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Shipwrecks and amphorae:
Their relationship with trading routes and the Roman economy in the Mediterranean.

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The only thing that is more fun than chasing a dream, is living it!

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Abstract

Maritime trade has always played an important role in the Roman economy. The growing numbers of Roman shipwrecks that are yearly found are the evidence of this activity. Amphorae are a part of this large-scale exchange of goods as they are particularly made for sea transport. There are limitations on the available data due to confusing amphorae typologies, the lack of information in unexplored areas and bad or non-existing publications. However, the general impression is that the known data from shipwrecks indicate similar patterns in economy as the archaeological evidence of land sites. The shifting centres of economical power are reflected in the origin of cargoes of contemporary shipwrecks. The data can also be linked with the information derived from ancient texts. The known navigational routes of the vessels have been derived from these texts and they can be linked with the frequency of shipwrecks and the origin of their cargoes. But the archaeological data has to be handled careful as maritime routes and trade were rather complex and dependent on many external factors.

I. Introduction

The archaeology of shipwrecks has shed new light on the economy of Classical Times. It gives us a clearer impression of the importance of food trade. Combined with literary sources, it confirms the large scale of sea-borne economic activity. During the Roman Empire the economy changed from a predominantly agricultural to a more complex, trade based industry (Garnsey et al 1987). Commodities from the whole empire and its neighbours were shipped and mainly brought to Italy, more specifically Rome. This vast amount of traded goods had a huge diversity. Some of the cargo was perishable and no trace of it is left. Others can still be found in ancient shipwrecks. One of the more obvious remains are amphorae, which are a distinctive type of big jars. They were used on an enormous scale and although amphorae can break, the ceramic itself is almost indestructible. Amphorae were a result of a further specialization of the sea trade and were specially developed for a wide variety of contents. The information of the amphorae provides us with a determination of the production centre and a probable dating of the ware. Can this information help us to determine the exchange mechanisms of maritime trade in Antiquity? Are we able to tell something about the routes used by the vessels by looking at the composition of the shipwreck's cargoes, as those navigational routes will help us in the further understanding of the trading mechanism of the Roman Era? Do the changes in Roman economy and trade, which can be found in the archaeological record of land sites, also reflect in the wreck sites? The main aim of this research will be to look at the information that can be derived from the amphorae and look at their contributions and limitations in the research of maritime trade.

II. The role of ships in antiquity

In our modern times with rapid transport by airplanes or motorised transport on highways, we easily forget the importance of maritime transport. Until the 19th century, ships were the largest and most complex entities made by man. They reflected not only the latest technological enquiries of a civilisation, were the way to transport cargoes par excellence. Cities located at the sea had enormous advantages as they had the potential for bulk transport at relatively low costs and the possibility of vital import of grain in case of famine. Gregory of Nazianzus already realised this advantage in Antiquity:

Gregory of Nazianzus (Fulford 1987):
"*Coastal cities supported shortage of corn without much difficulty as they can dispose of their own products and receive supplies by sea; ... Inland is there no means of disposing of what we have or of importing what we lack*."

Cost was probably the primary incentive to send goods by ship. It was cheaper to transport grain from Tunisia to Rome than to transport the same quantity 80 km over land (Garnsey et al 1987). Research on the "Price Edict of Diocletian" indicates that inland waterways cost 4.9 times as much as sea transport. Land transport cost between 28 and 56 times as much (Peacock 1978). However, the high cost of land transport cannot on its own explain the decision of long-distance transport by ship. In practise economic or political factors and the risk factor will have determined the choice of route as the availability of transport, information and trader organisation (Hopkins 1980).

Speed was an essential advantage of transport by sea. It took a ship up to 30 days to sail from Marseille to Alexandria, while the journey on land took four times as long. Another reason was safety. Fragile items such as pottery or amphorae were at constant risk due to shocks in carts. In ships the breakage was restricted to loading and unloading the cargo. The disadvantage was that ships only could sail from March until November, as the sea was too dangerous during wintertime and there was the obvious possibility of wrecking.

Rome was the centre of the Roman Empire and was the final destination of many goods. There was a market with the most exotic and luxurious products for a limited group of wealthy civilians (Meijer et al 1992).

Aelius Aristides, "To Rome" 10-13 (Meijer et al 1992):
"… Here is brought from every land and sea all the crops of the seasons and the produce of each land, river, lake, as well as the arts of the Greeks and the barbarians, so that if someone should wish to view all these things, he must either see them by travelling over the whole world or be in this city… So many merchant ships arrive here, conveying very kind of goods from every people, every hour, every day, so that the city is like a factory common to the whole earth. It is possible to see so many cargoes from India and even from Arabia Felix…Your farmlands are Egypt, Sicily, and all of Africa, which is cultivated. The arrivals and departures of ships never stop, so that one would express admiration not only for the harbour, but also for the sea… So everything comes together here, trade, seafaring, farming, the scouring of mines, all the crafts that exist or have existed and all that is produced and grown."

But the demands of the rest of the population for grains and other basic goods, such as clothing were huge. They were so large that they could not be met from Italian sources alone and the market of Rome had to be supplied from all parts of the empire mainly by sea transport.

Grain made up the biggest part of ancient cargoes and the biggest supplier was North Africa. Oil and wine were besides grain the important commodities in the ancient international trade. Wine was produced in several places in the Aegean and Western Mediterranean. It was exported in large quantities with amphorae or dolia to places — such as Rome or Athens — where the demand for wine was too great to be satisfied by the local vineyards. Oil was brought in huge amounts to Rome from Africa and Spain. There were also other goods, which were traded in bulk. Metal, building materials such as marble and wood, salted fish, *garum* or fish-sauce, fruits, tiles, ceramics such as tableware or lamps, ivory, purple, spices, even wild animals and slaves were widely used and traded in antiquity.

The cargo ships also transported passengers. Travellers went down to the waterfront and asked around until they found a ship scheduled to sail to their destination or at least at a port along their line of travel. An example is Alexandria, which was a great centre not only those who wished to sail from Egypt, but also from the Levant. The passengers who wished to travel to the West followed the coast down and waited the sailing of the corn fleet (Charlesworth 1970). This fleet carried passengers often in great numbers. There was only one known route, between Brinisium and Dyrrachium (Map 1), on which vessels were used exclusively for the transportation of passengers (Rougé 1981).

III. Conditions of navigation in the Mediterranean

Sailing has always been directly depended on the sea and meteorological conditions. These conditions will not only have their effect on the direction of different navigational routes to be used, but they will also play an important role in the restrictions of navigation and thus influencing economy in general.

The Mediterranean tides and currents are fairly weak and affected navigation only in certain straits, channels or ends of the deep sea (Casson 1995). On the other hand, the speed of sailing ships in antiquity was largely dependent on the weather, more in particularly the direction of the wind. The Mediterranean basin is not always a calm and sunny environment; unpredictable winds can suddenly appear and are sometimes very violent. Because of its geographical position the Mediterranean knows during the year two major, opposite atmospheric systems (Pomey 1997). In summertime, the weather is controlled by anti-cyclone, which provides good and stable weather, ideal for sailing (PIC). The winds are stable and come largely from the north-west. In wintertime, the Mediterranean is swept by numerous depressions, which provoke unstable weather not suitable for sailing.

This is why sailing was a seasonal activity normally restricted to the summer months when the weather conditions were stable and when the winds were predominantly northerly. Outside this season — during the winter months — sailing was reduced to a minimum, such as carrying vital dispatches, urgent supplies or military movement and

ports went into hibernation to wait for the spring (Pomey 1997). This was not only a matter of the severity of winter storms, but also of visibility. The cloudiness and scant daylight makes navigation difficult and the mist veils the cliffs, headlands and mountains. Vegetius wrote about the different periods in which navigation was assumed to be safe.

