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The Development of Maritime Archaeology

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The Oxford Handbook of Maritime Archaeology

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Abstract and Keywords

This article highlights the development of maritime archaeology as a discipline. It is by watercraft that some areas and smaller islands of our planet, seas and oceans, have been discovered, explored, settled, exploited, supplied, and defended. Maritime archaeology has several branches including coastal archaeology, nautical archaeology, which is the largest and best-known of the subdisciplines of maritime archaeology. In the 1970s, maritime and nautical archaeology became academic disciplines. Maritime archaeology is today, a respected subject. Even in the field of nautical archaeology, there are various specializations. This article talks about the problem of lack of availability of thorough, scholarly publications of fieldwork. One of maritime archaeology's greatest challenges lies in educating the public about the purposes of archaeology. Both cultural resources or heritage management archaeologists and those from academic institutions often face time constraints in collecting and publishing as much information as possible on sites that might otherwise be lost forever.

Keywords: maritime archaeology, maritime cultures, underwater archaeology, nautical archaeology, heritage management, coastal archaeology

Introduction

The importance of maritime cultures to the history of humankind is clear. Only by watercraft have some areas of our planet, from Australia to the smaller islands of the Earth's seas and oceans, been discovered, explored, settled, exploited, supplied, and defended. The myriad uses of watercraft include fishing and whaling, the transport of goods and people, warfare, exploration, and recreation. Watercraft require crews, usually drawn from the people living near the coasts. Additionally, watercraft require "homes," from simple sloping shores on which they may be beached to large and complex ports and harbors, the latter requiring specialized workers both for construction and later for utilization. These workers, in turn, as well as sailors, porters, merchants, and their

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families, require an infrastructure of support that includes at least temporary or permanent living quarters, suppliers of food and other essentials, land transport, maintenance installations including shipyards and chandleries, and financial, storage, and entertainment facilities.

The study of maritime cultures by means of archaeology is not the same as underwater archaeology. Although it may often use the general methods of underwater archaeology, maritime archaeology does not include the archaeology of sinkholes, like Little Salt Spring and Wakulla Springs in Florida, with their Paleo-Indian and paleontological remains, or the cenotes of the Yucatán Peninsula, with their Maya deposits, or the lake dwellings in Poland, Italy, Germany, Switzerland, and (p. 4) elsewhere. Indeed, an argument might be made that maritime archaeology does not include riverine archaeology, but that distinction is less clear, since a boat that leaves a sea to travel upriver stays the same boat, and how does one really distinguish riparian cultures from seashore cultures? Should there be any distinction between maritime and lacustrine archaeology, since there is so little difference between a small sea and a large lake?

In a sense, maritime archaeology is so new it is still defining itself. As this volume demonstrates, it has several branches. Coastal archaeology is the archaeology of those who simply lived in maritime zones, whether their sites are now on land, under water, or partly in both zones. Nautical archaeology is the archaeology of the *ship* (*naus* in Greek), whether the ship is on land, under water, partly on land and partly under water, or in some cases still afloat. It includes the archaeology not only of ships, but of all kinds of watercraft, from simple rafts, inflated skins, dugouts, kayaks, umiaks, and birch-bark canoes, to huge and complex modern freighters, tankers, passenger ships, and war vessels. Because the *naus* cannot be separated from its home, the study of ports and harbors and those who peopled them is usually considered part of nautical archaeology, just as it is part of the broader field of maritime archaeology (McCann et al. 1987; Raban 1985; Raban 1989; Raban and Holum 1996). Another developing specialization is the archaeology of aircraft, which may be included in nautical archaeology because aircraft are really ships of the sky.

The following chapters show that nautical archaeology remains the largest and best-known of the subdisciplines of maritime archaeology. A brief overview of its development should, therefore, be useful.

Development

What we today call nautical archaeology actually predates its perception as a separate branch of archaeology. In the nineteenth and twentieth centuries archaeologists routinely uncovered and studied Middle Kingdom boats in Egypt (de Morgan 1895: 81–83, with pls. XXIX–XXXI), part of a Roman ship dredged from a harbor at Marseille (Bass 1972: 81), the tenth-century Anglo-Saxon ship burial at Sutton Hoo in England (Bruce-Mitford et al. 1975–1983), various early vessels in Britain from the Bronze Age (Wright 1990) through the Roman period (Marsden 1994) and later (Marsden 1996), Viking ships in Scandinavia

(Christensen 1972), and dugouts around the world (McGrail 2001: *passim*). These examples do not include the early, pre-scuba efforts of amateur archaeologists to examine sunken vessels. They range from the fifteenth-century breath-holding dives on two Roman vessels in Italy's Lake Nemi and the first use of a diving helmet in the following century on the same vessels (Ucelli 1950: 5–34), through the lowering of diving bells onto wrecks in Italy, Sweden, and the Caribbean as early as the sixteenth and seventeenth centuries, (p. 5) followed by eighteenth- and nineteenth-century explorations and salvage attempts by helmet divers on early wrecks in England (Broadwater 2002: 18, 23), to the 1935 raising, from Lake Champlain in the United States, of the intact colonial-period gunboat *Philadelphia*, now displayed at the Smithsonian Institution in Washington, DC (Bratten 2002).

Although the study of watercraft has continued on land in many places, as with the two Khufu ships in Egypt (Ward 2000: 45–68), parts of fifteenth-century BCE ships found in caves at a Pharaonic port near the Wadi Gawasis on the Egyptian Red Sea coast (Fattovich, Bard, and Ward 2007), dozens of ancient wrecks from the fifth century BCE to the fourth century CE at Pisa (Camilli and Setari 2006), Greek and Roman wrecks in Marseille (Pomey 1995), the Graveney boat in England (Fenwick 1978), and more than 30 Byzantine ships in a silted harbor at Constantinople (Kocabaş 2008), the branch of nautical archaeology that entails diving had its beginnings in the simple observation or collection of old things of antiquarian interest. There was nothing innately wrong with this at the time, for it satisfied the same craving for knowledge of the past that still attracts millions of people annually to visit the pyramids of Egypt, Pompeii, Machu Picchu, Angkor Wat, and Mount Vernon, or to view museum displays of the contents of King Tut's tomb, the Uluburun shipwreck, or the *Titanic*. Without this first stage, now unacceptable, scientific nautical archaeology would never have evolved.

By the nineteenth century, archaeologists like Augustus Pitt-Rivers in England, Heinrich Schliemann in Turkey, and Flinders Petrie in Egypt demonstrated how much more could be learned of the past by properly recorded stratigraphic excavations on land and the sequence dating of artifacts. Because helmeted sponge divers in cumbersome suits and lead-weighted shoes could not conduct such careful excavations, however, no one looked askance at their picking up artifacts from the floor of the Adriatic for personal and monastic collections. The early-twentieth-century discovery and salvage of classical bronzes by Greek sponge divers in the Mediterranean and Aegean Seas were even acclaimed by professional archaeologists, especially because on land such statues had rarely survived the scrap heap. Art historians knew only that the most highly prized classical Greek statues in the National Museum of Greece and in the Louvre came from the sea (Bass 1966: 74–85), as did the Roman statuary and pottery exhibited in Tunisia's Bardo Museum (Hellenkemper Salies 1994: 5–29). The salvage of these masterpieces, however, was not true archaeology.

All this changed in the 1940s when Frenchmen Jacques-Yves Cousteau and Emil Gagnan developed the Aqua-lung, a simple yet reliable self-contained underwater breathing apparatus, or SCUBA. By enhancing divers' mobility, this device allowed underwater

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excavators to work even more carefully than their terrestrial counterparts, a statement I can make with confidence from my own experiences both on land and under the sea; by floating just over a site and creating small currents with one or two fingers, a diver can remove sediment a few grains at a time, without the use of any scraping or digging tool.

