Transport Ceramic:
An Article of Mass Production as Key to the History of Economics and Trade in the Ancient World

organised by

German Society for the Promotion of Underwater Archaeology

in cooperation with

Institute for Archaeological Sciences, Dept. II

Johann-Wolfgang-Goethe University of Frankfurt am Main

The Conference Committee:

Barbara Ditze M.A. / Dr. Ulrike Ehmg / Dr. Alexander Heising / Prof. Dr. Hans-Markus von Kaenel / Katharina Meyer-Regenhardt / Peter Winterstein M.A. / Daniel Zwick M.A.
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Transport amphorae and relief pithoi from the Knidian peninsula. Results of interdisciplinary research on eastern Doric ceramics.

In the course of processing the finds of the Turkish-German excavation in the Apollo sanctuary of Emecik/TR we have obtained for the first time archaeometrical data of diverse ceramics of the Knidian peninsula. Besides decorated fine wares we were dealing with relief-decorated storage vessels and Hellenistic transport amphorae. The archaeological and archaeometric analysis of selected samples served the recording of the various shapes used in different local or regional workshops. Seven new chemical groups A to G play an important role (results of a neutron activation analysis by Prof. Dr. Hans Mommsen, HISKP University of Bonn).

Apart from the production of Knidian transport amphorae also local manufacturing of diverse forms of fine wares was verified. In addition a local Knidian production of relief storage vessels (amphorae, pithoi) is likely, the origin of which has been uncertain until now.

These results are – in considering the rapid change in the state of research on eastern Greek pottery – a significant cornerstone for comparative analyses of ceramics on eastern Mediterranean sites.
Pirate activity and surveillance of trade routes: New archaeological evidence from the rock-cut slipways in the Aegean Sea.

Important trade routes and sea-lanes were closely surveyed both by powerful maritime powers and pirates during classical antiquity. Recent underwater research in naval stations throughout the Aegean Sea, located in geostrategic positions and busy sea-lanes has revealed features of their organisation and layout, and contributed to the understanding of their role in trade and warfare. Underwater investigations in the naval base of Sounion in southeastern Attica in Greece have given new insights on its configuration, date and function in the surveillance of one of the most important trade routes in the Aegean (2004 Survey). The naval station situated in the southernmost point of Attica, under the temple of Poseidon, controlled all maritime traffic to and from the metropolis.

In the end of the 5th century, the naval base was fortified and became part of an extensive network of maritime fortresses located along the coasts of Attica in order to control the sea-lanes against enemy assaults and piracy. This was necessary to protect the trade route for grain supply from the Black Sea, the biggest supplier of Athens, when the land route was blocked during the Peloponnesian war. All merchantmen had to pass Cape Sounion, a difficult navigational route, but the only one on the way to the capital.

Similar naval stations, consisting of rock-cut slipways, have been recently investigated underwater throughout the Aegean Sea (2005 Survey). They are located in sheltered and well-hidden strategic locations on important sea-routes. They are often related to independent cities, which were sometimes naval stations for pirates, a constant danger for ancient merchantmen in classical antiquity.

All naval bases were equipped with steep rock-cut slipways, and were usually fortified. They were intended to house light and fast oared-warships, mainly patrol craft ready for quick launching against enemy ships or pirates. Equally, they were used for pirate vessels lurking the passage of unsuspecting merchant-men. Among the objectives of the new investigations is the study of their geographical distribution in the Aegean Sea; the identification and deconstruction of the eventual shipping-lanes; the date and historical context of their establishment and their function in maritime surveillance and ancient trade.
Homeric references to aspects of ancient trade in the view of the archaeological and later philological data.

The Homeric epic is a precious source of information on aspects of ancient trade. Several relevant references in the epic that will be dealt in this paper can be classified to the issues below:

- Ships: The identification of merchantmen.
- Cargos: The description of several ships’ cargo.
- Harbour installations: The description of natural mooring sites and of the harbour installations of Phaiaces.
- Sea-routes: The description of sea routes and the estimation of distances.
- The role of the Mycenaeans and the Phoenicians regarding the sea and particularly trade and the relationship between them.
- The problem of piracy

This paper critically considers and examines the reliability of the above references, by cross-checking the information and the details with the existing archaeological (excavational, iconographic) and later philological data. Concretely with:

- The evidence from Late Bronze Age shipwrecks’ cargoes.
- Archaeological evidence of artificial harbour installations and natural mooring sites in the Late Bronze Age and Geometric period.
- The iconographic Late Bronze Age data on the form of merchantmen.
- Evidence of the relationship between Mycenaeans and Phoenicians in seaborne trade.
- Later philological and iconographic data on piracy at that time.
The Tantura F Shipwreck - Analysis of the Ceramic Material

Tantura F, a merchantman about 15 m long with a beam of 5 m, is the first wreck of its period discovered and excavated in the eastern Mediterranean to date. Among the wreck's contents were the remains of about 30 ceramic vessels *in situ*. The ceramic assemblage includes eight amphoras, two juglets, and remains of 20 storage jars that contained fish bones. Typological analysis of the pottery supports the $^{14}C$ date of the wreck to the beginning of the 8th century CE. Comparative study of the ceramic and petrologic tests indicate a Nile Delta origin. This has been further examined by Mass Spectrometry (ICP-MS).