Vegetius, "Epitome Rei Militaris" IV.39 (Meijer et al 1992):
"*From the sixth day before the calends of June [27 May] until the rising of Arcturus [24 September] navigation is believed to be safe… From then up to the third before the ides of November [11 November], navigation is uncertain… From there until the sixth before the ides of March [10 March] the seas are closed.*"

During the sailing season, the Mediterranean knows regular winds, which are blowing prevailingly from the north-west. This determined major navigation routes by favouring certain directions and restricting others (Map 2). The best known of these winds are the Etesians. Pliny said that those winds blew for 40 days from the same directions (Pomey 1997). It came from the north in the Aegean and from the north-west in the rest of the Eastern Mediterranean (Mediterranean Pilot V). This northern wind blows 80% of the time (Casson 1995). The combination of the wind direction and the restricted sailing season gives a definite pattern to ancient seaborne activity. Ancient square-riggers were designed for travelling with the wind. Voyages from the north to south could profit from these prevailing northerly winds in the summer months. The voyage from Rome to Alexandria was rather quick and easy, but the return voyage was slow and troublesome. In contrast to the journey from Rome, which took up to three weeks, the return trip took up to three months. Crossing in the opposite direction took much longer as it was not possible for ancient square-rigged ships to sail much closer to the wind then seven points (Casson 1995). This close-hauled course meant that they had to tack often to sail against the wind (Casson 1995). The only possible westward voyage was sailing at night — when the wind dropped — or hugging the Syrian and Asiatic coast so the vessels could use the local breezes (Charlesworth 1970). But most ships sailed outside the season of the Etesians during the first weeks of august or the first weeks of September. As a result the ships, which sailed from Alexandria, could do no more then two round-trips if they were

lucky enough to have a quick turn-around at either end. Most ships probably managed to do just one.

Regional winds — such as the Mistral, Bora, Meltem, Sirocco — are numerous and well known in the Mediterranean (Map 2). They played an important role in trade routes, as they could facilitate certain crossings by allowing the ship to navigate against the reigning wind direction. However, the unpredictable and violent character of these winds makes them sometimes very dangerous. They were sometimes the reason that ships had to tie up behind islands, because they couldn't beat against the violent breezes. Finally, the local land winds associated with the sunrise and fall were a considerable help to the navigation and in this extent frequently used in antiquity. They helped the ships to sail in and out the harbours, established the departure or arrival times and helped to round difficult capes. Combined with regional winds they allowed the ships to sail against the dominant wind direction.

IV. Archaeological data

Parker said that ancient wrecks can teach us much about maritime cultures, economical and even political and religious backgrounds of civilisations (Parker 1992 b). But this information needs to be retrieved from the evidence that remained in the wreck sites. This is why this chapter will deal about the specific archaeological data that can be retrieved from shipwrecks:

A. Ships

The typical ancient merchant ships were sailing ships with a length 8 and 40 m and a width between 5 and 10 m (Meijer 1990). Parker's research indicates that the most common type of merchant ship had a capacity of 1500 amphorae or 75 tons and was 15 to 20 m long (Parker 1992 b). There is a tendency for the ships to become smaller in the Late Roman Empire, but there is no reason to believe that those smaller ships were not seaworthy (Parker 1992 b).

The tonnage of the merchant ships in antiquity was variable. Especially the coastal vessels were very numerous and the capacity of these boats varied from 10 – 20 tons for small vessels under 15m of length to 50 – 60 tons, which were about 20 m long (Pomey 1997). In spite of their small capacity, some of those vessels were capable to navigate around the Mediterranean. These ships were used for cargo that required rapid transport. As propulsion they were almost completely dependent on oars, the square sail being used only under very favourable conditions (Meijer et al 1992).

In the ancient texts vessels with a capacity of 10.000 *modii* or 70 – 80 tons were the smallest ships allowed to carry the food supply of Rome and enjoy the benefits that this status brought. Those vessels are the smallest of the medium class transport ships. Most ships of this class have a capacity of 150 tons. They are mentioned regularly in the ancient texts and they probably take up most of the vessels for long-distance trade. These larger vessels used the oars only when entering or leaving a harbour. They were real sailing ships and were used to transport dispatches, passengers or cargo, particularly cargo that required rapid transport. There are many types of merchant galleys known, though their names were probably used with as little precision as in our modern world (Casson 1994).

- Actuaria: certain kind of oared galley
- Akatoi: vessel used in open water as in rivers
- Keles/Celox: ship built for speed, carrying dispatches or passengers
- Lembus: Little fishing boats or river crafts
- Cercurus: oared cargo vessel of substantial size
- Cybaea: cargo galley
- Phaselus: transport of passengers rather than cargo

The biggest of these merchant vessels were sometimes more then 40 m long and may have had a capacity of 300 – 400 tons (Meijer 1990). Examples are known from underwater excavations of the wrecks Isola delle Correnti, Albenga and Madrague de Giens. They were called *muriophoroi* (Pomey 1997. De Donato 2003), which literally translated means carriers of 10,000 amphorae. These ships did not need to remain close to the coast, nor did they require special harbour facilities, which made them excellent to use on most of the sea routes.

A special type of vessel was the so-called super-freighter with a capacity of more than 1.000 tons. They were only used to transport exceptional cargoes — like the Caligula obelisk — or the *annona* grain supply for Rome. These vessels could only anchor in the largest harbours such as Ostia, Alexandria, Antioch, Massilia, Carthage and Piraeus. The Isis was such a large grain ship. Lucian described it when it took shelter in the harbour of Piraeus. It measured 120 cubits or 55 m in length and from deck to bottom 43 cubits or 13 m. It capacity was probably around 1200 tons, which fits the description of these ships in the ancient texts (Casson 1994).

B. Cargo

On monuments of the Roman period can be seen that cargo was rarely carried on deck. The deck of the ship was normally reserved for passengers and crew (Rougé 1981). The ships carried a wide range of size and arrangement of cargo in their hold and amphorae were the containers of the antiquity to transport a wide range of foodstuffs from liquids such as oil, wine, fruits, garum, defrutum (Parker 1984) etc… but other ceramic jars, glass bottles, baskets, barrels and sacks must have been used to transport goods.

Pomey divides the different objects found in shipwrecks into three main groups (Pomey 1997):

- The main cargo
- The secondary cargo
- The ship's fitting or crew's possessions

The main cargo is the primary reason for the destination and vindication of the journey. The secondary cargo consists of goods that would not justify the journey, but will increase the profit because it fills up the empty spaces in the ship's hold. The word "piggy-back" is given to these small amounts of cargo found a long distance from its origin (Parker 1990 b). The shipper would probably have been interested in an increasing secondary cargo. Most of the contracts were not concerned about this and it meant an additional profit for the shipper. It would explain some movements of

especially pottery, but the evidence of shipwrecks tends against this view of trade. It seems to be normal for Roman ships to make up a cargo from a variety of sources (Figure 1). The other objects are of a practical reason like the rigging or goods or personal goods of the crew, which will lighten life on board.

