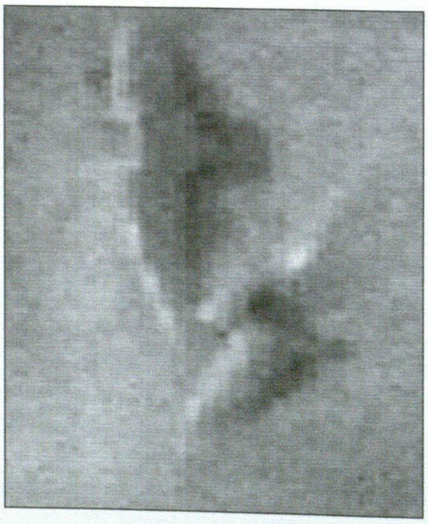


Fig. 4. *Details from a low altitude (left) and high altitude (right) photomosaic of a fouth-century BC Roman shipwreck. As expected, the imagery from the low altitude photomosaic has much higher resolution.*

Photo: (left) US Navy, (right) H. Singh

Photo: O. Pizarro

Fig. 5. *Mosaic of the RV* Northern Horizon *and some of the individual images in the mosaic taken by rotating the camera. The ship is warped because the distance from the camera to the target changes as the camera is rotated. The camera perspective stays the same from image to image, though, which makes the individual images line up with each other more accurately.*

Photo: O. Pizarro

Fig. 6. *Mosaic of the RV* Northern Horizon *and some of the individual images in the mosaic taken by translating the camera. The ship has roughly the correct proportions in this mosaic, but the change in perspective of the individual images causes problems when mosaicking.*

interest (fig. 6). In this case, the ship is roughly the same size in each image but the change in perspective from image to image is considerable, making mosaicking difficult.

One must take special care in archeological mosaics to insure that artifacts are neither repeated nor left out of the final product. In figure 5, the person is not seen in the final mosaic. Notice how the car present in the individual images is not present in the final mosaic, and how the single mast becomes two (fig. 6). This process can be used to the archaeologist's advantage in other ways, such as eliminating unwanted passing clutter, such as marine life.

Conclusion

Digital mosaics are a valuable tool to aid in the interpretation and identification of underwater objects, allowing archaeologists to view large areas of the sea floor despite limited visibility. As we have seen, current techniques for the production of mosaics are limited by lighting, range versus resolution, and perspective changes that occur when imaging three-dimensional objects. Distortions can result from the merger of successive images so the final mosaic may provide a qualitative—rather than quantitative—representation of the site.

Acknowledgments: This work was supported by a sub-contract from the Office of Naval Research (contract #N00014-95-1-1316). This is Woods Hole Oceanographic Institution publication number 10483.

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Review

Archeologia delle acque: Semestrale di antropologia, archeologia etnografia, storia dell'acqua,
Anno II-N.4, Luglio-Dicembre 2000.

Fittingly, the land that gave Europe its most significant Renaissance is now experiencing a flourishing rebirth of interest in maritime archaeology. Nautical archaeologists in Italy have received potent stimuli in recent years. A graveyard of late antique shipwrecks has been unearthed in Pisa. A treasure of ancient and medieval wrecks has been located along the coast of Sardinia. Two derelict hulls from the fourteenth century—one of them a galley—are presently being freed from the mud of Venice's lagoon. These developments only skim the surface.

Research in the Veneto and Emilia Romagna has led to the publication in Forlì of a new journal entitled *Archeologia delle acque*. This appears twice a year under the editorship of Dr. Silvia Costantini and the scientific supervision of Dr. Luigi Fozzati. It is co-sponsored by the Nucleo Archeologia Subacquea del Veneto, headquartered in Venice, and the Museo della Regina, situated in Cattolica. The most recent number appeared in the fall of 2000. Typically, the journal includes a series of articles organized around a specific theme, in this instance the "archaeology of the waters of Emilia Romagna," and in-depth reports on field work in progress in various parts of Italy.