Preliminary results of the ceramic analyses will be presented.

The identification of the production centre may indicate the port of departure of the ship’s last passage from Egypt to Dor; evidence of a maritime connection. Anchoring at Dor may hint at an existing settlement there, evidence for which is lacking from any other source.
West Embiez 1 wreck: a secondary cargo of vintage wine amphorae at the transition II-III A.D.

The West Embiez 1 wreck, which has been excavated since 2002 by Marie Pierre Jézégou and her team at a depth of 56 m., has become renowned for its main cargo: raw glass, window glass, oculi, and glass ware. Even if the excavation is not finished, the number and the type of amphorae found confirm a secondary cargo of wine amphorae, mainly from the Occident (Italy, Southern France, Spain), North Africa and Orient (the Aegean Islands, Turkey). The form of certain amphorae make one believe that they contained quite expensive wine, surprising in standard transactions. It might be a special order by a trader. The ongoing exploration and the uncovering of the hull will yield a better understanding of the position of the cargo compared to the crew amphorae.
Modern analytical methods in archaeometry.

Techniques for the quantitative analysis of major and trace elements and of radiogenic and stable isotopes have advanced considerably in the last 10 to 15 years. The major breakthroughs were the introduction of single and multi collector ICP MS (Inductively Coupled Plasma Mass Spectrometers) and of laser ablation (LA) systems. ICP MS enables the rapid and accurate analysis of almost all elements of the periodic table in concentration levels down to ppt (parts per trillion) from dissolved samples. It also allows the analysis of the isotopic composition of about 30% of these elements because of enhanced ionisation properties. This allows a much higher sample throughput of archaeological materials like ceramics, glasses and metals at increased analytical accuracy, and provenance studies become more accurate. With ICP MS coupled with LA samples can be measured without destruction and a high spatial resolution down to 20 microns can be achieved. Very small samples, thin films or welding seams may be analysed for the same set of elements and isotopes.
NAVES ACTUARIAE - Sea-going ships used for amphorae transport in Roman times? An iconographic and historical examination.

Ancient literary sources report that naves actuariae were used for military purposes (as troop carriers) as well as for trade. These ships probably belonged to a major group of asymmetric medium sized ships. Though the naves actuariae clearly shared characteristics of warships and merchantmen, several ancient authors distinguish between actuariae and onerariae, whilst others make a difference between actuariae and warships (naves longae). Due to the combined method of propulsion – by oars as well as by sails – the actuariae were swift and manoeuvrable ships. Yet iconographic sources, particularly mosaics, suggest that actuariae were often used for amphorae transport. This is proven by an interesting ship depiction on mosaics in Thebessa (Tunisia). Another depiction of an asymmetrical ship (probably an actuaria), which is loaded by several persons with great quantities of commodities, is on a Roman relief in Gaul.
Towards a Typology of Erythraian Amphoras.

The ancient Greek city of Erythrae, one of the 12 cities of the Ionian League, is located on the Aegean coast of Turkey opposite Chios. The city, which sits at the head of an enormous gulf with abundant arable land toward the interior, clearly possessed considerable natural assets. Historical texts and inscriptions refer to Erythraean commerce in wine and woolen textiles, while Pliny the Elder describes Erythraean potters renowned for the thinness of their ceramics. Excavation at Erythrae has been sporadic; however, recent work uncovered a Hellenistic ceramic workshop, including amphora wasters, a kiln, and potter’s wheel. Across the Aegean at Athens, studies of Classical and Hellenistic amphora stamps at the Kerameikos drew increased attention to Erythraean stamp types.

This paper presents a preliminary outline for the history of Erythraean amphora production and exports. Beginning with the rather problematic “Samian” types of the Archaic period, Erythraean production is traced with more certainty through the Classical period, for which the most secure datum point is the cargo of a fifth-century B.C. ship wrecked off the Turkish coast at Tektaş Burnu. Stratified assemblages on land at Ephesus, Athens, Troy, and elsewhere continue the typological sequence through the Hellenistic period and indicate a strikingly prosperous export trade.