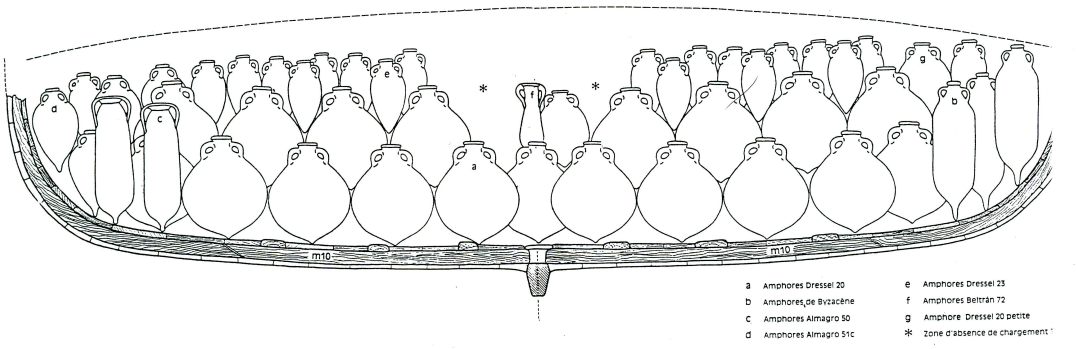

Figure 1: Cross-section of the shipwreck "Cabrera C" (Pomey 1997: p 126)

Most of the times, amphorae are the main cargo. Especially when there is only one type of cargo found, 75% of the time it is amphorae (Parker 1992 a). This is mostly due the bad knowledge/exploration of the site. The unique form of the amphorae makes it easy to recognize, even by laymen. A cargo of tiles is denser and not so easy to spot. However, if multiple cargoes types are found in a shipwreck, the percentage of amphorae in the total consignment is rather low (Parker 1992).

I divided the cargoes into the amphorae, dolia, ceramics — all kinds of pottery—, stones, sarcophagi, tiles, metal and glass (Appendix 2). I only used the wreck sites or reports that had a reasonable good identification of amphorae types. Some reports only vaguely mention amphorae as Roman or Byzantine. This information cannot be used in research. The division of the ships in different periods is based on the date of sinking presented by the researchers who excavated the wrecks (Appendix 3). Because of this date, the information of a particular ship can be used in more than one period as the assumed data of the wreck covers different periods. For example: there is a shift of economic importance from Spain to Africa in the 3rd century AD. So I divided the information into a Spanish period, before 200 AD and an African period, after 200 AD. This means that the information of cargoes from ships like Capo San

Alessio — 100 to 300 AD — will be used in both periods, as there is no possibility to conclude if this data can be put in one particular period.

C. Stowing

Cargoes of vessels were carefully stowed to prevent breaking and shifting of the cargo. The goods in the hold were arranged according to their weight and type. Heavy goods such as metal ingots were loaded at the foot of the hold and lightweight goods, such as pottery, were usually stowed on top of the main cargo and fore or aft of it. At La Garoupe A, the amphorae were stacked on top of the dolia and in Dramont E slender amphorae were placed between fatter, larger ones. Some shipwrecks have empty spaces in their holds, whether this because the ship was this empty or there were perishable consignment on board is hard to determine. Complementary or space-filling goods are mostly on top or at one end of the main cargo (Parker 1992 a).
Grain had no uniform manner to be stored in the hold. It was carried in baskets, leather sacks or *cupae*, which are large, wide-mouthed earthenware vases. But more often it was probably transported loose. Precautions were necessary to avoid shifting during the voyage. The cargo hold was probably divided into a number of compartments separated by bulkheads. This method was probably used when the cargo belonged to different owners or when it did not consist exclusively of grain. Potteries, like amphorae, were piled on top of each other on layers of straw or dunnage, but pottery could also have been transported in crates or baskets.

The amphorae were set upright in superimposed tiers and could be stowed from one layer to nine layers in super freighters like Albenga. Each amphora was placed with its pointed bottom into the open space around the necks of the jars in the tier below (Figure 2).

Figure 2: Theoretical reconstruction of the amphorae stowinf in the "Madrague de Giens" (Pomey 1997: p 149)

In many cases the cargo was stowed on a layer of brushwood, heather or vine twigs. The stacking of the cargo was so carefully that a minimum of dunnage was needed. This dunnage of twigs and branches kept the jars cushioned against each other and the hull and can sometimes been found in excavations of wrecks. But in case of amphorae, the points of the bottom row were sometimes set in sand or pebbles —like Cap Gros C —, which was also used as ballast.

D. Amphorae

Amphorae are the ancient equivalent of the medieval barrel or modern steel drum (Casson 1994). The ancient authors did not give so much attention to pottery, but the references that do exist emphasise the amphora's function as a transport container (Tomber 1993) specially made for seaborne commerce. In the Mediterranean where wood was relatively scarce and expensive, clay jars and not barrels were the shipping containers par excellence.

The pair of handles set vertically opposite one another near the rim gave this jar its etymological name, which means “carried on both sides”. A fairly narrow mouth and neck bulge into a more or less cylindrical body, which tapers to end in a point or small flat bottom. They were sealed with stoppers of fired clay or cork. Generally speaking amphorae are around 1 m high and they have a capacity between 20 and 40 litres. This does not count for the mini amphorae found in some shipwrecks or the huge dolia with a capacity of up to 4000 litres.

A typology of amphorae is not easy to make, as they remain individual products of artisans who may work quite independently (Parker 1992 b). Amphorae were made differently according to time and place. Each region had a different shape and, as time passed, certain features were subject to changes. The replacement of one amphora type by another probably reflects a change in agricultural practice or economy. An example is the appearance of Class 10, which probably reflects a general contraction in the export of Italian wine (Paterson 1982). But even within a single shipment of amphorae, probably made in the same area or even same pottery, there can be a wide variation of profile and size. Nevertheless certain broad divisions of forms are widely recognized by archaeologists (Appendix 1). The individual characteristics of the can also give indications of the time period. Forms such as Class 25 are definitely attributable to a certain region — southern Spain — and a broad period of time. In contrast to the ship’s hull and other perishable goods, such as grain or fruits, fired clay of the amphorae is nearly indestructible. So the amphorae can tell us, with reservations, the place of departure of the ship and ports it visited on its journey.

I am using the typology made by Peacock & Williams because this is a broad, comprehensive typology with fabric descriptions and other information (Peacock & Williams 1986). But even this broad typology does not cover every form of amphorae that has been found in the shipwrecks. That is why I also use additional typologies from Keay, Dressel, Panella. A lot of reporting on amphorae are a mixture of typology — Dressel, Pascual…—, descriptive terms — ovoidal —, geographical attributions — Africana — and references to excavated specimen — Kingsholm 117 — (Appendix 1 & 2). Some of this information can be used in the reconstruction of the vessels navigational route or in a map showing the amphorae distribution/expansion of a certain region. But most of it, such as the descriptive

terms, cannot be used, as they do not give specific information. Almost all the amphorae types that are not included in the Peacock & Williams classifications are only found in small numbers so they will not provide major changes in the general patterns. This is way the additional list of other types is not included in the tables of appendix 3. They are included in the general class that is names “others”.

E. Position of the shipwrecks

The development of scuba diving has brought to light many new sites since World War II. The great majority of these lie in the Western Mediterranean. Reasons for this distribution can be found in the early growth of the sport diving in the area, the accessibility of its coast to large centres of population and a European interest in antiquities (Parker 1980). The West Mediterranean basin includes at least 70% of all wreck discoveries (Gibbins 2001). Especially the waters of southern France, the west coast of Italy and the Islands of Corsica and Sardinia with its good visibility are well known to sport divers. On the other hand are there few underwater sites known from N-Africa — inaccessible coasts — or from the east coast of Italy where shelving coast make the visibility poor and unsuitable for wreck discovery (Map 5).