To communicate to members of INA the riches of this resource, let me summarize important findings in the specific field of nautical archaeology and the broader realm of aquatic archaeology. The journal's fourth number offers enticing details on the excavation and recording of shipwrecks from ancient and medieval times. Edoardo Tortorici supplies an in-depth report on the first season of excavation of an ancient wreck discovered in the Adriatic Sea approximately seven nautical miles from Grado. That first season allowed the excavators to publish a site plan and recover objects deemed at risk. These included two lead anchor stocks, one whole amphora, and several amphora sherds. Analysis of all the ceramic material suggests a uniform cargo of wine amphoras of Greco-Italiot type. Tortorici proposes that the best parallels come from the mid-third century BCE and that promising comparisons have been made to amphoras found in the necropoleis of Adria and Spina.

With understandable excitement, Tortorici examines the implications of the find. If confirmed to be a large trading vessel carrying wine amphoras manufactured in Southern Italy and shipped to Adriatic ports around the year 250 BCE, the shipwreck would be the oldest yet discovered in the Upper Adriatic. It would help fill an existing void in material remains from that region in the third century. Moreover, the wreck almost surely predates the founding of the Roman colony at Aquileia in 181 BCE. Therefore, it will compel a reconsideration of Hellenistic trade routes and ports in the Upper Adriatic and the commercial relations between that region and Magna Grecia to the south.

That "Republican" wreck near Grado was located in the course of examining another wreck dated to the Roman Imperial period and excavated from 1988 to 1999. Carlo Beltrame and Dario Gaddi explain the methodology they will use to record and reconstruct the hull of that Roman vessel, which was dismantled on the bottom and raised in pieces. The skilled Venetian model-builder Gilberto Penzo has been recruited to contribute a detailed scale rendering. Initial analysis of the surviving timbers has already yielded evidence of repairs to the planking, graffiti traced on the planking by the ship's carpenter during construction, and traces of whitewash painted upon the hull.

The journal has finally published the analysis of a late-medieval hull that Marco Bonino completed in 1981. Fragmentary remains of the medieval vessel were found in 1979 in a sand and gravel pit near Ravenna. The pit is on the site of a former lagoon near Porto Fuori that was used as an emergency anchorage until the end of the fourteenth century. Bonino judiciously proposes that the surviving timbers come from the stern, given the angle of the post and the rounded shapes produced by the frames. The timbers include a section of the rabbeted keel, frames of irregular dimension including an elegant Y-frame, and a section of the keelson. The inner hull received longitudinal strengthening from the keelson and three stringers, while the outer hull was reinforced by at least two wales. Bonino interprets the wales as an integral aid in the construction process; because they overlap the joints in the frames, the wales were most likely installed before the planking and accompanied the mounting of the frame elements. Overall, Bonino argues that we have the remains of a fourteenth-century coasting vessel equipped with a lateen rig which sank at a relatively young age. The vessel's construction features fall between the Contarina I wreck from around 1300 and the Logonovo boat from around 1400.

Members of INA will also find of interest the broader concerns of the journal—beyond nautical archaeology in the strict sense. The editors have chosen to treat questions of anthropology, ethnography, and history as they are reflected in waters of every sort, from rivers to lagoons to the sea. In discussing the water systems used for transport around Modena in ancient times, Remy Mussati and Elena Righi produce textual evidence of a fascinating episode. Roman generals managed to communicate with their troops in Mutina in 43 BCE by engraving a message on a lead plate and tying it to the wrist of a diver who smuggled it into the besieged city.

Contemporary volunteer divers assisted Maria Luisa Stoppioni in the last phase of her excavation of a Roman well at Cattolica. Materials in the lowest stratum such as African clay *paterae* (shallow bowls) and pitchers were dropped into the well by accident. Other materials were tossed in as refuse when the surrounding Roman *mansio* was abandoned late in the third century. The refuse includes three roof tiles with the stamp of "Fuscus," a manufacturer already known from a collection of eleven stamps in the Cattolica Museum. The density of these finds suggests that Fuscus had his manufacturing kiln in the immediate vicinity of Cattolica.