The economic history of Erythrae has been largely ignored to date. Many fragments have been mis-identified, and few jars ever bore the stamps that often attracted scholarly attention in the past. Furthermore, Erythraean amphoras were not always of a shape unique to that city; in this way too they contradict traditional expectations. In this case, the close coordination of studies of shipwreck material and land sites has filled a significant gap in our understanding of amphora production and exports in central Asia Minor.
The unsolved question of Graeco-Italic amphorae: Some solutions from wrecks.

The development of underwater archaeology in the last fifty years has revealed important elements of the circulation of commodities and of commercial tendencies, especially in the Western Mediterranean. Scientific investigation of wrecks of merchant ships render particular insights. Wrecks are direct and accurate manifestations of specific commercial events and they yield data that are partly distinctive and complementary to that of terrestrial excavations. Moreover, a wreck contains a whole set of commodities and objects that are not found together very often, in terms of chronology, assortment, quantity and state of preservation. Due to these factors, a wreck is an extremely interesting context, which can be crucial in the solution of specific problems, as for instance those concerning production and circulation of amphorae, the quintessential commercial containers. In particular, wrecks provide clues that allow us to clarify such aspects with relation to a specific type of amphorae, the so-called Graeco-Italic amphorae, and with relation to a specific historical period, the III. century B.C., thus filling substantial gaps in the archaeological and literary information available.
The Dor 2002/2 shipwreck and its construction details: Was it one of Napoleon's vessels?

In May 2002 a wreck was exposed in very shallow water on the shoreline of Dor lagoon, and designated Dor 2002/2. Two underwater excavations were conducted during 2002 and 2003. It was suggested that this was a raft used by Napoleon's army which passed through Tantura in May 1799, on its retreat after the siege of Acre. According to this assumption, when the soldiers were ordered to dump weapons and ammunition in the sea they needed to float the heavy artillery, and they improvised a raft that was dragged by horses towards the sea; but the effort failed on the shoreline when everything collapsed. However, during the first excavation season, it turned out that the wreck was probably the starboard side of a ship's hull. The possibility that the hull itself was used as a raft was raised, but later dropped, since no evidence of attachments or secondary usage was found.

The fact that the wreck is only a small part of a vessel made it difficult to categorize it, but the research suggests that the original ship was apparently a sailing vessel about 15 m long, 4.5 m beam, 1.35 m draft, with a displacement of about 35 tons. The ship had probably one mast.

Its construction is typical of those built in the shipyards of the Levant. In addition, one cannot ignore the similarity between some elements of the wreck and Greek vessels. Greek shipwrights travelled throughout the Mediterranean, working and carrying with them ideas and ship construction methods. The high quality of the wreck's components indicates that it was built in a well-established shipyard, perhaps supported by the resources of the authorities.

The apparent date of the wreck is the turn of the 18th century. However, the hypothetical connection to Napoleon's overnight stop at Tantura in May 1799 that initiated the research cannot yet be definitely proved.
The Classification of Canaanite Amphoras.

When the Uluburun shipwreck was first located and considered for excavation in 1982, archaeologists noticed only about half a dozen Canaanite amphoras situated near the center of the site (Pulak 1997:234). Over the course of eleven field seasons, some 150 Canaanite amphoras were raised and documented, and efforts to conserve and analyze them are ongoing. The amphoras are a Bronze Age type first categorized as being Canaanite in origin by Virginia Grace in 1956. Since then, scholars have struggled to classify Canaanite amphoras, especially those found in countries outside of the Levant, and even today, still revert to Grace's study. Grace was the first archaeologist to challenge the established premise that this type of vessel had its origin in Egypt, noting that the vessel shape was introduced to Egypt by Asiatics (as evidenced in depictions from the Tomb of Rekhmara) and had been manufactured throughout the Levant for at least a millennium before evolving into the type readily recognized as Egyptian. Using Grace's study as a springboard, this paper seeks to clarify what is known about Canaanite amphoras (both Levantine and Egyptian types), and to open a dialogue about their situation in the wider socio-political context of sea-borne trade in the Late Bronze Age.


The trade of works of art; the youth of Kythnos.

The youth of Kythnos is a bronze statue retrieved by a fishing boat in October 2004 that was brought to the Ephorate of Underwater Antiquities by the port authorities of Lavrion.

This bronze statue of a youth, probably of an athlete, enriches the already rich collection of bronze statues found not only in the Greek seas but also in the Mediterranean in general.

This paper attempts a first presentation of the statue since the continuing conservation does not allow as yet a more detailed study.
Roman amphorae: Potentials and limitations of their expressiveness.