Throughout the 1950s in the Mediterranean a number of noteworthy pioneering attempts to excavate Roman shipwrecks were made at places such as the Grand (p. 6) Congloué, Cape Dramont, and Île du Levant in France, Mahdia off Tunisia, and Albenga in Italy (*Atti del II Congresso* 1961; du Plat Taylor 1965: 34–103). French and Italian divers adapted standard tools like airlifts to remove sediment and underwater television to allow archaeologists to follow the progress of work from the surface. Near the island of Spargi, north of Sardinia, Gianni Roghi developed a method of mapping by means of metal grids constructed over a wreck (Roghi 1958–1959, 1959, 1965). Still, underwater excavations lagged behind those on land because the archaeologists on these early projects did not dive; instead they stayed on deck and gratefully accepted the artifacts handed up to them by hired divers. None of the excavations were carried to completion.

This pioneering stage of shipwreck archaeology, controlled by scuba divers who at first often exaggerated the difficulties of diving in order to keep their monopoly on shipwrecks (Frost 1963: 13–18, 170–171, 254–259; Tailliez 1965: 91), was short-lived. As early as 1959 anthropology professor John Goggin, who dived in Florida’s freshwaters, dismissed so-called archaeology by diving enthusiasts (Purdy 1991: 201–203), accurately stating that “it is far easier to teach diving to an archaeologist than archaeology to a diver!” (Goggin 1959–1960: 350).

In 1960, nautical archaeology exploded like a celestial nova, often at sites that had been identified in the previous decade. Scuttled Viking ships discovered by divers in Roskilde Fjord, Denmark, would soon be surrounded by a coffer dam to allow the site to be pumped dry and excavated by archaeologists like a terrestrial site (Crumlin-Pedersen and Olsen 2002: 23–41). A Bronze Age shipwreck at Cape Gelidonya, Turkey, was the first ancient wreck excavated in its entirety on the seabed, its excavation the first directed by a diving archaeologist (Bass 1967). In Sweden, the seventeenth-century warship *Vasa* was being raised from the depths of Stockholm harbor (Franzén 1962; Cederlund 2006: 12–290). That same year scuba divers began “whitewater archaeology” below rapids in Minnesota and Canada, where fur-traders’ canoes had overturned, spilling out their cargoes (Wheeler et al. 1975); colonial bateaux came safely out of Lake George, New York, and were treated with polyethylene glycol (Inverarity 1964; Seborg 1964); and the first attempts were made to salvage the Civil War ironclad *Cairo* in Mississippi’s Yazoo River (Bearss 1980).

The field was still so small that almost all directors of the projects just mentioned were able to meet in early 1963 in one room of the Minnesota Historical Society for an international conference on modern underwater archaeology (Holmquist and Wheeler 1964); sadly, word reached its participants that the prescient John Goggin, who was to have been a central figure, had died tragically young. In the half century since then,

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nautical archaeology has grown too vast for any one person to keep abreast of the major projects around the globe. Long gone are the days when virtually all practitioners knew one another on a first-name basis.

Diving archaeologists devoted the 1960s largely to overcoming some of the inherent problems of working at depth, especially on the deeper, usually better-preserved wrecks that require decompression dives, which limit the amount of time an excavator can spend on a site in any given day. Improving efficiency was critical. (p. 7) Recognizing the importance of context, archaeologists devoted themselves to improving underwater mapping techniques, first using grids and photo towers (Bass and van Doorninck 1982: 8–31), then three-dimensional mapping by stereo-photography (Rosencrantz 1975), and finally photogrammetry from *Asherah*, the first commercially built American submersible (Bass and Rosencrantz 1977). Although all of those methods have been superseded by mapping with digital cameras and combinations of computer software (Green, Matthews, and Turanli 2002), the earlier techniques allowed Frederick van Doorninck to demonstrate for the first time that an ancient ship could be reconstructed on paper from its fragmentary seabed remains (Bass and van Doorninck 1982: 32–64, 87–120).

There could no longer be any excuse for conducting underwater excavations with lesser standards than those deemed acceptable on land. At the same time, technical improvements continued to be made (Bass 1968; Bass 1975: 147–167). Before the decade was over, plastic airlifts made of light and readily available irrigation pipes had replaced the heavy and cumbersome metal airlifts that had been used for nearly two decades. Safety improvements included the first use of oxygen for normal, twice-daily decompression periods, and the air-filled plastic dome situated on the seabed, dubbed the “underwater telephone booth,” that served as a safety refuge in case of equipment failure. A submersible decompression chamber raised itself independently through the various stages of decompression during one 1967 project. The same year, in Turkey, sonar was shown to have the ability to locate ancient shipwrecks (Bass 1968: 417–423).

In the 1970s nautical archaeology truly came into its own. Its very name came into common use with the introduction of the *International Journal of Nautical Archaeology and Underwater Exploration* in 1972, although its publisher, the Council for Nautical Archaeology, had been around since 1964. The American Institute of Nautical Archaeology (now simply INA) borrowed the name from the journal when it was incorporated the year the journal began. About that time, the well-preserved classical Greek ship excavated off Kyrenia, Cyprus, demonstrated that a sunken and restored hull could be every bit as important as the salvaged ancient Mediterranean cargoes that earlier had dazzled both archaeologists and the public (S. W. Katzev 2005). Increasing attention was paid to the *naus*.

The same decade saw the global spread of underwater shipwreck excavations conducted to increasingly high standards, including those of a Roman shipwreck at the Madrague de Giens in France (Tchernia et al. 1978), a sixteenth-century Basque whaler at Red Bay in Canada (Grenier, Bernier, and Stevens 2007), the 1554 Spanish fleet sunk off Padre

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Island, Texas (Arnold and Weddle 1978), a Punic ship at Marsala in Sicily (Frost 1981), the seventeenth-century Portuguese frigate *Santo Antonio de Tanna* in Kenya (Piercy 2005), the fourteenth-century ship at Shinan-gun in Korea (Keith 1980), Spanish Armada wrecks in Ireland (Martin 1975), a classical Greek wreck in the Strait of Messina (Eiseman and Ridgway 1987), and Dutch East India Company ships off Australia (Green 1977).

In the 1970s, too, maritime and nautical archaeology became academic disciplines. The Leon Recanati Institute for Maritime Studies at the University of Haifa (p. 8) (RIMS) was established in 1972, while the St. Andrews Institute of Maritime Archaeology was founded the following year. Although various courses on maritime or nautical archaeology had been taught around the world, in that decade there were now degree-granting programs, at the University of Haifa through its Department of Maritime Civilizations, followed by the Nautical Archaeology Program at Texas A&M University, and the Maritime Studies Program at East Carolina University. Maritime archaeology is today, with an increasing number of university programs and courses, a respected subject in which its earliest practitioners pass on what they learned by trial and error to increasingly better-educated generations of students. No longer can an archaeologist simply learn to dive, as half a century ago, and be considered competent to excavate an ancient ship. Today's graduate students can take seminars on preclassical, classical, medieval, postmedieval, and Far Eastern seafaring, learning the histories of naval warfare and of maritime commerce, sometimes studying paleography so they can conduct their own archival research. They learn to draw ships' lines and make half models and digital reconstructions in laboratory courses on the history and theory of wooden hull construction. They become familiar with the history of the politics of sea power and the principles of harbor design and construction. They increasingly become involved in the legal aspects of underwater archaeology. And they learn the methods of maritime conservation, often gaining practical experience in university, institute, or museum laboratories. Indeed, most graduate students serve apprenticeships on actual surveys and excavations and in laboratories.