Gibbins has done research on the amount of ships wrecked in antiquity. He based himself on the information on Venetian large merchant ships, which had a chance of one on twenty or thirty to wreck on medium to long distance journeys (Gibbins 2001). Monte Testacchio contains the remains of 55 million south Spanish amphorae from middle of the 1st century to the early 3rd century. If the vessels transported an average of 1,500 amphorae a shipment, this would result in 36,500 cargoes or 250 cargoes a year over 150 year. The two main routes to Spain are to the north-west littoral or across open sea through the strait of Bonifacio. The sites found represent one wreck every two years or 1:500 sailings. In other words, there should be 20 to 30 times as many wrecks. It indicates how important episodes in the seafaring history are absent.

The coastal distributions of wrecks, how representative are they for sailing as a whole? Most routes were coast hugging, but there must have been open-sea passages. Ships on open-sea passages are more likely to be blown inshore than to swamp out at sea. Therefore one cannot assume that the geographical distribution necessarily reflects the intensity of maritime navigation and commerce.

The exact location of the wrecks is not pinpointed (Appendix 2), as this is not of great importance. The aim of this research is to find correspondence in certain cargoes and their relation in the navigation routes of antiquity. Ancient mariners were following a route, which should be more viewed as a general direction then an exact route. This means that a position within a few kilometre radius of the place where the wreck lies, is accurate enough for the objective of my research.

V. Trading mechanisms and navigational routes

A. Mechanism of exchange

The stereotype idea of the merchant in antiquity is an adventurer, sailing from port to port and buying or selling goods without knowing if he will make profit or when he will return to his port of origin (Pomey 1997). This kind of merchant probably existed from the Archaic period onwards, but it is not representative for the merchants in the Hellenistic/Roman period. So how should we see the Roman economy: "tied" with exchange of goods determined by redistribution or "free" with exchange resulting from commercial marketing? Most researchers are following the theory developed by archaeologists and anthropologists to describe the trading/exchange mechanisms used in antiquity (Peacock & Williams 1986). This exchange mechanism can be divided into three main systems:

- Reciprocity: social customs dictate the exchange
- Redistribution: a central authority collects the goods and redistributes them
- Marketing: exchange of goods for profit

1. Reciprocity

Of those three systems, redistribution and marketing are mostly used. On the other hand, reciprocity might explain occasional finds of exotic goods outside their natural marketing area (Peacock & Williams 1986), but can be hardly identified on the basis of archaeological material. Parker thinks that the Hellenistic wreck Chrétienne C

could have been carrying a gift of produce from one estate (Parker 1990 a). Maybe we can classify the wrecks loaded with works art such as Mahdia or Antikythera A under this category? Are these legally bought objects or are they war/surrender booties from cities, which can be seen as a social custom.

2. Annona or redistribution

The *annona* or state food supplies are a special kind of exchange. These goods were collected in agricultural rich regions and redistributed to cities that have outgrown the resources of their own hinterland or to military stations on the borders of the empire. Those shipments took a considerable part of the maritime transport. Grain, being the basic food in classical antiquity, made the bulk of most *annona* transports, but products like oil were encouraged and managed by the Roman State from Hadrian onwards. In later Roman period the *species annonariae* also included wine, fat and fruit (Peacock & Williams 1986).

Rome relied already in its early history on the import of grain from Campania and Etruria. From the second half of the third century BC, as the population of the city grew, grain from Sicily, Sardinia and North Africa reached Rome through sale or diplomatic gift (Garnsey 1983). Contributions from other western area such as Gaul cannot be ruled out. As the provinces became assimilated into the empire as Roman provinces, rents from imperial estates or tributes assured a constant supply of grain. The armies on the frontiers and the city of Rome consumed more taxes than was produced locally. There was a large-scale interregional flow of taxes and trade from rich tax-exporting provinces such as Spain, southern Gaul, Northern Africa, Asia Minor, Syria and Egypt to Rome. The tributes of the provinces were paid in money. To pay their taxes, the provinces needed trade to gain money (Hopkins 1980). On a local level, simple farmers were forced to produce and sell a surplus in order to pay their taxes. This was followed by changes in patterns of consumption. Artisans could buy more food and make other higher value goods, which increased the growth of mercantile economy (Woolf 1992). The towns and markets thrived under this growth of markets. Bureaucracy developed to get goods to the armies at the frontiers. This all increased the monetization of the Roman economy. Rents functioned in similar ways

as taxes, both were charged on the surplus produced by peasants. Many taxes however, were raised in kind.

The city of Rome had adequate stocks of food for sale to the public, but there was also the supply of free grain, meat and wine. However, some researchers are of the opinion that most of the taxes were paid in money and that only as little as 15% of the grain was distributed freely under the population (Hopkins 1980, Temin 2001). Temin suspects that the imports of grain would have been too large to be managed by the government and that there is no indication of such a large bureaucratic administration. He thinks that the bulk of the grain imports must have been privately owned. The ships transporting the grain from Egypt were neither owned by the Imperial state nor operated directly by the state. The shipping contracts with ship owners or *navicularii*, were only used to obtain grain for the imperial distribution, which does not sound like command behaviour or centric transfers. Grain undoubtedly came onto the market through the regular activity of private merchants or *negotiators* (Garnsey 1983), but the arrangements or contracts to transport the *annona* do not exclude an interference of the state. It would be unwise to neglect all the references in the ancient texts: from the amount of grain imported and distributed to the building of an imperial fleet. Most of the *annona* supplies were acquired primarily in the provinces through taxation in kind and they had to be transported. The mechanisms by which the Spanish oil reached Rome and the military on the Rhine frontier could hardly be described as free trade (Mattingly 1988).
Class 25 oil amphorae would presumably not have travelled as far as their distribution shows without some subsidising effect (Mattingly 1988). Additional supplies of grain and oil came from the rents of the imperial estates or were bought by the state from merchants or private landowners.

To transport this huge amount of goods the state sold contracts for collection and transport of grain to Rome or to the army under the Republic. The shippers were attracted into service of the *annona* with tax and insurance benefits. Most grain that was imported in such way was presumably state-owned (Garnsey et al 1987). From the late Republic onwards, there was an increasing Imperial involvement in the organisation of the food supply to secure a regular provision and transport of the *annona* to Rome. This service became so vital that it could not be left totally in the

hands of private entrepreneurs. So Augustus created the service of the *annona*, which was under control of the *praefectus annonae*. When Egypt became part of the Roman Empire in 31 BC, there was a constant supply of grain from the East. The ancient texts mention that Egypt supplied 20 million *modii* or 130.000 tons.

Epitome de Caesaribus I.6 (Meijer et al 1992):
"*In the days of Augustus 20 million modii of grain were imported each year from Egypt to the city.* "

But the importance of other areas has not diminished; Africa, Cyprus, Chersonese and Spain are also known to have exported grain to Rome. Fulford however, suspects that the contribution of the overseas transports were exaggerated by the contemporary witnesses because the exigencies of the sailing season meant that the first arrivals where at the time of year between sowing and harvesting when the grain stocks were inevitably low and the people anxious (Fulford 1987). He thinks that agricultural capacity of traditional sources such as Sicily, Sardinia and Campania was greater than mentioned in the ancient texts. Nevertheless Flavius reported that during the reign of Nero, Africa supplied Rome with grain for 8 months a year.