More than any other kind of finds, amphorae provide substantial information of far-reaching economic-archaeological interconnections. They were the standard vessels for the transport of a number of important victuals. Oils, wines, seasoning sauces as well as pickled olives and fruits arrived from the Mediterranean to the North. The great number of prominent shipwrecks and their cargoes of thousands of amphorae render an impression of trade volumes and preferred sea routes. Rests of the contents, inscriptions on amphorae and the shape of the vessels provide the base for a particularistic study of the amphora, thereby allowing to suggest its original content. This is achieved through the application of diverse archaeological, epigraphic-philological and also scientific methods. The latter plays an increasingly important part for the determination of proveniences of amphorae, yet only thorough archaeological questioning can lead to historically useful results. The limitations of the expressiveness of amphorae become apparent once compared within a wider sphere: Whilst amphorae evidence displays the consume of its respective contents, the lack of shapes is not – as has been demonstrated in the surroundings of Mainz – necessarily corresponding to the local lack of commodities.
Ceramic transports across the Baltic Sea. Investigations of harbours and wrecks off the coast of Mecklenburg-Vorpommern.

Medieval and early post-medieval archaeology relies heavily on ceramic analyses. Particularly excavations in medieval city centres have yielded extensive finds, which provide significant information about the manufacture and marketing of pottery. The investigated sites, however, mostly allow only general conclusions about routes and the means of transport, which were used for trading ceramics. Often only few details allow an exact dating of ceramic vessels, like vessels containing coins, inscriptions with dates of manufacture or brands, as well as hints from historical sources.

Ceramics found in shipwrecks and harbours provide important evidence for the kind of transport, trade routes and the volume of goods handled in ports. As sunken ships mostly form closed complexes of finds – which were "frozen" when sinking – they provide advantageous conditions for precise dating of the material culture. It is important to compare all datable elements of the find. Indications for its chronological context could be gained through dendrochronological analyses of ship’s timber as well as of pieces of wood like fuel or barrels, which were brought aboard just before sinking. Also finds like coins or metal ware with the brand of the master craftsman or the town of origin facilitate an exact dating of the sinking. Under favourable circumstances the wreck could be identified through the study of historical sources and hence the date of sinking could be determined precisely.

Diverse sites off Mecklenburg-Vorpommern's coast have yielded evidence for ceramic transport across the Baltic Sea from the 13th to the 19th centuries.
Raw glass, vessels and windows glass: The main cargo of Embiez wreck in the South of France (third century A.D.).

The Embiez Island Shipwreck's main cargo (sunk in 55 m depth between Marseilles and the Italian border) is composed of raw glass (12 to 20 t), of blown-glass vessels (more than 2000 drinking glasses, flasks and bottles) and of several tens of cast window-glass (four-angled matt-glossy panes and large hemispheric pieces).

After a description of the characteristics, typology and chemical composition of each kind of product, we will present the particularity of the glass trade and the various assumptions on the origin of this exceptional cargo.
Sea trade as reflected in mosaics.

Depictions of ships in mosaics were not only used as decorative patterns to embellish such surfaces, they rather provide wide evidence of ancient ships, merchants carried on board and different harbour activities. These mosaics may be considered as complementary data to our understanding of ancient sea trade and society concurrent to the period of the mosaics production.

This paper will discuss the following:
- Ship types and references to some of their home place in the Roman Provinces depicted in the shippers' offices at Ostia.
- Recording the cargo of jars before being shipped away.
- Loading of amphorae from a large seagoing merchantman, anchored in open waters, onto a smaller lighter to be sailed upstream the Tiber to Ostia or Rome.
- Visual evidence of using the *artemon* mast as a crane for loading/unloading merchandise from the ship to the warehouse is found at Ostia.
- The most sophisticated concept synthesizing the sea transport of exotic African animals from North Africa to Ostia or Rome appears in the Great Hunt Hall at Piazza Armerina, Sicily.

Depictions in mosaics as referred above complement the data that is indicative in the newly developing experimental archaeology, in the reconstruction of ancient vessels such as the *KYRENIA LIBERTY*.
Nautical aspects in Xenophon's *Anabasis*.

The Athenian writer Xenophon (ca. 430-355) was one of the military leaders of a mercenary unit of 10,000 men, who lead them 401 after unsuccessful operations on wearing marches across Phrygia, Cilicia, Mesopotamia, Armenia, and Bithynia to Byzantium. He has described everything in his *Anabasis*. The text contains numerous references – yet rarely details – to water craft encountered in the lands, which were crossed. At one point dugouts are mentioned, then various vessels mostly used for military purposes, e.g. types of rafts used for pontoon bridges, but also – after the Greeks having reached the Black Sea near Trapezunt – the seagoing ships of the locals and Greeks, the thirty-rowers, fifty-rowers and the warships with three thwarts, the triremes, all mostly used as transport vessels. Xenophon is the first writer to mention hospital ships and sea chests. As expected cargo ships play an important part in transporting people and commodities across the sea. In several passages Xenophon alludes to the legendary past (Jason, Odysseus), but also to victories in the Persian wars, which were about to become a historic myth, particularly Salamis (480).