Even in the subfield of nautical archaeology, there are various specializations. Just as any terrestrial excavation staff may include a numismatist, epigrapher, art historian, physical anthropologist, and palynologist, nautical excavations may include both those who study the vessels themselves—their hulls, rigging, ballast, anchors, and such—and those who only interpret vessels' contents, both cargoes and personal possessions. Even nondiving nautical archaeologists can be important members of the excavation team, as was J. Richard Steffy, a leading authority on ship reconstruction (Steffy 1994). The resultant collaborations among such specialists explain the multiple authorship of many excavation reports. In the same vein, should not those who study early and ancient ships by their representations and contemporary descriptions be considered nautical archaeologists (Basch 1987; Casson 1971; Needham 1971; Rougé 1966)? Both students of nautical archaeology and professional excavators would be hard pressed to work without the books of these and other scholars.

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Many technical problems of shipwreck excavations have been solved since the first wreck was excavated in its entirety in 1960, but improvements are always welcome. Diving has become safer and more comfortable. Gauges allow divers to see how much compressed air remains in their tanks, buoyancy compensators increase diver safety, and fabric-lined wet suits no longer tear almost daily. Still, perfection of a flexible, one-atmosphere diving suit, being undertaken by Phil Nuytten in Canada, will allow excavators to work for hours instead of mere minutes at the depths that now limit bottom time (Symes 2005).

(p. 9) Conservation methods and treatments have been developed specifically for wet or waterlogged artifacts (Hamilton 1996). These methods are constantly being refined. Conservators have been experimenting with materials from sugar (Parrent 1983) to silicon oils (Smith 2003), for example, to find a better substance than polyethylene glycol for treating waterlogged wood.

Similarly, the technology of locating and excavating shipwreck sites is vastly improved by both remote sensing, with magnetometers and various kinds of sonar, and visual search from submersible vehicles, both human-occupied and remotely operated (Akal, Ballard, and Bass 2004; Bass 2004). Still, sonar of even higher resolution is needed so that one day searchers on the surface will be able to differentiate between sunken cargoes and seabed boulders.

The experimental archaeology of early ships has a long history, from the replica of the Gokstad ship that crossed the Atlantic for exhibition at the Chicago World's Fair of 1893, through a more recent replica of a *faering* (small boat propelled by two pairs of oars) found with the Gokstad ship (McGrail 1974) to the variously scaled sailing replicas of the fourth-century BCE Kyrenia ship (M. L. Katzev 1980: 44–45; M. L. Katzev 1991; Pomey 1997: 170–171) and the Lake Champlain Maritime Museum's replicas of the 1776 gunboat *Philadelphia* and the 1862 sailing canal boat *Lois McClure*. There are other authentic replicas, but some rather fanciful vessels built to retrace ancient routes are based on little archaeological evidence. Nevertheless, a less expensive method of testing the sailing qualities of excavated vessels is now at hand. Following on work done by the Germans on the Bremen Cog, Filipe Castro is using computer models to simulate stability conditions and sailing performance of archaeological reconstructions of various ships (Monroy, Castro, and Furuta in this volume).

Controversy and Publication

This preface began with a discussion of the definition of maritime archaeology. Regardless of its precise definition, maritime archaeology will constantly evolve in both its aims and its techniques. The aims of the earliest nautical archaeologists, for instance, were originally the same as the aims of classical archaeologists, medieval archaeologists, and art historians, and this remains largely the case despite attempts to rid maritime archaeology of historical particularism—with a week-long symposium devoted solely to that purpose by those who believe that “archaeology is anthropology or it is nothing” (Gould 1983). Archaeologists of a different persuasion have never been so

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narrow as to claim that “archaeology is history or it is nothing,” although the Bronze Age shipwreck excavated off Uluburun, Turkey, as just one example, has contributed greatly to the histories not only of ship construction, but also of trade, diet, metallurgy, metrology, glass, ceramics, religion, music, and literacy, involving such disparate fields as Homeric studies and Egyptology (Pulak 1998). No research design could have prepared the excavators for what they found. (p. 10) Luckily, they were not restricted by one, for they simply wanted to learn everything possible from the site. The opposite approach has yet to prove its value (Gould 2000).

Another controversy in the aims of nautical archaeology is the debate over whether a shipwreck site should be excavated in its entirety rather than simply sampled. Proponents of the idea that it is wrong to excavate all of a shipwreck base that precept on accepted approaches to terrestrial sites. To excavate an entire terrestrial site to bedrock, whether a Bronze Age village or a sprawling Roman city, would be immoral. With new questions and better techniques, archaeologists of the future should be in a position to return to partially excavated sites for decades or centuries to come. Archaeologists at such sites, however, often excavate individual burials or dwellings in their entirety.

A shipwreck, being a coherent whole, is more like just one burial. It is hard to imagine an archaeologist excavating only part of a skeleton and leaving the rest. A concrete example is the eleventh-century shipwreck at Serçe Limanı, Turkey. At the end of the first excavation season, there was pressure to publish both scholarly and popular articles on the site. These publications are now embarrassing. Almost every conclusion was wrong. Because we had raised mainly the ship’s Near Eastern cargo of glass vessels and glazed terra-cotta bowls during the initial campaign, I concluded that they were evidence of a Muslim merchant venture (Bass 1978). In the following campaign, however, we found the pork bones, lead seals with Christian images, fishing weights decorated with crosses and the name Jesus, and graffiti that proved the merchants on board were Hellenized Christian Bulgarians who lived on the north shore of the Sea of Marmara near Constantinople, which is slowly leading into even more detailed contributions to medieval history (Bass et al. 2004). This could be repeated for many excavated wrecks. Sampling wrecks can lead only to historical inaccuracies. The debate should be closed.

There should be no debate at all, however, about a serious problem facing all archaeologists, maritime or otherwise: the lack of thorough, scholarly publication of fieldwork. Sir John Boardman of the University of Oxford, who has carefully studied the situation, believes that “over the last fifty years, far less than 25 percent of material and results of professional archaeological excavations has been properly published, and the rest will never get beyond preliminary reports, if that (Boardman 2009: 109).” Others have estimated that 70% of excavations in the Near East is not published (Atwood 2007: 60; Owen 2009: 140–141), and perhaps 80% of all Italian archaeological material remains unpublished, with the record in Egypt perhaps no better (Stoddart and Malone 2001).

An unpublished shipwreck, no matter how meticulously and brilliantly excavated, is simply a looted wreck. That is why I stopped directing diving operations in 1985 and

turned over the direction of the most exciting ancient shipwreck ever found, that at Uluburun, Turkey, to a younger colleague (Pulak 1998). I had seen the two excavation directors I assisted as a student in the 1950s die before publishing their decades of digging. My decision was proven correct when in 2009 the last of my publication obligations finally went to the printer (Bass et al. 2009). It takes years or decades to produce excavation reports that are more than simple catalogs, (p. 11) which is why some sites have not yet been completely published long after their excavation. It is a sad certainty, however, that far too many shipwreck excavations will never be published.