Flavius Josephus, "Jewish War II". 382-3 & 385-6 (Meijer et al 1992):
"*This third of the whole world…bounded by the Atlantic and the pillars of Hercules; and supporting right up to the Red Sea the thousands of Ethiopians, is subdued in its entirety; and these people, besides their annual crops, which feed for 8 months of the year the populace of Rome, pay tribute of every kind… Alexandria, so populous, so wealthy, so vast… besides money she sends grain to feed Rome for 4 months.*"

What Flavius probably meant was that only for 4 months a year, from June to September, grain ships from Egypt arrived at Rome. Because if he meant that only a third of the total amount of grain came from Egypt, where Egypt delivered 20 million *modii*, it would mean that Rome consumed 60 million *modii* of grain a year. If we assume that a regular person used 1 litre of grain or 2,500 calories per person per day, the city of Rome had 1.5 million inhabitants, which is more then what sources indicate. Recipients of handouts of cash or grain during the reign of Augustus numbered at various times between 200,000 and 320,000 (Pomey 1997). This was

only for male citizens from the age of ten. This would bring the population on 670,000 inhabitants. If we add a slave population of 30% this would give a number of 1,000,000 inhabitants, without counting in free foreigners or citizens of status who are not involved in the grain dole (Garnsey et al 1987). Modern estimates are that the city of Rome had an estimated population of one million inhabitants in the first two centuries AD Rome (Meijer 1990). Garnsey says that Rome with its one million inhabitants required a minimum of 30 *modii* or 200 kg of grain — a minimum of 1700 calories a day — per head per annum, which means that Rome needed 30 million *modii* or 200.000 tonnes of grain a year (Garnsey 1983, Pomey 1997). This consumption rate is also reflected in some ancient texts; Severus wrote that there could be 75.000 *modii* issued daily, which would make 28 million *modii* annually. Lucian said on the other hand that Rome needed 80.000 *modii* daily (Lucian I 139, Vita Severi XXIII). Although some authors think that the city of Rome used the double or 60 million *modii* of grain each year (Meijer et al 1992, Casson 1980). Garnsey thinks that it is not unthinkable that the import levels of grain reached 60 million *modii* occasionally, as the quantity dispatched from the grain producing regions must have varied greatly in response to widely fluctuating harvest levels, but a regular consumption of this quantity seems widely improbable.

To get so much grain on yearly basis from Alexandria to Rome called for a highly developed organisation. Claudius shifted the main port for Rome from Puteoli to Ostia; Commodus built a state merchant fleet — Classis Africanus — and port facilities at Carthage. But in general, fiscal cargoes for the *annona* were still carried by ship-owners — *navicularii*—, which were contracted by the state for the purpose. These merchants or ship-owners were recompensed considerably with rewards such as for example citizenship. From time to time emperors took measures to make it more attractive to invest in grain transport, which can be found in the texts of Suetonius.

Suetonius, “Claudius” 18-19 (Meijer et al 1992):
“*After a series of droughts had caused a scarcity of grain… as a result he took all possible steps to import corn. Even during the winter months, insuring merchants against the loss of their ships in stormy weather and offering a bounty for every new grain-transport built, proportionate to its tonnage.*”

Shippers made a lot of profit because the *annona* ships carried in addition to paying passengers, other goods of diverse ownership. In the 3rd century, private and fiscal goods were exempt from port tax if carried alongside fiscal loads. Several regulations are known to intercept the private gain to the detriment of *annoni*. The Theodosian Code warned shippers not to overload their grain ships with private cargo and in the 5th century a law penalised the deviation of ships loaded with state grain cargoes from direct routes in order to deliver unrelated cargoes (Reynolds 1995, Tomber 1993).

The solution in getting this large amount of corn to Rome in such limited time-span was the use of oversize freighters. The vessel "Isis", which took shelter in the harbour of Piraeus, could probably carry a cargo of 1200 to 1300 tons (Casson 1994). This means that a fleet of about 100 to 120 ships was needed to ferry the amount of grain that Egypt sent each year to Rome. However, from 330 AD, Egyptian grain was diverted to the city of Constantinople and Rome relied on its traditional western sources.

3. Marketing

Besides the *annona* or tax in kind, which was largely a free enterprise under state supervision, there are numerous inscriptions and references to merchants or *negotiators* indicating that market trading was an important facet of Roman life (Peacock & Williams 1986, Greene 1986). However, it is very unlikely that merchants would risk their money on long journeys without knowing the geography or the climates — more specifically winds — of the coast, which they are sailing (Pomey 1997). But still exotic imports arrived in all parts of the empire. This means that even under free merchants there had to be a sort of redistribution of goods. Pomey introduced for redistribution the concepts of "direct route"–"redistribution route" and "principal port"–"secondary port" (Pomey 1997). The first step is the transport of the homogenic cargoes from a region of production to a principal harbour via a direct route (Figure 3). Sud-Perduto 2 is an example of a shipwreck with a homogenic cargo. The second step is the transport of a heterogenic cargo by coastal vessels, which connect this principal harbour with secondary ports by a "redistribution route" (Figure 3).

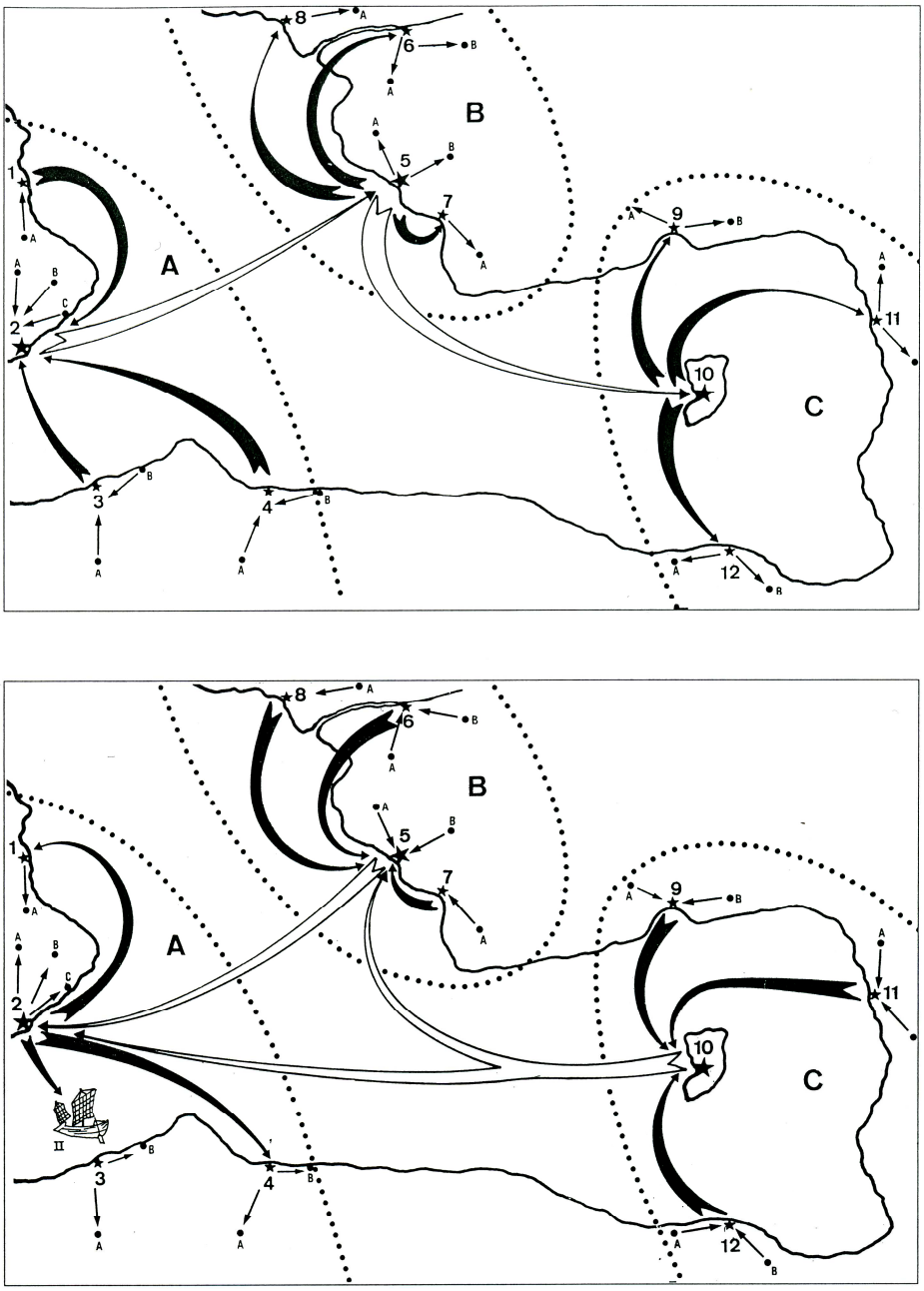

Figure 3: Schematic representation of the direct-redistribution route/principal-secondary port (Pomey 1997: p 157). A, B, C are the zones of economical influence around the principal ports 2, 5 and 10.