The text is interspersed with nautical metaphors.
Dr. Daniela Gräf

Berlin

Boat Mills in Europe – From Early Medieval to Modern Times.

This presentation, which is based on a doctoral dissertation submitted by the author in 2003, uses archaeological finds, technical and historical facts about boat mills for the whole period of their existence as a fundament for a technical-historic view. Illustrations, written sources and artifacts are gathered from all over Europe.

Historic boundaries of tradition are visible in the various different manners of constructing boat mills. In the construction of boat mills, both boat and mill building techniques were combined in an unique way.
Amphora capacities in early monetary Asia Minor: The Pabuç Burnu shipwreck.

A guiding concept in the study of amphora capacities has been the notion that amphorae were treated much like coined metal: Sufficiently standardized and certified by the civic government to be used in exchange without analysis of each object. The notion that each amphora served as a badge of its producing city (also like coinage) seemed to support this analogy between coinage and amphorae. The idea of amphora as badge of city is problematized by the realization that regions, rarely individual cities, defined amphora styles. An equation between amphorae and coinage becomes even more interesting in the case of amphorae dating to the earliest phases of Aegean coinage.

The opportunity to study this stage of amphora standardization is provided by the Pabuç Burnu shipwreck. The date of the wreck, likely in the second quarter of the 6th century BC, comes from the wide base of one Klazomenian amphora, the plain bases of the mortaria, and form and decoration of the Ionian and ‘Dorian’ cups. The bulk of the shipwreck’s cargo, however, is comprised of more than 200 intact and broken amphorae with a generally Milesian profile (but not with Milesian fabric; they may have been produced much further south). Twenty-eight of these were sufficiently preserved for capacity measurement. Measurements taken with polystyrene beads and water yielded an average total capacity of 19.32 liters; 18.75 liters represents the average capacity to the neck-shoulder join. While capacity studies on amphora groups from shipwreck sites are most commonly reported in terms of such averages, in the case of the amphorae from the Pabuç Burnu shipwreck, the interest comes from the individual measurements rather than the averages. The twenty-eight amphorae measured revealed a measurement range from 16.93 liters to 22.73 liters in total capacity, or a difference of 5.8 liters between the largest and smallest amphorae in our set. The large range of measurements, suggestive of minimal capacity standardization, hints at the potentially high transactional costs that must have resulted from the economic exchange of amphorae whose quantitative content could not be guaranteed by any single standard.
Lamps on board of ships: Merchandise or on-board usage?

Apart from amphorae, fine ceramic wares constitute the best known archaeological group, the distribution of which can reflect trade relations, if considered within the chronological and regional context. Amongst the merchandised vessels are only few of which the shape reveals a specific function: One of these is the group of lamps, i.e. vessels, which served for lighting. Their shipment presupposes not only a demand in specific regions but was arguably also connected with a certain transfer of technology. Find context from terrestrial archaeology provide us with some starting points.

Of altogether 1259 registered wreck finds in the Mediterranean (Catalogue of A. J. Parker 1992), only 91 wrecks are known to have had lamps or other luminous devices on board, i.e. also thymiateria and storm-lanterns are mentioned. The lamps are documented in varying quantity and provide a very heterogeneous and sketchy starting point. Its previous interpretation and its classification either as for use on board or as cargo on the basis of its position, quantity and/or its burnt residues partly don't withstand a consequent and critical examination. The speaker aims to roughly illustrate current research. Yet a firm and methodically valid decisive factor cannot be established, if no further data can be obtained.
Recycling of amphorae for maritime purposes.

Amphorae normally serve as containers for goods and provisions at sea. Other areas of applicability, which have been determined by written and pictorial sources as well as from ethnographic studies, will be presented in this paper. They derive from the following areas: Extraction of marine resources, defence and propulsion on the water. Hopefully these methods of applicability, which are up to now manifested in secondary sources only, could be detected in the course of time in order to obtain a sustainable archaeological base.
Deep water survey and amphoras: A terrestrial ceramicist’s point of view.

A relatively recent discovery west of Cyprus by the Nauticos corporation, and studied in collaboration with Shelley Wachsmann, provides a useful example of the interaction between deep water survey and amphora studies. Initial reports dated the wreck to late 3rd or early 2nd century BC and proposed that it plied the trade route from Rhodes to Alexandria. These features would make this wreck nothing more than an illustration of what we already know from other sources. In fact, the wreck dates close to 100 BC and its main cargo is comprised of Pamphylian amphoras.