Still, it is encouraging to see the appearance of so many multivolume final reports, including, besides the volumes on Red Bay, the *Vasa*, and Serçe Limanı already referred to, the five-volume archaeology of the *Mary Rose* (including Jones 2003; Marsden 2003; Gardiner 2005), the final reports on the excavation of the fifth-century BCE Ma'agan Mikhael wreck in Israel (Linder and Kahanov 2003; Kahanov and Linder 2004), ships and boats of the North (including Crumlin-Pedersen 1997; Sørensen 2001; Crumlin-Pedersen and Trakadas 2003; and Lemée 2006), and the excavation reports coming out of Catalonia (including Nieto et al. 1989; Nieto and Puig 2001; Nieto and Raurich 1998), along with those on the Bremen Cog (Lahn 1992–2003) and on the vessels uncovered in the Dutch polders (Hocker and Vlierman 1996; McLaughlin-Neyland and Neyland 1993; Neyland and McLaughlin-Neyland 1996; Van de Moortel 1991). In addition, there are myriad single-volume reports, including those on the Archaic Greek shipwreck at Gela (Panvini 2001); a fishing boat from the time of Christ in the Sea of Galilee (Wachsmann 1990); a medieval boat in France (Rieth, Carriere-Desbois, and Serna 2001); the eighteenth-century *General Carleton*, lost in the Polish Baltic in 1785 (Ossowski 2008); and a Lake Champlain horse-powered ferry (Crisman and Cohn 1998).

Archaeology vs. Treasure Hunting

One of maritime archaeology's greatest challenges lies in educating the public about the purposes of archaeology and the difference between maritime archaeology and treasure hunting. There are still nations that grant permits to treasure hunters, sometimes with the naive belief, based on wild promises made by the treasure hunters, that nations will gain financially by cooperating in the search for treasure. Working with archaeologists, however, is usually of far greater national and financial benefit.

The *Vasa* Museum now attracts more than a million paying visitors annually, according to Marika Hedin, director of the museum, and Robert Olsson, Director General for Sweden's National Maritime Museums. This makes the museum 100% self-sufficient, other than for extraordinary costs of conservation and ongoing research. Approximately 25–30% of all international tourists who come to Sweden visit the *Vasa*. These foreign visitors contribute to the Swedish economy not only by museum entrance fees, but also by money spent simply getting to and from and staying in Stockholm. Similarly, according to Turkish government figures, the Bodrum Museum of Underwater Archaeology has become the most visited archaeological museum in Turkey, attracting a quarter of a

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million paying visitors every year. That should earn in ticket sales about \$2 million annually for the Ministry of Culture, far more than the cost of staffing and maintaining the museum. Visitors (p. 12) to the Bodrum Museum, however, additionally pay for souvenirs, meals, taxis, and other things that help the Bodrum economy. Another example is provided by the United Kingdom, where the *Mary Rose*, according to maritime archaeologist Chris Dobbs (pers. comm. 2009) of the Mary Rose Trust, has attracted over 7.6 million paying visitors since its temporary museum opened in 1983. He says that this contributes significantly to the local economy and provides much of the funds required for the expensive process of conservation. An object of national pride, the purpose-built *Mary Rose* museum scheduled to open in 2012 will allow visitors from around the world to see the hull and contents of King Henry VIII's great warship *in one place*. This unity, common to all shipwreck museums, is as important for shipwrecked artifacts as for those found on land.

Treasure hunting does not equal archaeology in societal value largely because ships' contents are not usually kept together as permanent collections (would it not be regrettable for the public as well as Egyptologists had the contents of King Tut's tomb been auctioned off piecemeal rather than kept together for the enjoyment and education of millions of people around the world?). But there are other reasons as well. Treasure hunters must make a profit in order to repay the financial backers of their search and salvage operations. They do not have the luxury of time. Yet Institute of Nautical Archaeology excavators calculate that they spend far more money, energy, and time on post-excavation work than on the mapping and retrieval of their finds, spending on average two years on conservation, research, and publication for every month they dive. Treasure hunters, even those inclined to conserve the nonsalable items from their sites, cannot wait for decades to repay sponsors.

There are, of course, archaeological exceptions. Both cultural resources or heritage management archaeologists and those from academic institutions often face time constraints in collecting and publishing as much information as possible on sites that might otherwise be lost forever. An example is the work on an abandoned eighteenth-century British merchant frigate found under Manhattan's Water Street exactly where a large building was being constructed. It was not feasible to halt construction indefinitely, but it was stopped long enough for archaeologists to collect data and some of the physical remains (Riess 1987). More recently, Texas A&M University archaeologists, under contract with Okeanos Gas Gathering Company (OGGC), collected as much data as possible in two weeks from an early-nineteenth-century wreck 1,220 m deep in the Gulf of Mexico that OGGC had encountered during a survey for its Mardi Gras Pipeline System (Ford et al. 2008).

Despite such exceptions, and despite using accurate mapping techniques, raising and conserving some of the monetarily worthless materials from the seabed, and even hiring professional shipboard archaeologists to lend legitimacy to their work, treasure hunters are not practicing archaeology. The goals of treasure hunting and archaeology are in opposition. Archaeology does not stop when a site has been salvaged, no matter how

completely. That is only the beginning. What treasure hunters would have spent years monitoring the chemical treatment of the disassembled Serçe Limanı hull, and additional years piecing together its thousands of wooden fragments in order to study and understand the hull and its place in the (p. 13) history of ship design and construction, as well as to display it for the public (Bass et al. 2004)? How many would have paid for a year-round conservation staff to spend decades looking for joins among between half a million and a million fragments of glass, and then having the resultant glass vessels cataloged and illustrated not only for museum display, but also for a 525-page volume on the largest collection of medieval Islamic glass in existence (Bass et al. 2009)? What treasure hunters would have spent the time learning to read Russian, Bulgarian, and Rumanian as diving archaeologist Frederick van Doorninck did at the conclusion of the excavation? Only by doing so could he determine the meaning of the graffiti he was finding on the amphoras, which in turn revealed remarkable details about the identity and commercial practices of their makers and owners, as he will reveal in the third volume of the Serçe Limanı report (van Doorninck, forthcoming).

There is, however, a gray area. Even to suggest it will draw instant and reflexive criticism, but the subject should be debated. Before continuing, therefore, I must make my credentials clear. I am the “balding Southerner” described by Karl Meyer in his seminal *The Plundered Past* as being a prime mover in the “revolt against the acquisitive tradition of major American art museums” (Meyer 1973: 73–75). Probably no professional archaeologist has been more outspoken against treasure hunting (Bass 1979a, 1981, 1983), by debating treasure hunters on national television, testifying before both House and Senate Committees as they considered bills to protect historic shipwrecks in American waters (Hearings 1986: 122–134; Hearings 1987: 154–179), and correcting some of the numerous falsehoods spread by and about treasure hunters, such as that they developed 90% of the equipment used in underwater excavation, that there is no need to excavate hull remains in the shallow Caribbean because they have been too badly damaged by storms and anyway there are accurate plans of early hulls in the Archives of the Indies in Seville, that archaeologists don’t deal with monetarily valuable artifacts, that archaeologists don’t go out and actually find wrecks, and other such nonsense (Bass 1985). However, I still must ask, which is worse: the professional archaeologist who carefully excavates a site and never publishes it, or the treasure hunter who spends millions of dollars searching 1,400 square miles of ocean in order to locate a nineteenth-century wreck more than a mile deep, salvages part of it, conserves that part, and publishes a book on the operation (Thompson 1998)? Would any archaeologist now or five hundred years from now spend that amount of money and effort to locate and excavate a vessel like many others of the same type that can be found in lesser depths? Is not saying that all vessels should be left alone like saying that all structures on land are sacrosanct because one day they will be antique? Old homes are demolished daily and replaced by more modern structures, just as old vessels are scrapped or sunk as artificial reefs. And one can know far more about the wreck just mentioned, the U.S. mail steamship *Central America*, than anyone will ever know about many wrecks excavated by professional archaeologists and never fully published. The *Central America*’s hull and machinery

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remain on the ocean bottom, on the slim chance that they will ever justify archaeological excavation, but clothing, written documents, ceramics, and glass were meticulously conserved, photographed, and published.