The wreck of Illa Pedrosa is what Pomey calls a heterogenic cargo because it has a cargo of Italian ceramics and grinding stones from Agde, Sicily and Gerona. This *emporoi* or tramping is the speculative and small-scale contractual transport of goods in regular maritime port-to-port coasting (Rougé 1981). They served the small ports where large ships could not moor. It has a cellular appearance (Figure 3), which means that the vessels are focussed around principal harbours, receiving goods from

outside and acting as nodes for internal distribution (Gibbins 2001). References of short distances traders, who carried out small –scale trading between Africa and Sicily, can be found in Tacitus (Tomber 1993). How extensive this trading may have been, it was still small-scale trade compared to the trade of big vessels on major trading routes. The final third step will be the connection of the secondary goods to the major cities inland.

The difference between a principal harbour — entrepôt — and secondary port is that the latter is under the economical sphere of influence of the principal port. Most of its commercial activities are linked and dependent on this principal port. The principal harbour has the necessary infrastructure for humans, space for the loading and unloading of long-distance cargoes and provisions for the supplying and careening of ships. Naturally it has also the material infrastructure such as storehouses, cranes, quays etc… All the important harbours in Roman times, such as Alexandria, Ostia, Carthage, Cadiz, Narbonne, Puteoli… had their storehouses. The most important aspect is its geographical situation. It has to lie on a main trade route and it should also be the terminal of a number of feeder routes that would bring raw material of surrounding countries. This function means more than the mere bulking of goods and its transmission to other ports. It includes the processing of the cargoes such as cleaning, sorting etc… (Miller 1969). In those ports big vessels handled homogenic cargoes in bulk. Those goods will be reloaded onto smaller coastal vessels, which will redistribute it under the secondary ports in the economic sphere of influence of the principal port. The status of a port could change in time. This switch happened to the harbours of Puteoli – Ostia or Emporium – Narbonne (Map 1). It is important to know the difference of the status of a harbour, as the most important ports were linked with the major trading routes. Pomey thinks that the differences in ports can be seen in the ancient texts (Digest, L, 16, 59: Pomey 1997). In these texts the words *portus* and *statio* are used; Portus is a place with a huge market and storehouses, where *statio* is a secondary market. Severus said that the *Portus* were places were the ships hibernated and station is a place where the vessels stayed a short while (Rougé 1966). Pomey is certain that *portus* can be linked with the principal harbours and *statio* with the secondary ports in the economical sphere of the principal harbour. For the north-west Mediterranean under the Republican Period the harbours of Emporium and Marseille had the status of Portus. In the Imperial Period these changed to Arles and Narbonne.

The coastal vessels that were in charge of the redistributions under the different statios only sailed well-outline routes. The distances that the coastal vessels covered were liable to marine geography and different historic periods, but were relatively small distances. This allowed the mariners to build up a profound knowledge of the difficulties encountered on their journeys, which decreased the risks of wrecking considerably. Once large numbers of ships visited a region regularly, navigational expertise for those areas would mount in contrast to less frequented routes.

As seen above redistribution was also used in transporting and selling of products for profit and thus cannot simply be linked with only the *annona* cargoes.

B. Navigational Routes

Rougé was one of the first researchers to examine some of the principle shipping routes in the Republican-Imperial period (Map 3), which are known from written or epigraphic sources (Rougé 1966). At present, the known network of regional and inter-regional shipping routes is primarily based on the distribution of the ceramics and to a lesser extent on textual evidence (Reynolds 1995).

The data provided by wreck sites should be considered in terms of its field situation and of closely comparable sites. One should be careful with interpretations such as the "Last route" theory, which is based on the places of origin of the cargo found aboard of the wreck (Parker 1995). The latter can not always be derived from the goods on board, because one should take into account situation like: entrepôts, return cargoes, ships' chandlers etc… Interpretations should be based on field experience and observation of the cargo, such as complementary cargo, paying ballast or space filling goods. Examination of wrecks like the Madrague de Giens, shows that the position of assumed complementary cargoes such as tableware — on top of or at the end of bulkier cargoes — may be due to the wrecking process or the displacement of the goods when the ships start to perish and fall apart (Muckelroy 1978, Ward et al 1999). So its relatively economic unimportance is not automatically linked with its position found in the excavation.

Artefacts distribution on land sites can help examining long-distance trade (Peacock & Williams 1986, Tomber 1993), but the routes followed by the ships can be complicated and circuitous. Some routes were straight from A to B and back. A good example is the route of the grain-ships between Alexandria and Rome. Unfavourable conditions of weather however could divert ships from their original routes, forcing them to make a detour. The journey of the grain ship "Isis" is an excellent example of such a detour. Lucian described the sea voyage of the ship, which had to shelter in Piraeus.

Lucian "The ship" (Greene 1986):
"*When they left Pharos the wind was not very strong and they sighted Acamas [west Cyprus] in seven days. Then it blew against them from the West and they were driven abeam to Sidon [North Beirut]. After Sidon a severe storm broke out and carried them through Aulon [channel between Turkey and Cyrpus] to reach Chelidonenses [Gelidonya, Turkey] on the tenth day… where the Pamhylian and Lycian seas divide, the swell is driven by numerous currents…the rocks are knife-edged and razor-sharp…the wave as high as the cliff itself…they saw the fire from Lycia…they guided the ship back into open sea…sailing across the Aegean beating up with the trade winds…seventy days after leaving Egypt, they anchored in Piraeus.*"

The merchant ships were stopping at various ports of call, which makes the maritime routes even more complex. In every harbour there would have been an off- and onloading of cargoes, which suited the ships purpose or next destination. The examination of wreck assemblages and the hypothesis based on them introduce explanations in terms of history and economics. Cargoes of marble and tiles for example are susceptible to direct analysis, as they were probably no subjects to trans-shipment (Parker 1995). Wreck locations and their density/frequency add an important discipline to such studies.

Throughout most of the Roman Period, Italy and more specifically Rome, was the centre of trade, and thus of navigation routes. From the 1st century on, the Roman economy became increasingly import orientated. Strabo described how boats leaving Italian harbours, were considerably lighter than when they arrived (Jurisic 2000). Harbour cities, as loading and unloading centres, became the junction points between

which the major sea routes ran (Map 3). They were primarily determined by geographic-maritime factors and by actual political-strategic situations (Jurisic 2000). The principle ports of the empire were: Ostia, Puteoli, Marseille, Arles, Narbonne, Tarragona, Cartagena, Cadiz, Emporium, Carthage, Aquila, Split, Athens, Constantinople, Rhodes, Antioch, Caesarea Maritima, Gaza, Alexandria, Cyprus & Crete (Map 1) (Reynolds 1995). The western maritime routes connected Rome through these harbours with the western provinces such as, Spain, Gaul, Britain and Africa. The eastern route connected Rome with numerous eastern provinces, among which Greece and Egypt should be emphasized. Although the connection between the eastern Adriatic and the economic powerful west of Italy was never strong, the Adriatic Sea had a specific role in the maritime routes: the longitudinal Adriatic route was used to serve northern Italy (Jurisic 2000).
In addition to these major routes there must have been regional traffic and redistribution of goods between the important harbours and minor ports or even coastal villas.