As such, the wreck becomes a potential contributor to economic archaeology. There is no other such assemblage of Pamphylian amphoras. There is no comprehensive study of the amphora type, its stamps, its capacity standards, or its distribution. And yet, to contribute to such standard topics of inquiry, this wreck must be excavated. A sampling will neither show the full range of stamped jars, nor recover all the bits of other amphoras or plainwares whose juxtaposition might narrow the date of the cargo, nor allow for a maximal view of the capacities of the jars.

This Pamphylian wreck highlights both the advantages and challenges of Deep Water survey. New sites are being found, often with cargoes that are larger than those previously known. The circumstances of the discovery, however, conspire against the wrecks fulfilling their potential contribution to archaeological and historical scholarship. Various technological, economic and legal difficulties remain to be overcome: recovery, conservation and storage of artifacts; financing the storage and study of such massive cargoes; and determining the country of ownership for wrecks in international waters.
The Cypriot transport amphora: Notes on its development and distribution.

Transport amphorae of the Archaic and Classical Greek states of the Aegean, with their unparalleled value for investigating economic and social history, have logically been the subject of intense scholarly study for some time. Their counterparts along the eastern edge of the Mediterranean, however, have rarely been mined as extensively for this same valuable information, although their potential is evident.

Of particular interest is the so-called “basket-handled” amphora, often attributed to Cyprus. These jars, so named for their thick looping handles that rise from the shoulders to well above the rim, present a strikingly different appearance from the typical Aegean amphorae. Though still in the preliminary stages of study, basket-handled amphorae offer unique insights into the maritime commerce of a less understood era in the eastern Mediterranean, especially around Cyprus and the nearby Levantine coast.

The present work considers the nature of Archaic and Classical maritime trade in the eastern Mediterranean basin through a comprehensive typology of the basket-handled amphora from the scattered evidence on land and underwater, including recent finds from surveys off the coast of Cyprus.
Transport Amphoras from the Shipsheds of Sicilian Naxos (5th Century B.C.).

How does one explain the presence of amphorae in shipsheds?

Regular excavation campaigns conducted since 2001, and still under way, have brought to light remains of the Neorion (dockyard) of the ancient Greek colony of Naxos. The four surviving ramps fit perfectly into the orthogonal street grid of the fifth-century city – clear proof that the neorion and naval harbour formed part of the urban plan. The investigations have gradually made clear the functional particulars of each ramp. In this respect much information has been obtained from the study of the material finds and in particular their distribution within the ramps. This material includes transport amphoras: rather numerous and of diverse fabrics, they provide an important sample of the imports present in the city, but they also represent a novelty in this type of harbour installation, a novelty not easy to reconcile with the military function of the installation.
Wood Species Used in Ancient Shipbuilding in Turkey as Evident from Dendroarchaeological Studies.

Comprehensive dendroarchaeological studies that have been carried out during the last year on twelve vessels that sank along the coasts of Turkey enable the identification of various wood species used in ancient shipbuilding in Turkey.

Results show that the hull of two Late Bronze Age vessels (Uluburun and Cape Gelidonya) was made of *Cedrus libani* (Cedar of Lebanon), whereas the hulls of later vessels built between the 6th century BC and the 16th century AD were built mainly with *Pinus brutia* (Calabrian pine), *Pinus nigra* (Corsican pine; Austrian pine) and *Quercus cerris* (Turkey oak).

The native habitats of the tree species used in the construction of these hulls point to the possible region where each vessel was built.
Amphora wrecks in the Aegean.

This paper attempts to present in rough lines the first results of an ongoing effort of the Ephorate of Underwater Antiquities to compile the evidence about wrecks, available in the archives of the Ephorate, and to systematize the way shipwrecks are recorded. This process has been a very painstaking and laborious task that along with the results that it started to produce has brought to light the limitations of our database and of the recording method applied so far. The information available is grouped into categories according to date, finding place and type of cargo, in this case amphorae. These groups of sites will be presented briefly only as an indicator of the frequency of occurrence of different amphora types and their geographical distribution overtime. No attempt is made to address any issues regarding the typology or chronology of amphorae.
Deposits of Early-Imperial amphorae from the harbour area of Naxos.

Excavations in the area of the Classical shipsheds of Naxos have provided valuable evidence about the economic activities of the harbour area in Roman times. Several dumps with a great quantity of Roman amphorae have so far been uncovered. Among amphorae of various origins, it is possible to enucleate a class of amphorae produced in Naxos itself, as is shown by kiln wastes often found in the dumps. Although kilns are still to be precisely located, it is possible to suppose that they were not far from the harbour area, thus showing the close relationship between the production of the amphorae and their commercialisation. Moreover, amphorae of this type have been found in the shipwreck of Capo Sant’Alessio. The paper will focus on a dump found in 2003 in the area of shipshed 3, and datable to the Early-Imperial age, i.e. probably at the beginning of a production that lasted several centuries, and that, to a great extent, is still to be investigated.
Greco-Italic amphorae: Production and spread.