(p. 14) Perhaps a better example is the Spanish galleon *Nuestra Señora de la Concepción*, excavated off Saipan in the Northern Mariana Islands of the Pacific Ocean. Published both as a beautifully illustrated coffee-table book (Mathers and Shaw 1993) and in a 550-page excavation report (Mathers, Parker, and Copus 1990), its scattered cargo spread down a slope from near the surface to a depth of 60 m (c. 200 ft), so there was no hull to map and preserve. Rather than being auctioned off, the artifacts were sold as a collection to a Japanese company that promised to curate and display them for 40 years in a hotel as a tourist attraction and then donate the collection to the local government, but because the hotel was not built, the collection now simply belongs to the government (van Tilburg in this volume).

To be critical of treasure hunting, archaeologists must continue to make a better case to the public for their approach to shipwrecks, by doing a better job and not simply by chastising treasure hunters.

Lest treasure hunters take my comparison with archaeologists who do not publish out of context, it should be pointed out that INA archaeologists who have examined the known early ships of discovery and exploration of the New World—in the Bahamas, the Turks and Caicos, the Dominican Republic, and Mexico—have noted that the only postsinking damage suffered by the wrecks, once stabilized in the seabed, has been at the hands of misguided treasure hunters, and these ships are of inestimable historic and archaeological importance. The targets of treasure hunters are too often the most historically and archaeologically important wrecks. In general, treasure hunting simply is destructive of our search for knowledge of the past (Bass 1979b; Hall 2007).

Further, after spending years of expensive legal wrangling over ownership with states or the original insurers or owners of sunken vessels, it is a rare treasure hunter who actually makes any profit and repays investors (Pringle 2007).

Laypeople sometimes ask why it is necessary to keep duplicate artifacts together as permanent collections, out of sight in museum storerooms. The archaeologist will tell them why. With more advanced laboratory analyses, as well as new questions to be answered, teams of archaeologists work for months annually in the Bodrum Museum on artifacts raised nearly half a century earlier, often with startling results for history. Elsewhere artifacts are examined by the latest methods of dendrochronology, petrography, isotope analysis, radiocarbon dating, DNA studies, and dating by thermoluminescence. This is possible only because the collections remain intact. It is relatively simple to find and salvage antiques or antiquities. It is what happens to those antiques or antiquities later that makes their recovery part of archaeology.

In summation, because international admiralty laws often conflict with antiquities laws, maritime sites increasingly require new legal protections, both national and international. Because laws are created by people, education about maritime archaeology by means of publications, lectures, museum displays, and television programs is vital. The distinction between archaeology and treasure hunting is misunderstood by far too large a part of the population.

(p. 15) Deepwater Archaeology

Modern technology is opening the deeper parts of the world's seas and oceans to maritime archaeology, beyond the depths in which scuba divers can operate (McCann and Oleson 2004; Ballard 2008; Ford et al. 2008; Wachsmann in this volume). No deepwater wreck has yet been excavated in its entirety, but surely that day will come.

In the meantime, however, because most deepwater wrecks lie in international waters, they raise the question of where they and all their contents should go. For a while it was argued that archaeological finds from international waters should be returned to the land of cultural origin. The very first completely excavated wreck points to the absurdity of this notion. For nearly half a century archaeologists debated in academic publications whether the Bronze Age ship excavated at Cape Gelidonya was Greek or Proto-Phoenician in origin. But if the latter, should the finds from the ship go to Syria, Lebanon, or Israel? Recent, unpublished laboratory analyses—made possible only because the collection of artifacts has been kept together in the Bodrum Museum—have shown that neither hypothesis was correct, for the ship's metal cargo, ceramics, and anchor were all from the island of Cyprus.

A better and earlier example is the Uluburun shipwreck, with its cargo collected more than three millennia ago from what are today perhaps a dozen modern countries, from tropical Africa to Asia to northern Europe (Pulak 2008). Happily, it all stays together in one museum, the Bodrum Museum in Turkey, even though that is not near the sources of either the ship or its cargo, much of which has since been exhibited in museums in Germany (Yalçın, Pulak, and Slotta 2005) and the United States (Pulak 2008).

The problem is being partly resolved by countries bordering the Mediterranean that plan to extend their national boundaries out to 200 miles, leaving a relatively small part of that sea international (Kliot 1988: 209). This could protect many Mediterranean wrecks, but could also have the unfortunate result of keeping maritime archaeologists from northern Europe, America, Australia, and Asia from studying wrecks that could be more closely tied to their ancestry than to the modern peoples living around the Mediterranean who would control the wrecks. Three million Americans, for example, claim Greek descent according to the U.S. Department of State, and a third of a million Australians claim Greek ancestry. Why should they not have as much right to study an ancient Greek ship found nearly 200 miles off the North African coast as the modern inhabitants of the nearest nation?

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The problem is exacerbated by wrecks lying in deep water that are now and always will be extranational. These wrecks are increasingly vulnerable to human disturbance. The partial but legal salvage that followed the discovery of the famed *Titanic* demonstrated even before the search for the *Central America* that vessels lying kilometers deep are no longer beyond the reach of either archaeologists or treasure salvors. The UNESCO Convention on the Protection of the Underwater Cultural Heritage, already ratified by the minimum of 20 nations, is aimed at protecting such wrecks from destructive looters.

Because of the expense of excavating at great depth, however, perhaps a new model is needed. Early terrestrial excavations were funded by great museums that sent out expeditions to bring back antiquities, and although this is no longer a practice, the modern world is a richer and better place for encyclopedic museums like the Louvre, the British Museum, the Metropolitan Museum of Art, and the Berlin Museum (Cuno 2009). Would it not be sad if only visitors to Nigeria could ever see a Benin bronze? What if in order to see a single example of Chinese or Japanese porcelain one had to travel to China or Japan? Thus, if a Roman ship of unknown origin were found in the deep Atlantic Ocean, why should it not go to the British Museum, if that museum could afford its proper excavation? After all, London was once Roman. Why should not the half million Lebanese Americans have as much claim to enjoy a Phoenician wreck found in the Atlantic Ocean as the four million current inhabitants of Lebanon—both people now thoroughly mixed with more modern Arabs of non-Phoenician descent?

Nearly four decades ago, when urging that antiquities dealing in all countries be made illegal, except as approved by the governments in question, I also wrote: “For their part, the lands in which the only remnants of our most ancient past are to be found should take a realistic attitude toward sharing duplicate objects, offering frequent loan exhibits, and making vast basement stores readily available to scholars of all countries” (Editorial 1970). If nonpublishing archaeologists deserve criticism, so too do local museum directors who may often see artifacts as things to be locked away, out of sight, for safekeeping.

Conclusion

As these words are written, maritime archaeology is a mature discipline with well-trained practitioners around the world excavating, conserving, restoring, displaying, replicating, and, most importantly, publishing their sites (Delgado 1998). The future seems bright.

References

Akal, T., R. D. Ballard, and G. F. Bass, eds. 2004. *The application of recent advances in underwater detection and survey techniques to underwater archeology*. Bodrum: Uluburun.

The Development of Maritime Archaeology

Arnold, J. Barto, III, and Robert S. Weddle. 1978. *The nautical archaeology of Padre Island: The Spanish shipwrecks of 1554*. New York: Academic Press.

(p. 17) Atti del II Congresso Internazionale di Archeologia Sottomarina, Albenga 1958. 1961. Bordighera: Istituto Internazionale di Studi Liguri.