Dumping of refuse continued in the Middle Ages and continues to be a valuable source of information. Marco Bortoletto sampled the organic remains excavated along Venice's Grand Canal near the medieval market situated at the Rialto bridge. Though the Commune of Venice had set up in that neighborhood a series of wooden containers for the collection of garbage, the containers were emptied only twice a week. Filled to overflowing in the interim, they attracted rats and drove the residents to fall back upon the easy alternative of dumping their garbage directly into the canals. Heavier materials such as sheep's heads, whole eggs, and pine nuts accumulated in the canals and eventually threatened to block the city's vital waterways. In addition to the organic remains from the market, Bortoletto also found ceramic, metal, and glass debris at the base of the stone embankment built at the Rialto in 1398. In a city renowned for her glass manufacturing, it seems only fitting that the Venetians themselves showed a decided preference for glazed ceramics, comprising eighty-seven percent of the material that Bortoletto recovered.

From a careful examination of this single number of *Archeologia delle acque*, it should be apparent that the journal offers a range of material of decided interest to readers of the *INA Quarterly*. For confirmation, they need only consult the second number of volume I, edited by Dr. Marco D'Agostino and dedicated entirely to nautical archaeology. That issue contains Mauro Bondioli's fascinating examination of the rivalry between native Venetian shipwrights and their foreign competitors from Rhodes in the first half of the fifteenth century. In fact, INA itself is well represented in that number through the articles of Patricia Sibella on a Roman *dolia* wreck excavated off the coast of Corsica at La Giraglia and Frederick Hocker on the ninth-century Byzantine wreck excavated off the coast of Turkey at Bozburun. *Archeologia delle acque* is published by ABACO editions in Forlì. Interested readers can find further information on the journal and ways to subscribe at the publisher's website: http://www.abaco-mac.it/ADA.

John M. McManamon, S.J.

IN MEMORIAM

Erkut Arcak
1971–2001

The unexpected loss of Erkut Arcak cost INA and the Texas A&M University Nautical Archaeology Program a promising student, a valued colleague, and a dear friend. He passed away on June 9, 2001, a breezy Istanbul evening, at the young age of thirty, suddenly and unexpectedly, after having visited his beloved Ottoman galley, the *Kadırga*, earlier in the day. At his funeral, family and friends related their vivid images of his joyful smile. It is this smile that will be etched in our hearts and minds forever. He is survived by his wife Cory and their son Andrew, his mother Gülhan and father Yurdakul, his older brother Aykut, sister-in-law Tijen, and their daughter Berfin, and his younger brother Enver.

Although he was born in Elazığ, eastern Turkey, many of Erkut's school years were spent in Ankara. After graduating from high school, he was admitted to Middle Eastern Technical University (METU), where he received a bachelor's degree in Philosophy in 1996. During his university years, Erkut not only found a ripe environment to foster his love for the sea, but he also became interested in ancient shipwrecks. To prepare himself for a career in his new passion, he applied to the graduate program of Bilkent University's Department of Archaeology and History of Art.

Photo: C. Arcak

Erkut's participation in many surveys and excavations galvanized his interest in the field. In his own words, "he aspired to journey the less traveled roads." While serving as the president of the Subaqua Society at METU, he formed a group to investigate shipwrecks. Apart from those conducted by INA, these surveys were among the first of their kind in Turkey. They ranged from ancient shipwrecks along Turkey's Mediterranean coast off Cilicia and Iskenderun to eighteenth-century shipwrecks of the Turco-Russian wars off Sinop, in the Black Sea, and at Çeşme, in the Aegean. The results of these surveys were mostly presented at annual symposia in Ankara and later published in their proceedings. Erkut also assisted Nergis Günsenin with her surveys in the Sea of Marmara. There, he was among the team that discovered and investigated a thirteenth-century CE shipwreck, now in its first year of excavation.