The goal of this paper is to present a summary of the available data and the problems encountered with the production and spread of Greco-Italic amphorae (particularly the oldest types).

The starting point is the island of Ischia (Naples), where in the 4th and 3rd centuries BC Greco-Italic amphorae with Greek stamps were manufactured in Lacco Ameno in a long-lasting district of pottery workshops. The study of amphorae from Ischia / the Gulf of Naples enables a more precise definition of the production and the export of Campanian wine as well as the economic situation in the area around the Gulf of Naples in the Republican era.

Typological, epigraphic and archaeometric data contribute to the reconstruction of patterns of the trade from Campania (and the Tyrrhenian regions of central Italy) into the western Mediterranean.

Further information concern new studies on shipwrecks with Greco-Italic amphorae and a database being currently established of archaeological and archaeometrical data of Italic ceramics.
Ceramic materials used in building: The shore line works discovered in the beds of the Venice Lagoon.

The Roman period works built in the lagoon using ceramic material and amphoras have similar characteristics, even though they were made for different purposes.

The lagoon is a different environment to that of the mainland and therefore requires specially constructed works with amphoras and ceramic material, which in this instance were very differently used than those in ancient Altino. The lagoon constructions, in fact, refer for the most part to the embankments, the reinforcements of the banks, seaports and piers.

There are two factors that are constant in almost all of the works that we have examined: the materials and their usage.

The works have been divided into five categories:
- road embankments
- levees
- bank reinforcement
- reclamation
- piers and ports
Dr. Luis Pons Pujol
Dr. Felix Teichner
Department de Prehistoria
Historia Antiga i Arqueologia
Facultat de Geografia i Història
Universitat de Barcelona

Roman Sea Trade across the Straits of Gibraltar. An ancient “Anti-economic” practice?

[This abstract will appear here shortly]
Irena Radic Rossi
Croatian Conservation Institute
Underwater Archaeology Department
Zagreb

The origin and function of the amphoras' spike.

While the typological study of amphorae has made significant advances over the past few decades, little has been discussed and reflected on the causes for the emergence of this specific vessel shape designed primarily for the marine transportation of goods, as well as its long-lasting survival in practical use.

Most of the current definitions describe the characteristic pointed end at the bottom of amphorae merely as a convenience for storing them in warehouses on land or below ship-decks and for the handling of individual vessels. Sometimes, however, they also refer to their strength, which is enhanced by such a bottom shape.

Scientific confirmation of the significance of amphora shapes for their resilience has been obtained in the Shipbuilding and Marine Technology Institute of the Mechanical Engineering and Naval Architecture Faculty in Zagreb, by applying computer-aided modelling in the SESAM program and using finite element method.

The analysis of amphora strength has shown that specimens with conical bottoms demonstrate better resistance to vertical loads. The pointed end, which was added to the bottom of amphorae of increased size and, accordingly, higher weight and capacity, provided additional protection against vertical loads.
The Roman wreck at the Perduto reef, Corsica.

Off Corsica's coast many ancient ships have foundered. Several of these wreck-sites are known to the community of underwater archaeologists.

W. Bebko has dived in 1965 at well-known sites in the south of Corsica - off the east and west coast - and described the finds. Amongst these sites was Perduto 1. At that time it was reported as destructed and no further investigations were carried out. The site is located in the rocks of the Perduto reef in a depth of 22 – 24.5m.

In 1978 the wreck was rediscovered by a diving base and frequently visited. After a short time all visible remains have disappeared. It was impossible that a site of negative assessment yielded so many visible finds that were pillaged. At the same time I learned of this site.

In 20 years I carried out 123 dives with a total dive time of ca. 91 hours. Many of the remaining artefacts were seized, inventoried, partly studied and evaluated.

In 1987 the preliminary results were presented on the shipbuilding symposium (ISBSA) in Athens and they were published in 1988.

The coherence of the individual finds enables us today to make a statement about the ship, its cargo and route as well as the date of sinking.

[Wolfgang Schultheis]

The Perduto 1 wreck is one of the less known wrecks of Tarraconian origin in the strait of Bonifacio. One of the oldest discoveries, she was highly looted before any archaeological observation was made. However certain characteristics shown in the drawings of some hull pieces by W.S. reveal a new type of stitch-assembly. This use of stitching to connect timbers and planking was first observed by D. Colls in 1983 on the Cap Béar III wreck. Two recent theses studying this technique, submitted at the University of Aix-Marseille in December 2005, feature Perduto 1 in a specific series.

[Hélène Bernard]
The course of an analysis with samples of a siliceous matrix exemplified with Roman tiles.