Atwood, Roger. 2007. Publish or be punished: Israel cracks down on delinquent diggers. *Archaeology* 60 (2): 18, 60, 62.

Ballard, Robert D. 2008. *Archaeological oceanography*. Princeton, NJ: Princeton University Press.

Basch, Lucien. 1987. *Le musée imaginaire de la marine antique*. Athens: Institut Hellenique pour la Préservation de la Tradition Nautique.

Bass, George F. 1966. *Archaeology under water*. London: Thames & Hudson; New York: Frederick A. Praeger.

Bass, George F. 1967. Cape Gelidonya: A Bronze Age shipwreck. *Transactions of the American Philosophical Society* 57 (8).

Bass, George F. 1968. New tools for undersea archeology. *National Geographic* 134 (September): 402–423.

Bass, George F., ed. 1972. *A history of seafaring based on underwater archaeology*. London: Thames and Hudson; New York: Walker.

Bass, George F. 1975. *Archaeology beneath the sea: A personal account*. New York: Walker.

Bass, George F. 1978. Glass treasure from the Aegean. *National Geographic* 153 (June): 768–793.

Bass, George F. 1979a. Treasure-hunting divers. *Journal of Field Archaeology* 6: 104–107.

Bass, George F. 1979b. The men who stole the stars. *Sea History* 12 (Fall): 30.

Bass, George F. 1981. Treasure-hunting vs. underwater archaeology [a letter coauthored with 10 others]. *Journal of Field Archaeology* 8: 517.

Bass, George F. 1983. Shipwrecks and treasure hunters. *Journal of Field Archaeology* 10: 389.

Bass, George F. 1985. Archaeologists, sport divers, and treasure-hunters. *Journal of Field Archaeology* 12: 256–258.

Bass, George F. 2004. Wreck-hunting by *Carolyn*, a human-occupied submersible. *Sea Technology* 45 (4): 59–64.

The Development of Maritime Archaeology

Bass, George F., Robert H. Brill, Berta Lledó, and Sheila D. Matthews. 2009. *Serçe Limanı*, vol. 2. *The glass of an eleventh-century shipwreck*. College Station: Texas A&M University Press.

Bass, George F., Sheila D. Matthews, J. Richard Steffy, and Frederick H. van Doorninck Jr. 2004. *Serçe Limanı: An eleventh-century shipwreck*, vol. 1. *The ship and its anchorage, crew, and passengers*. College Station: Texas A&M University Press.

Bass, George F., and Donald M. Rosencrantz. 1977. The *Asherah*—a pioneer in search of the past. In *Submersibles and their use in oceanography and ocean engineering*, ed. Richard A. Geyer, 335–351. Amsterdam: Elsevier.

Bass, George F., and Frederick H. van Doorninck Jr. 1982. *Yassi Ada*, vol. 1: *A seventh-century Byzantine shipwreck*. College Station: Texas A&M University Press.

Bearss, Edwin C. 1980. *Hardluck ironclad: The sinking and salvage of the Cairo*. Rev. ed. Baton Rouge: Louisiana State University Press.

Boardman, Sir John. 2009. Archaeologists, collectors, and museums. In *Whose culture? The promise of museums and the debate over antiquities*, ed. James Cuno, 107–124. Princeton, NJ: Princeton University Press.

Bratten, John R. 2002. *The gondola Philadelphia and the battle of Lake Champlain*. College Station: Texas A&M University Press.

Broadwater, John D. 2002. Timelines of underwater archeology. In *International handbook of underwater archaeology*, ed. Carol V. Ruppé and Janet F. Barstad, 17–24. New York: Kluwer Academic/Plenum.

(p. 18) Bruce-Mitford, Rupert, et al. 1975–1983. *The Sutton Hoo ship-burial*, 3 vols. London: British Museum.

Camilli, Andrea, and Elisabetta Setari. 2006. *Ancient shipwrecks of Pisa (Le navi antiche di Pisa)*. Milano: Electa.

Casson, Lionel. 1971. *Ships and seamanship in the ancient world*. Princeton, NJ: Princeton University Press.

Cederlund, Carl Olof, with Fred Hocker. 2006. *Vasa I: The archaeology of a Swedish warship of 1628*. Stockholm: Statens Maritima Museer.

Christensen, Arne Emil. 1972. Scandinavian ships from earliest times to the Vikings. In *A history of seafaring based on underwater archaeology*, ed. George F. Bass, 159–180. London: Thames and Hudson; New York: Walker.

Crisman, Kevin J., and Arthur B. Cohn. 1998. *When horses walked on water: Horse-powered ferries in nineteenth-century America*. Washington: Smithsonian Institution Press.

The Development of Maritime Archaeology

- Crumlin-Pedersen, Ole. 1997. *Viking-age ships and shipbuilding in Hedeby/Haithabu and Schleswig*. Schleswig and Roskilde: Viking Ship Museum.
- Crumlin-Pedersen, Ole, and Olaf Olsen, eds. 2002. *The Skuldelev ships I: Ships and boats of the North*, vol. 4.1. Roskilde: Viking Ship Museum.
- Crumlin-Pedersen, Ole, and Athena Trakadas, eds. 2003. *Hjortspring: A pre-Roman iron-age warship in context*. Roskilde: Viking Ship Museum.
- Cuno, James, ed. 2009. *Whose culture? The promise of museums and the debate over antiquities*. Princeton, NJ: Princeton University Press.
- de Morgan, J. 1895. *Fouilles à Dahchour: Mars-juin 1894*. Vienna: Adolphe Holzhausen.
- Delgado, James P. 1998. *Encyclopedia of underwater and maritime archaeology*. New Haven: Yale University Press.
- du Plat Taylor, Joan, ed. 1965. *Marine archaeology*. London: Hutchinson.
- Editorial [unsigned, by Glyn Daniel]. 1970. *Antiquity* 44: 89.
- Eiseman, Cynthia Jones, and Brunilde Sismondo Ridgway. 1987. *The Porticello shipwreck: A Mediterranean merchant vessel of 415–385 B.C.* College Station: Texas A&M University Press.
- Fattovich, R., K. Bard, and C. Ward. 2007. Sea port to punt: New evidence from Marsa Gawasis, Red Sea (Egypt). In *Natural resources and cultural connections of the Red Sea*, ed. J. Starkey, P. Starkey, and T. Wilkinson, 143–148. Oxford: BAR International Series 1661.
- Fenwick, Valerie, ed. 1978. *The Graveney boat: A tenth-century find from Kent*. Oxford: BAR British Series 53.
- Ford, B., A. Borgens, W. Bryant, D. Marshall, P. Hitchcock, C. Arias, and D. Hamilton. 2008. *Archaeological excavation of the Mardi Gras shipwreck (16GM01), Gulf of Mexico Continental Slope*. New Orleans: U.S. Department of the Interior Mineral Management Service.
- Franzén, Anders. 1962. *The warship Vasa: Deep diving and marine archaeology in Stockholm*. Stockholm: Norstedt and Bonnier.
- Frost, Honor. 1963. *Under the Mediterranean: Marine antiquities*. Englewood Cliffs, NJ: Prentice-Hall.
- Frost, Honor. 1981. *Lilybaeum. Notizie degli scavi di antichità* 30 (1976): *Supplemento*. Rome: Accademia Nazionale dei Lincei.
- Gardiner, Julie, with Michael J. Allen, eds. 2005. *Before the mast: Life and death aboard the Mary Rose*. Portsmouth: Mary Rose Trust.