During the summer of 1995, at Bozburun, near Marmaris, Erkut began his first direct collaboration with INA. He took part in the excavation of the ninth-century CE Bozburun shipwreck under the directorship of George Bass and Fred Hocker. Erkut became a regular member of this project until its conclusion in the fall of 1998. In 1996, after the excavation season at Bozburun, he also worked with Eric Rieth on the Sorbonne University's excavation of the Port-Berteau Charante shipwreck in France. He was one of the few students chosen in 1999 to represent INA in the Black Sea project conducted jointly by Fred Hiebert of the University of Pennsylvania's University Museum, Robert Ballard of the Institute for Exploration, and Cheryl Ward of INA. Concurrently, he worked on the excavation of a fifth-century BCE shipwreck at Tektaş Burnu, near Çeşme, directed by George Bass and Deborah Carlson.

However, Erkut was soon to realize that, no matter how much practical experience he gained in the field, for his passion to bloom into a full profession he had to compliment it with theoretical knowledge and a solid academic background. With that goal in mind, Erkut enrolled in the Nautical Archaeology Program at Texas A&M in 1997 and began his coursework the next year.

His main interest was in Medieval and Ottoman seafaring and shipbuilding. Erkut and I launched a long-term study in 1999 of the famed Sultans' galley, the *Kadırga*, in the Naval Museum in Istanbul. I had pondered its origins and constructional aspects since I first

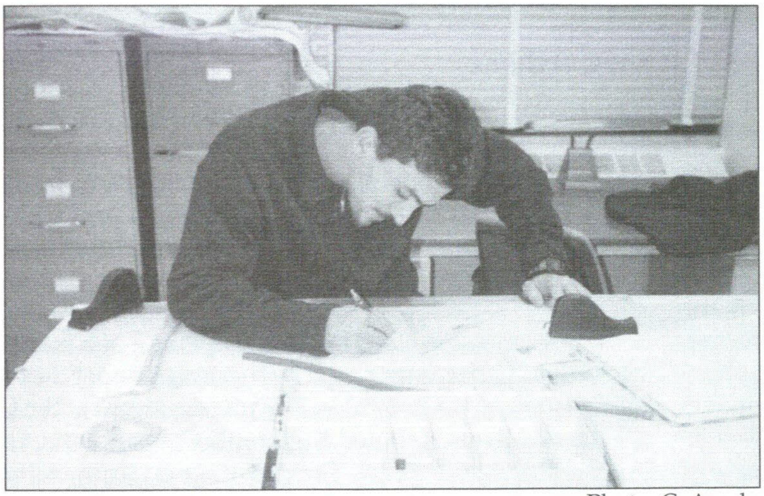

Photo: C. Arcak

saw it at the age of fifteen. In conjunction with my study of a late sixteenth-century Ottoman shipwreck we excavated off Bodrum in 1982 and 1983, I learned much about the *Kadırga* but had simply not found the time for an in-depth study of this remarkable vessel. The opportunity came when Erkut expressed his interest in Ottoman seafaring and the *Kadırga*, and invited me to be the chairman of his thesis committee. I could not have had a more enthusiastic, encouraging, and driven individual with whom to work.

Erkut was nearing the completion of a preliminary study for submission to A&M as his thesis for the Master of Arts. This would have been the first step toward a comprehensive treatise that Erkut and I envisioned. I considered myself privileged to be collaborating with him on this project. We spent several weeks for the last three summers in Istanbul recording and studying this historic vessel. At the end of each day, we laughed heartily at our pathetic chimney-sweep appearance from crawling through the grimy bowels of the ship. Back in College Station, Erkut would spend many hours each day behind the drafting table drawing and, after checking with me, often redrawing the ship's features. He never took any offence at my corrections and requests for additional modifications. The Old World Laboratory is just not the same without Erkut crouched over the plans of the *Kadırga* with his usual inquisitive, and sometimes puzzled, expression. He was a disciplined, devoted, and enthusiastic student

Erkut had great prospects for the future. He dreamed of establishing a nautical archaeology curriculum in an academic institution in Turkey after concluding his studies in the United States. All the doors to his dreams seemed to be opening when he died. He was already regarded by some as the future of nautical archaeology in Turkey, and as having a major role in the future of INA's Turkish branch.