Various methods are applied in archaeometry for ceramic analyses. It is important to examine if the results of diverse methods are comparable within a framework of statistical evaluation. On the basis of two methods, ICP and RFA, this shall be tested here.

For many methods of elementary analyses like ICP-MS/OES it is a requirement that all samples are in a soluble state. Especially in the case of the siliceous matrix of ceramics this is a particular challenge. Diverse methods for digestion shall be gauged on their applicability for routine analyses. This includes a thorough examination of various methods and acid mixtures. A microwave-pressure-digestion with a mixture of HNO$_3$, HF and HClO$_4$ proved to be most efficient.

After having carried out the measurements, the results of ICP measurements are compared with the RFA data. It was possible to demonstrate within a statistical evaluation, that the results for the respective samples of both methods of analysis could be assigned to the same proveniences.
The cargo of the Grado 1 wreck: Re-use and recycling in Roman imperial times

The cargo transported by the Grado 1 wreck was an exceptionally interesting one: It consists of four different types of jars, originally produced in three separate areas of the Mediterranean commercial zone and mainly used for transporting wine and oil. All were reused as containers for processed fish.

A wooden barrel stored towards the prow, was full of fragments of glass plates, bowls, trays, drinking glasses and bottles destined to be melted down in a glass workshop to obtain the vitreous mass needed to make new objects, saving on raw materials, fuel and the temperature that the furnace had to reach in order to make the vitreous mass suitable for working with. The types of fragments in the barrel were extremely varied; the quality of the glass indicates that the objects were manufactured in at least three areas.

A rather varied and functional range of ship’s cooking pots, made of terracotta and metal, suggests that rations were calculated for the duration of the voyage. The menu on the Grado 1 was varied, not restricted exclusively to fish.

But … SPQR, “sono pazzi (imprevedibili) questi romani” [(which translates into: “these Romans are crazy (unpredictable)”), as a well-known French cartoon character likes to say.

This unpredictability was obvious in the Grado 1, which showed signs of survival in the form of secondary, recycled use of jars which were chronologically far distant from one another. The use of glass bars or scraps – as was characteristic to the Mediterranean before Roman times – was now popular in the whole of the Imperial Roman North Adriatic, presenting another chapter on the routes for the search of glass to be melted down. Because even the barrel containing fragments of glass was reused.

The glass, accessories, cargo and ship’s equipment allow us to estimate the date of the shipwreck, the dynamics of the ship’s owner and the owner of the cargo, the transport and sale rights, the long-term economic circumstances, usufructs and the financial expectations of a particular kind of transport based upon recycling.
The ship of Uluburun – Globalisation in the Late Bronze Age.

At a rocky headland off the south-westerly coast of Turkey, sponge divers noticed in the summer of 1982 strange 'metal biscuits' in a depth of 50m. This was the beginning of the history of discovery of a late Bronze Age merchantman, which sunk around 3,300 years ago near Uluburun (southern coast of Turkey). Remains of the wreck and its entire cargo were recovered in the years 1984-1994 by the Institute of Nautical Archaeology (INA) at the Texas A&M University and the Museum for Underwater Archaeology in Bodrum. The team of the underwater archaeologists George Bass and Cemal Pulak required 22,500 dives in order to document the exact position of all finds in a depth of 40 to 60 m and to recover them afterwards. The precise stock-tacking facilitated the reconstruction of this 15 m long vessel.

The ship was laden with 10 tons of copper and one ton of tin; moreover all important raw materials of the Bronze Age were on board, like glass, faïence, turpentine resin, luxury goods made from gold, silver, ivory, beads from Baltic amber and diverse stones, ostrich eggs, African ebony as well as ceramics, weapons and much more. It was arguably sailing from the east (maybe from Ugarit) to a western destination, probably a Mycenaean palace in the Aegean. Yet it never reached its destination and capsized with the cargo off the rocky headland of Uluburun.

The cargo and prestige objects of cosmopolitan nature originated in Egypt, in the Levant, Anatolia and Cyprus, the area of the Mycenaean cultural, southern Italy, the Black Sea area and northern Europe. It draws an image of interconnection of cultures in the second half of the 2nd millennium BC, their contacts, their trade relations which became essential due to the unevenly distributed raw materials, of the diplomatic activities and the political structures. It is the image of an early "globalisation": The cultural development of the Mediterranean in particular has never taken place in isolation, but always in communication with other cultural groups.
The IN POSEIDONS REICH XI proceedings will be released in a forthcoming SKYLLIS issue, which is published by the German Society for the Promotion of Underwater Archaeology (DEGUWA).

SKYLLIS

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In this year we visited with our friends & colleagues the reconstructed Roman fort Saalburg. A sumptuous Roman meal was the best thing to get started with the 11th annual conference of the DEGUWA

Photo: Dr. Mathias Orgeldinger