The Development of Maritime Archaeology

Goggin, John M. 1959–1960. Underwater archaeology: Its nature and limitations. *American Antiquity* 25: 348–354.

(p. 19) Gould, Richard A., ed. 1983. *Shipwreck anthropology*. Albuquerque: University of New Mexico Press.

Gould, Richard A. 2000. *Archaeology and the social history of ships*. Cambridge: Cambridge University Press.

Green, Jeremy N. 1977. *The loss of the Verenigde Oostindische Compagnie jacht Vergulde Draeck, western Australia 1656*. Oxford: British Archaeological Reports Supplementary Series 36(i).

Green, Jeremy, Sheila Matthews, and Tufan Turanli. 2002. Underwater archaeological surveying using PhotoModeler, VirtualMapper: Different applications for different problems. *International Journal of Nautical Archaeology* 31: 283–292.

Grenier, Robert, Marc-André Bernier, and Willis Stevens, eds. 2007. *The underwater archaeology of Red Bay: Basque shipbuilding and whaling in the 16th century*. 5 vols. Ottawa: Parks Canada.

Hall, Jerome. 2007. The Black Rhino. *Journal of Maritime Archaeology* 2 (2): 93–97.

Hamilton, Donny L. 1996. *Basic methods of conserving underwater archaeological material culture*. Washington, DC: U.S. Department of Defense.

Hearings before the Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries House of Representatives Ninety-Ninth Congress First Session on Abandoned Shipwreck Act (H.R. 3558) October 29, 1985, Serial No. 99-19. 1986. Washington, DC: U.S. Government Printing Office.

Hearings before the Subcommittee on Public Lands, National Parks and Forests of the Committee on Energy and Natural Resources United States Senate One Hundredth Congress First Session on S. 858 to Establish the Title of States in Certain Abandoned Shipwrecks, and for other purposes. September 29, 1987. 1987. Washington, DC: U.S. Government Printing Office.

Hellenkemper Salies, Gisela, et al. 1994. *Das Wrack: Der antike Schiffsfund von Mahdia*. 2 vols. Cologne: Rheinland-Verlag.

Hocker, Frederick M., and Karel Vlierman. 1996. *A small cog wrecked on the Zuiderzee in the early fifteenth century*. Lelystad: Nederlands Instituut voor Scheeps- en onderwater Archeologie.

Holmquist, June Drenning, and Ardis Hillman Wheeler, eds. 1964. *Diving into the past: Theories, techniques, and applications of underwater archaeology*. St. Paul: Minnesota Historical Society.

The Development of Maritime Archaeology

Inverarity, Robert Bruce. 1964. The conservation of wood from fresh water. In *Diving into the past*, ed. J. D. Holmquist and A. H. Wheeler, 68–70. St. Paul: Minnesota Historical Society.

Jones, Mark, ed. 2003. *For future generations: Conservation of a Tudor maritime collection*. Portsmouth: Mary Rose Trust.

Kahanov, Yaacov, and Elisha Linder. 2004. *The Ma'agan Mikhael ship: The recovery of a 2400-year-old merchantman*, vol. 2. Haifa: Israel Exploration Society.

Katzev, Michael L. 1980. Assessing a chance find near Kyrenia—a cargo from the age of Alexander: The study and conservation of an ancient hull. In Keith Muckelroy, ed., *Archeology under water: An atlas of the world's submerged sites*, 40–45. New York: McGraw-Hill.

Katzev, Michael L. 1991. The Kyrenia ship restored. In *The sea remembers*, ed. Peter Throckmorton, 55–59. New York: Smithmark.

Katzev, Susan Womer. 2005. Resurrecting an ancient Greek ship: Kyrenia, Cyprus. In *Beneath the seven seas*, ed. George Bass, 72–79. London and New York: Thames & Hudson.

(p. 20) Keith, Donald H. 1980. A fourteenth-century shipwreck at Sinan-gun. *Archaeology* 33 (2): 33–43.

Kliot, Nurit. 1988. Maritime boundaries in the Mediterranean: Aspects of cooperation and dispute. In *Maritime boundaries and ocean resources*, ed. Gerald Blake, 208–226. Lanham, MD: Rowman and Littlefield.

Kocabaş, Ufuk, ed. 2008. *The “old ships” of the “new gate,”* vol. 1. Istanbul: Ege Yayınları.

Lahn, Werner. 1992–2003. *Die Kogge von Bremen*. 2 vols. Hamburg: Ernst Kabel.

Lemée, Christian P. P. 2006. *The Renaissance shipwrecks from Christianshavn: An archaeological and architectural study of large carvel vessels in Danish waters, 1580–1640*. Roskilde: Viking Ship Museum.

Linder, Elisha, and Yaacov Kahanov. 2003. *The Ma'agan Mikhael ship: The recovery of a 2400-year-old merchantman*, vol. 1. Haifa: Israel Exploration Society.

Marsden, Peter. 1994. *Ships of the port of London: First to eleventh centuries CE*. London: English Heritage.

Marsden, Peter. 1996. *Ships of the port of London: Twelfth to seventeenth centuries CE*. London: English Heritage.

Marsden, Peter. 2003. *Sealed by time: The loss and recovery of the Mary Rose*. Portsmouth: Mary Rose Trust.

The Development of Maritime Archaeology

- Martin, Colin. 1975. *Full fathom five: Wrecks of the Spanish Armada*. New York: Viking.
- Mathers, William A., Henry S. Parker III, and Kathleen A. Copus, eds. 1990. *The recovery of the Manila galleon Nuestra Señora de la Concepción*. Sutton, VT: Pacific Sea Resources.
- Mathers, William A., and Nancy Shaw. 1993. *Treasure of the Concepción: The archaeological recovery of a Spanish galleon*. Hong Kong: APA Publications.
- McCann, Anna Marguerite, Joanne Bourgeois, Elaine K. Gazda, John Peter Oleson, and Elizabeth Lyding Will. 1987. *The Roman port and fishery of Cosa*. Princeton, NJ: Princeton University Press.
- McCann, Anna Marguerite, and John Peter Oleson. 2004. *Deep-water shipwrecks off Skerki Bank: The 1997 survey*. Portsmouth, RI: Journal of Roman Archaeology Supplement.
- McGrail, Seán. 1974. *The building and trials of the replica of an ancient boat: The Gokstad Faering*. Part 1: *Building the replica*; Part 2: *The sea trials*. Greenwich, England: National Maritime Museum.
- McGrail, Seán. 2001. *Boats of the world: From the Stone Age to medieval times*. Oxford: Oxford University Press.
- McLaughlin-Neyland, Kathleen, and Bob Neyland. 1993. *Two prams wrecked on the Zuider Zee in the late eighteenth century*. Lelystad: Nederlands Instituut voor Scheeps- en onderwater Archeologie.
- Meyer, Karl E. 1973. *The plundered past*. New York: Atheneum.
- Muckelroy, Keith, ed. 1980. *Archeology under water: An atlas of the world's submerged sites*. New York: McGraw-Hill.
- Needham, Joseph. 1971. *Science and civilisation in China*. Vol. 4, pt. 3: *Civil engineering and nautics*, with the collaboration of Wang Ling and Lu Gwei-Djen, 379–699. Cambridge: Cambridge University Press.
- Neyland, Robert S., and Kathleen McLaughlin-Neyland. 1996. *A late sixteenth-century freighter from the Workumer Nieuwland Polder in Workum, Friesland*. Lelystad: Nederlands Instituut voor Scheeps- en onderwater Archeologie.
- Nieto, Xavier, and Anna Maria Puig. 2001. *Excavacions arqueològiques subaquàtiques a Cala Culip 3. Culip IV: La terra sigillata decorada de la Graufesenque*. Girona: Museu d'Arqueologia de Catalunya.
- (p. 21) Nieto, Xavier, and Xim Raurich, eds. 1998. *Excavacions arqueològiques subaquàtiques a Cala Culip 2. Culip VI*. Girona: Museu d'Arqueologia de Catalunya.