Erkut always made time for his friends and for soccer, an activity he pursued diligently in the amateur league in his native Turkey. He was also an ardent scuba diver. Erkut felt completely at home under water. In the flurry of his archaeological activities, he operated his own diving school between 1995 and 1998, and certified countless sport divers. He took his students to Kaş in southern Turkey for most of their training dives—a region he loved for its crystal-clear waters and excellent diving. A dive site there is now named after him and a marble and titanium plaque placed on the seabed in his memory reminds scuba divers of his kindness and dedication.

Erkut was a close friend to all and touched each person in a special way. He was dependable—a confidante who always managed to express a genuine interest in the lives of his companions. He made them feel that every day was a special one. His radiant smile and friendly personality made him equally special to us.

Erkut was laid to rest in his land-locked home city of Ankara, the parched earth over his grave quenched with seawater from his beloved Kaş. His temporary tombstone bore the words, "Erkut Arcak, diving to eternity," now replaced with, "*Carpe Diem*." We are left with a void that can never be filled and we miss him terribly. An old African adage says "a man is never truly dead until he is forgotten." Erkut Arcak lives, for those whose lives he enriched will always remember him.

Cemal Pulak

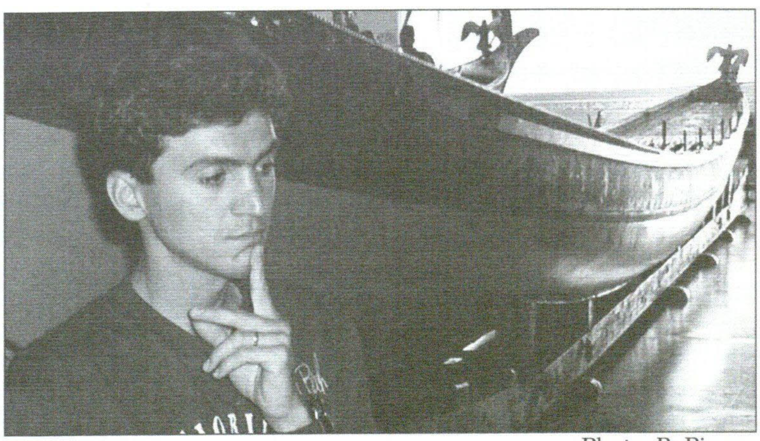

Photo: R. Piercy

Navigation and Trade in the Mediterranean

(Seventh to Nineteenth Century CE)

George K. Livadas, Athens

The Greek islands of Chios and Oinousses hosted the Eighth International Congress on Graeco-Oriental and African Studies, "Navigation and Trade in the Mediterranean (Seventh to Nineteenth Century CE)" from July 5 to 9, 2000. This successful conference was organized by the Greek Institute for Graeco-Oriental and African Studies, in collaboration with the University of Cairo and the Faculty of Arts of Ain Shams University, Egypt. Participants included representatives of renowned institutions from all over the world. These included the Vienna Academy of Sciences (Austria) and universities such as Cairo (Egypt), Princeton (USA), Rand Afrikaans (South Africa), St. Petersburg (Russia), and the Sorbonne (France), among many others.

Several notable speakers opened the first session of the Congress, July 5 on Chios. These included Alexander Beihammer of the Austrian Academy (on the seventh-century Arab raids on Cyprus), V. Christides of the Greek Institute for Graeco-Oriental and African Studies (on seventh to fourteenth-century Arab sources on trade and commercial activities in Cyprus, Crete, and Chios), and T. Hagg of Bergen University, Norway (on a Byzantine chronicle of a visit to Bergen in 1430).