Most of these navigational routes were never far from visible geographical points in the landscape, even for long distance routes. Some points — natural or man-made are visible from far distance, but knowledge of the coastal geography is vital.
The concentration of economic activity and the difficulty of land transport make coastal navigation very developed in the Mediterranean. But this is not everywhere, as some regions are more developed and others almost deserted. Navigation around the Aegean Islands is difficult, but a necessity. On the other hand, the African coast between Alexandria and Tascape is littered with dangerous reefs and there are few interesting economic centres except for the region around Cyrene.

A lot of the navigational routes were known as part of a network of greater routes. The route between Porto Torres in Sardinia and Ostia is an example of a route that formed part of a more important shipping route. It was also a part of the important Tarrogona-Ostia and Marseille-Ostia route. Similarly, routes from the East to the West could follow well-established routes in the West once they entered Western Mediterranean waters (Map 3).

1. Western Mediterranean

- *From Carthage*

The south-north route from Africa to Italy was of major importance because of the *annona*. There is textual evidence for the shipment of the *annona* supply from Carthage. Other ports from which fiscal cargoes may have sailed are Missua, Utica and possibly Rusicade (Reynolds 1995). There are different routes known from Africa to Rome; According to textual evidence of the Imperial Times, the ships, which sailed from Carthage to Puteoli, avoided Western Sicily and went straight to Campania. From the Mid-1st century onwards, an even more direct crossing to Ostia could be made. Another possibility is a route north to Sardinia and from the east coast of Sardinia to Ostia (Rougé 1966). According to Strabo, ships coming from Sardinia could sail northwards to the Isle of Elba and then sail southwards along the Italian coast. Reynolds thinks that the Strait of Messina in routes from NorthAfrica to Rome seems to be avoided (Reynolds 1995), but the evidence from the wrecks indicate that there are many wrecks with African amphorae at the east coast of Sicily, which could indicate a route through the Strait (Map 6).
The ships loaded with Tripolitanian products probably by-passed Carthage. This can be seen from archaeological evidence found in Malta, South Italy and Campania where Tripolitanian products are found numerous in contrast to Carthage (Reynolds 1995).

The demands of the *annona* caused strong eastwards shipping from southern Portugal, southern Spain and the western Mediterranean ports to Ostia and eventually Rome. In the opposite direction are there strong contacts between Tunisia and southern Spain, especially during Late Roman/Byzantine times. The absence of south-central Mediterranean coarse ware in Campania and Rome and their presence in Carthage and Alicante is an indication that these imports were carried and distributed along this south-Mediterranean shipping route. It is clear that the ships of this route travelled via the Balearics. The presence of African amphorae in the wrecks around the Balearics (Map 6) and the presence of Balearic amphorae found in Valencia in Imperial and Mid-Roman contexts suggest that the vessels probably travelled along the islands

(Reynolds 1995). There are also links in the archaeological records of Tarragona and Alicante, but strangely enough not Cartagena. The Balearic amphorae were probably distributed along the Carthage – Alicante route. The distinct sources and ranges of pottery found in Alicante and Cartagena, point out that certain goods from specific regional sources were supplied directly to Cartagena and others to Alicante. But there must have been another route along the African coast that has been described by Braudel as the busiest for shipping in Medieval Times (Braudel 1985, Whittaker 1989).

A few ancient sources relate to direct routes between Tunisian ports and harbours not related to Rome or Spain (Antoninus & Severus: Rougé 1966). Severus mentions a shipping route between Narbonne and Carthage and the presence of distinct amounts of Tunisian amphorae at Naples and Marseille suggests an independent supply from Carthage (Reynolds 1995).

- *From Spain*

The Western Mediterranean only had one great west-east route (Map 3), which was the route from Spain to Italy (Reynolds 1995). The most common of this west-east route was a departure from Cadiz — conjunction point from the Atlantic routes — to Sardinia along the northern route of the Balearics. From Sardinia the most common route was through the Strait of Bonifacio to Italy. The range of African sigillata found in the archaeological record links the cities of Valencia to Porto Torres in Sardinia and Ostia, by-passing Alicante (Map 7). But there was also a coastal route to the north: along the Gaulish coast to Corsica and northern Italy. An Spanish amphorae found in sea for the coast of southern France bears the inscription of "[R]oma (m) in via Lata", which meant that this particular amphorae needed to go to the busiest street in Rome, the via Latia (Pomey 1997).

Textual evidence for links between Beatica and Mauretania are known from the Imperial period (Antoninus & Severus: Rougé 1966). The governor of Beatica was responsible for sending cargoes of grain to the troops stationed in Mauretania. Archaeological evidence of African sigillata found on the east coast of Spain and southern France, suggests a south-north route of goods via the Balearics.

There was also a route from Baetica to the north following the eastern coast of Spain towards the Rhône and continuing by shipment or portage to the Rhine. Ships such as Madrague de Giens or Vendres B, probably had a consignment of goods for the northern areas (Parker 1980).

- *From Gaul*

Another important route was the route from Gaul to Italy, where two routes were possible; along the coast of France straight to Corsica, then onto the Italian coast via the Isle of Elba or a more direct route through the strait of Bonifacio were it joins the route Spain – Italy (Map 8).

- *The Adriatic*

The Adriatic Sea had a known route from Brindisi to the northern isthmus. Whether the vessels followed a route in the middle of the Adriatic or a more coastal route is hard to find out. Passenger ships are known to cross the Adriatic from Brindisi to Dyrrachium. The presence of the Aegean imports in Ravenna and Sicily may indicate a route from east Sicily to Ravenna via south Italy (Map 9). The cargoes found in shipwrecks of the Adriatic indicate that 70% of the goods can be attributed to a general eastern route (Jurisic 2000), especially wine — Class 10 — and pottery. The main cargoes coming out the Adriatic were north Italian wines in the forms of Class 8 and Class 42 amphorae.

2. East Mediterranean

The most important north-south route in the Eastern Mediterranean is the axis Egypt-Aegean-Black Sea (Rougé 1966). The Black Sea was the main supplier for *garum* in the Eastern Mediterranean (Casson 1994). All those north-south routes congregate in Rhodes, were the ships supplied when they came from or will be leaving for Egypt. Secondary routes will be Rhodes – Cyprus, Levant – Egypt. The Ports in the Levant have most of the time a northerly wind, which allows ships to travel easily to Egypt. In the opposite direction however, the vessels had to sail against the wind. This

resulted in a zigzag course north, the ships would finally arrive somewhere between Rhodes and the Gulf of Issus (Rougé 1966). Once the shipper knew where he was, using geographical markings in the landscape, he had to adjust his course in function of his port of destination.

The provinces of Cyrenaica and Triplotania cover most of the African coast in the Eastern Mediterranean. Although this area is inhospitable and the coast is littered with dangerous reefs, there was still export of goods: grain and medicinal herbs from Cyrenaica and olive oil from Tripolitania (Fulford 1989). Another drawback is the predominant north-west wind, which limits sailing direction. It makes sailing along the coast difficult in both directions. But sailing to the Peloponnese or Crete from Cyrenaica would have presented no problem. The prevailing winds encouraged navigation of north-south routes for Cyrenaica. As for the Tripolitanian sites, when the wind comes from the north, sailing west and to the north along the Tunisian coast would also present no problem. However, when the winds are blowing from the north-western direction, it would have been hard to sail along the coast. Depending on the direction of the wind, conditions off Tripolitania encouraged north or north-western routes. The evidence of the amphorae favours a west-central emphasis to the pattern of trade from Tripolitania (Fulford 1989). The absence of coarse pottery from the East reinforces this statement. In the 1st century BC there is a lot of coarse ware from the Island of Pantelleria, which could have been carried along the route where traffic was regular. Rather than to look to each other for mutual support, both regions had contacts with communities to the north. The Gulf of Sirte was probably a serious navigational problem for a two-way communication and it acted as a barrier between the two regions.