The Development of Maritime Archaeology

Nieto Prieto, Javier, et al. 1989. *Excavacions arqueològiques subaquàtiques a Cala Culip 1*. Girona: Casa di Cultura.

Ossowski, Waldemar, ed. 2008. *The General Carleton shipwreck, 1785* [in English and Polish]. Gdańsk: Polish Maritime Museum.

Owen, David I. 2009. Censoring knowledge: The case for the publication of unprovenanced cuneiform tablets. In *Whose culture? The promise of museums and the debate over antiquities*, ed. James Cuno, 125–142. Princeton, NJ: Princeton University Press.

Panvini, Rosalba. 2001. *The Archaic Greek ship at Gela*. Palermo: Salvatore Sciascia Editore.

Parrent, James M. 1983. The conservation of waterlogged wood using sucrose. MA thesis, Texas A&M University.

Piercy, Robin. 2005. The tragedy of the *Santo Antonio de Tanna*: Mombasa, Kenya. In *Beneath the seven seas*, ed. George F. Bass, 172–179. London: Thames & Hudson.

Pomey, Patrice. 1995. Les épaves grecques et romaines de la Place Jules-Verne à Marseille. *Comptes rendus des séances de l'année 1995 avril-juin de l'Académie des inscriptions et belles-lettres*, 459–482. Paris: Diffusion de Boccard.

Pomey, Patrice, ed. 1997. *La navigation dans l'antiquité*. Aix-en-Provence: Édisud.

Pringle, Heather. 2007. Profiteers on the high seas. *Archaeology* 60 (4): 20, 62, 64–65.

Pulak, Cemal. 1998. The Uluburun shipwreck: An overview. *International Journal of Nautical Archaeology* 27: 188–224.

Pulak, Cemal. 2008. The Uluburun shipwreck and Late Bronze Age trade. In *Beyond Babylon: Art, trade, and diplomacy in the second millennium B.C.*, ed. Joan Aruz, Kim Benzel, and Jean M. Evans, 288–385. New York: Metropolitan Museum of Art.

Purdy, Barbara A. 1991. *The art and archaeology of Florida's wetlands*. Boca Raton: CRC Press.

Raban, Avner, ed. 1985. *Harbour archaeology: Proceedings of the First International Workshop on Ancient Mediterranean Harbours, Caesarea Maritima, 24–28.6.83*. Oxford: British Archaeological Reports.

Raban, Avner. 1989. The harbours of Caesarea Maritima: Results of the Caesarea Ancient Harbour Excavation Project, 1980–1985. Oxford: BAR International Series.

Raban, Avner, and Kenneth G. Holum, eds. 1996. *Caesarea Maritima: A retrospective after two millennia*. Leiden: Brill.

The Development of Maritime Archaeology

- Riess, Warren. 1987. The Ronson Ship: The study of an eighteenth century merchantman excavated in Manhattan, New York, in 1982. PhD diss., University of New Hampshire.
- Rieth, Éric, Catherine Carriere-Desbois, and Virginie Serna. 2001. *L'épave de Port Berteau II (Charente-Maritime): Un caboteur fluvio-maritime du haut Moyen Âge et son contexte nautique*. Paris: La Maison des sciences de l'Homme.
- Roghi, Gianni. 1958–1959. Note tecniche sul rilevamento e lo scavo della nave romana di Spargi. *Bollettino e atti* (Centro Italiano de Ricercatori Subacquei): 9–20.
- Roghi, Gianni. 1959. La seconda campagna di scavi sotto marina sulla nave romana di Spargi (Sardegna). *Rivista di studi liguri* 25: 301–302.
- Roghi, Gianni. 1965. Spargi. In *Marine archaeology*, ed. Joan du Plat Taylor, 103–118. London: Hutchinson.
- Rosencrantz, Donald M. 1975. Underwater photography and photogrammetry. In *Photography in archaeological research*, ed. Elmer Harp Jr., 265–309. Albuquerque: University of New Mexico Press.
- Rougé, Jean. 1966. *Recherches sur l'organisation du commerce maritime en Méditerranée sous l'empire romain*. Paris: SEVPEN.
- (p. 22) Seborg, Ray M. 1964. Treating wood with polyethylene glycol. In *Diving into the past*, ed. J. D. Holmquist and A. H. Wheeler, 68–70. St. Paul: Minnesota Historical Society.
- Smith, C. Wayne. 2003. *Archaeological conservation using polymers: Practical applications for organic artifact stabilization*. College Station: Texas A&M University Press.
- Sørensen, Anne C. 2001. *Ladby: A Danish ship-grave from the Viking Age*. Roskilde: Viking Ship Museum.
- Steffy, J. Richard. 1994. *Wooden ship building and the interpretation of shipwrecks*. College Station: Texas A&M University Press.
- Stoddart, Simon, and Caroline Malone. 2001. Editorial. *Antiquity* 75: 233–240.
- Symes, Gunild. 2005. Profile: Dr. Phil Nyutten. *X-Ray International Dive Magazine (X-Ray Mag)* 9: 69–74.
- Tailliez, Philippe. 1965. Titan. In *Marine archaeology*, ed. Joan du Plat Taylor, 76–93. London: Hutchinson.
- Tchernia, André, Patrice Pomey, H. Hesnard, et al. 1978. *L'épave romaine de la Madrague de Giens (Var), campagnes 1972–1975: Fouilles de l'Institut d'archéologie méditerranéenne*. Paris: Éditions du Centre National de la Recherche Scientifique.

The Development of Maritime Archaeology

- Thompson, Tommy. 1998. *America's lost treasure: A pictorial chronicle of the sinking and recovery of the United States Mail Steamship Central America*. New York: Atlantic Monthly Press.
- Throckmorton, Peter, ed. 1991. *The sea remembers: Shipwrecks and archaeology*. New York: Smithmark.
- Ucelli, Guido. 1950. *Le navi di Nemi*. Rome: Libreria dello Stato.
- Van de Moortel, Aleydis. 1991. *A cog-like vessel from the Netherlands, Excavation Report 14*. Lelystad: Nederlands Instituut voor Scheeps- en onderwater Archeologie.
- van Doorninck, Frederick H., Jr. Forthcoming. *Serçe Limanı*, vol. 3. *The ceramics, mercantile equipment, and historical context of an eleventh-century shipwreck*. College Station: Texas A&M University Press.
- Wachsmann, Shelley. 1990. *The excavations of an ancient boat in the Sea of Galilee (Lake Kinneret)*. Jerusalem: Antiqot English Series 19.
- Ward, Cheryl A. 2000. *Sacred and secular: Ancient Egyptian ships and boats*. Philadelphia: University Museum, University of Pennsylvania.
- Wheeler, Robert C., Walter A. Kenyon, Alan R. Woolworth, and Douglas A. Birk. 1975. *Voices from the rapids: An underwater search for fur trade artifacts 1960–73*. St. Paul: Minnesota Historical Society.
- Wright, Edward. 1990. *The Ferriby boats: Seacraft of the Bronze Age*. London: Routledge.
- Yalçın, Ünsal, Cemal Pulak, and Rainer Slotta, eds. 2005. *Das Schiff von Uluburun: Welthandel vor 3000 Jahren*. Bochum: Deutschen Bergbau-Museums.

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