The morning session on July 6 included various papers on North African and Eastern Mediterranean history. Alia Hanafi of Ain Shams University presented a papyrus from the Copenhagen collection concerning the role of palm trees in the refitting and building of ships. E. Venitis of the University of Ionnina (Greece) spoke on the Sassanid occupation of Egypt. G. M. A. Al-Tahir of the Libyan School of Athens discussed in detail the Red Sea ports. Finally, C. Makrypoulias of the University of Ionnina dealt with the question of Byzantine triremes, concluding that Byzantine warships could not contain more than two banks of rowers. This session was followed by a tour of the Maritime Museum of Chios.

The evening session took place on the nearby small island of Oinousses, in the impressive facilities of the George C. Lemos Cultural Center of Oinousses. Roxanne Margaritis of Princeton University (a graduate of the Nautical Archaeology Program at Texas A&M University) compared the ports of Aden and Alexandria. H. Khalilieh of Haifa University (Israel) talked about the legal status of slaves at sea in Islamic and Byzantine times. V. Vavrinek of the Institute for Slavic Studies (Prague, Czech Republic) spoke on the Adriatic Sea as the connection between Byzantium and the Slav lands north of the Danube. M. Cook of Princeton examined a distinctive Shi'ite doctrine of the Qibla. Finally, N. Orfanoudakis offered a very interesting examination of the evidence concerning portable flame throwers in the Byzantine, Islamic, and Chinese armies. This was followed by the presentation of a full scale model Arab and Byzantine flame thrower, based on these sources.

The evening closed with the opening of a maritime exhibition. This was prepared by two teams under the overall direction of V. Christides. The research team at the University of Athens included K. Karapli, C. Spanoudis, G. M. A. Al-Tahir, and I. Fadel. The construction team included J. Angelidakis and C. Kaniadakis, with designs by M. Bonnino and J. Nakas. The exhibition includes Arab and Byzantine ship models, based on the iconographic and literary sources, as well as maritime illuminations from Arab and Byzantine manuscripts.

On July 7, the final presentations maintained the high quality of the Congress. Jehan Desanges of the Sorbonne examined Byzantine geographic sources pertaining to the Red Sea and North Africa. Archaeologist Monique Longerstay talked on the Punic navy, C. Edmund Bosworth of the University of Manchester (UK) on Cilicia in the early nineteenth century as presented by William Burckhardt Barker, and B. Arbel of Tel-Aviv University (Israel) on Venetian shipboard life in the sixteenth century. C. Gasparis and N. G. Moschonas of the Greek National Research Center presented, respectively, on maritime activity in Crete and the Eastern Mediterranean during the eighteenth century. S. Soucek of Princeton discussed naval engagements near Oinousses between the Ottoman navy and Venice (1695) and Russia (1770). B. Hendrixx of Rand Africaans University examined the commercial and political implications of the "*factum pacis* and *concordiae*" (1219) between Theodoros Lascaris and Giacomo Tiepolo.

The Congress ended with a round table discussion of the Egyptian Nobel Prize-winning novelist Naguib Mahfuz, under the direction of M. Hamdy Ibrahim, Vice-Rector of the University of Cairo, and M. Hagazzi of the same institution. The experience was rounded off by a day cruise around the island of Oinousses on Saturday, July 8. The acts of the Congress are to be published in the ninth volume of *Graeco-Arabica*, as the first part of a *Festschrift* in honor of Professor V. Christides.

Acknowledgments: The Congress would have been impossible without the great support of the municipalities of the Greek Islands of Chios and Oinousses, and in particular the Mayor of Oinousses, Evangelos Angelakos, the George C. Lemos Cultural Center of Oinousses, the Development Center of Oinoussai-Aegean, and the Maritime Museum of Chios.

FROM THE PRESIDENT

I was sitting at a desk in San Diego, California when the teacher sadly proclaimed that our President had been murdered in Dallas, Texas. From behind that desk I had learned that intelligence, wealth, power, fame, popularity—and yes, even good looks—guarantee absolutely nothing in this world. Minutes later, we poured through the door of Room Seven out into the lunch arbor where, away from our classroom, we grappled with our own ideas of and reactions to that sorrowful event.

The "desk" and the "door" have always been strong, defining points in the geography of my education. At one I sat passively while formal introduction was made to someone else's ideas and accomplishments; at the other came the call to realize, embellish, and create. It was at a desk that my classmates and I first shook hands with Schubert and Bizet, painstakingly contended with iambic pentameter, and pondered the simple logic of the scientific process. Yet at day's end, when we passed through the door, quarter notes came alive in our garages, Frost was proclaimed, albeit by rote memory, along the drainage ditches of our shoreline, and ad hoc chemistry experiments—the kind that rousted the neighborhood—were conducted in the alley behind Old Man Trenton's garage.

In the highly charged academic environment of INA, I am reminded daily of the role of education and the importance of scholarship in the affairs of our Institute. As students from around the world come to Texas A&M University to study in the Nautical Archaeology Program and to participate in INA projects, the desk and the door are still powerful, tangible symbols of the education that they pursue.

There are presently fifty graduate students enrolled in the Nautical Archaeology Program, among them our own Christine Powell, *INA Quarterly* Editor, Bill Charlton, INA Diving Safety Officer, and Janalyn Gober, INA Archivist and Website Manager. A&M is still the best place in the world for aspiring underwater archaeologists to prepare for their future endeavors. Drs. Cemal Pulak and Shelley Wachsmann carry the responsibility of educating potential scholars in Biblical and Near Eastern archaeology. Drs. Kevin Crisman and Felipe Castro have dedicated their careers to researching and teaching the intricacies of shipbuilding techniques and the impact that they hold in shaping the seafaring history of the New World. Drs. Wayne Smith and Donny Hamilton ensure that each new generation of graduate students becomes familiar with the cutting-edge techniques of understanding and conserving our submerged cultural heritage.

Moreover, when the semester concludes, INA provides the opportunities necessary to round out the classroom experience. The field is where students test many of the things they learned behind their desks. Those of you familiar with the processes of underwater archaeology know that most discoveries actually take place in the library and the laboratory. So, for every door through which our students walk—for each INA project in which they participate—they eventually wind up back at the desk, researching in greater detail the significance of the data they have collected.

In this volume of the *INA Quarterly*—and in many to come—you will read of the numerous accomplishments of Nautical Archaeology Program students: Elizabeth Greene, Stefan Claesson and Athena Trakadas are all graduates of the Program. John McManamon, INA Research Assistant and former visiting scholar in the Program, also authored an article. Thanks to your support, many graduate students have realized their own archaeological projects in 2001, among them Matthew Harpster, Asaf Oron, Ayşe Atauz, Ralph Pedersen, and Kroum Batchvarov.

Sadly, INA and the Nautical Archaeology Program lost an aspiring young scholar earlier this year. Erkut Arcak, whose memorial tribute written by Cemal Pulak is featured in this issue of the *Quarterly*, had a promising career in the field of underwater archaeology, one that had already been partially realized at both the "desk" and the "door." The last conversation we had, just days before he left for the field, was a candid discussion—a look forward, if you will—of how one maintains a passion for their work over many years. Erkut proudly proclaimed that his enthusiasm for research—be it behind a desk or through the door—would never diminish. His self-imposed challenge still rings in my ears.

So, Texas A&M University furnishes the desk; INA opens the door. Together they afford each new generation of students opportunities that are essential not only for managing their own successful futures, but also for carrying the discipline of nautical archaeology forward into the twenty-first century.

I would like to thank you for the difference that your membership makes. Without it, these wonderful student-driven projects could never be realized. You, and your participation in this adventurous collaboration, are greatly appreciated.

Jerome Lynn Hall

INSTITUTE OF NAUTICAL ARCHAEOLOGY