3. East – West routes

There are three great navigational routes when a vessel wanted to travel from the East to the West: a northern, a central and a southern route. Each of these routes crossed the east coast of Sicily (Map 10). From east Sicily, the vessels navigated to their final destination, which mainly had three great directions: to Rome, to Spain or to Gaul.

The northern route is well known, as it is part of the coastal navigation of the Aegean (Rougé 1966). All journeys from either port in Asia Minor to the West will pass the Aegean Islands. Depending on the ship's tonnage or cargo, there are two choices: the passage at the Corinthian Isthmus to Brindisi — Mare Adriaticum — or to Messina — Mare Tyrrhenum —. The second option is the route around the Peloponnesus and Cap Malea. When Cap Malea is rounded there are several options: straight to Sicily or along the coast of the Peloponnesus to the Adriatic Sea and then the east coast of Italy. Saint Paul travelled in the opposite direction from Rome to Antioch: his ship passed Messina, around the Peloponnesus with the headlands of Methone and Malea, along Cythera, Rhodes, Lycia and Cilicia to Antioch (Reynolds 1995).

Ships coming from the Levant and Cyprus used the central route (Rougé 1966). This route follows the coasts of Cilicia and Lycia to Rhodes/Carpathos Islands and Crete. This route will pass the southern coast of Crete, because it protects the ships against violent northern winds and there is a good sheltered port of Lebena (STRABO X 478: Rougé 1966). From Crete the vessels sailed straight to Sicily. The journey of St-Paul from Caesarea to Rome is a good example of this route (Map 5).

Acts of the Apostles 27 — Journey of St-Paul — (Meijer et al 1992, Pomey 1997):
" *Once we were on the ship, we took off for the coast of Asia Minor… From Sidon, we sailed under the wind from Cyprus as it comes from the opposite direction. After we crossed the seas of Cilicia and Pamphylia, we arrived in Myre [Lycia]. Here we changed over to a ship from Alexandria on its way to Rome. The following days we continued slowly until we reached the Isle of Cnidos, where the winds forced us to change our route more southerly. We passed Cape Salmone and sailed under Crete… The night of the fourteenth day, we arrived in the Adriatic…Our ship wrecked on the Island of Malta, there we stayed for three months… we sailed to Syracuse with a ship from Alexandria that had hibernated on the Island. After three days in Syracuse, we found a coasting vessel, which brought us to Rhegium and from there in two days to Puteoli.*"

The southern route is used from the great harbour of Alexandria. The African coast was used during the summer winds, because the vessels could take advantage of the alternating land and sea breezes up to 20 km from the coast (Rougé 1981). This route follows the coast of Africa to Paraetonium or Cyrene and from those harbours to Sicily (Tomber 1993). The hermit John talks in his "Vie d'Hilarion" about his journey from Paraetonium to Sicily (Rougé 1966).

McGrail thinks that the northern route was the most popular navigational route because the shores of the northern Mediterranean have a rather high coastal profile, which provides mariners a distinct aid to navigation (McGrail 2001). The indented coastline also includes many natural havens with sheltered landing places and supply of fresh water. The southern shores do not have those advantages. Those conditions and the fact that the European hinterland had a greater economic potential made McGrail conclude that northern routes were preferred above the southern routes for east-west voyages. The southern coast is not only a lee shore, but — especially in the eastern basin — has only a low-lying coastal area. Many places also have hidden reefs and shoals offshore. The harbours were few and far between on the African mainland.

- *To Rome*

The ships from the East heading for Rome passed through the Strait of Messina. The best examples are the *annona* grain ships from Egypt. This passage is sometimes impossible to take for sailing vessels as the ships encounter an opposite wind direction and current (McGrail 2001).

- *To Spain*

Large numbers of Aegean imports have been found in Carthage and Cartagena. It can be discussed that goods were imported from the East as far as Carthage and redistributed from there. However some finds of Eastern Mediterranean pottery in Alicante — which does not feature in the Carthage supply — suggest that this was not always the case. The distribution of certain eastern lamps in Alicante, South-east Sicily and south Italy suggests a navigational east-west route that by-passed Carthage, northern Italy/Rome, Gaul and the Balearics. This route was probably a specific route of some eastern goods in ships from the Levant straight to southern Spain. These

ships could be en route for the Atlantic, but specific ceramics have not been found in Portugal or Britain. Some of these routes are known in ancient texts: Aristides refers to commercial links between Cadiz and Alexandria (Reynolds 1995).

- *To Marseille*

There are also direct shipping routes between eastern ports and Gaul. A decree found in Beirut, talks about the favouring the shipping merchants from Arles. Severus also talks about a shipping route between Alexandria and Narbonne/Marseille. The ships sailed along the African coast via Cyrenaica and Carthage to Gaul.
It is likely that Marseille was supplied with eastern imports independent of Carthage or Italy. Although the archaeological record suggests that the sources supplying Marseille were distinct to those supplying Alicante. From here the cargo was redistributed to ports in north-eastern Tarraconensis.

4. Atlantic Routes

Significant amounts of shipping extended also to north-western France and British Islands. After the Roman conquest of Britain in 43 AD, large amounts of high quality pottery appeared on land sites (Gould 2000). The strait of Gibraltar, the Isthmuses of Gaul — Valleys of the Garonne, Loire & Seine — or the Rhone-Rhine axis connected the west coast of Europe to the Mediterranean.
In the 5th to 7th centuries there was probably an established route to south-west Britain, which can be seen in the presence of eastern Mediterranean import in sites on the British Isles and on the site of Conimbriga in Portugal. The absence at Conimbriga of eastern amphorae however, can indicate different and distinct markets. Maybe these markets were supplied independently? The finds of fine wares from Bordeaux on the same sites can also be connected to this traffic. It is possible that those ships on the east-west route were carrying a principle cargo of grain and no amphorae linked food or a combination of grain and lesser quantities of amphorae. This pattern is in contrast with cities such as Rome and Naples were abundant quantities of eastern amphorae are found. Textual evidence of such a journey exists of an Alexandrian captain commanding a ship carrying a cargo of corn to Brittany.

The absence of Late Roman ceramics at Carthage and Mauretania is good evidence for the by-passing of these regions by shipping carrying this cargo. Had there been redistribution from ports such as Carthage, the amount of Tunisian ceramics in the archaeological evidence would have been greater in Atlantic sites. Although the direct South Mediterranean route was the principle route to the Atlantic, less important routes such as East-Marseille-Cartagena-Atlantic could also have existed.

VI. Maritime trade and its reflection in the archaeological evidence

The initiative to transport trade goods is depended upon economic factors — supply and demand at the start and end point of the route — and the availability of transport to the chosen destination. By examining the size and the diversity of the cargoes and the position of the shipwrecks, it is sometimes possible to make some impressions concerning the cargo and the navigational route followed. However, one has to be careful to translate the provenance of the cargoes into navigational routes without reflection: The shipwreck of Cabrera C — 260 AD — has a cargo of amphorae from Baetica, Lusitania and Tunisia. The amphorae are well balanced and give the impression that they are loaded and stowed as one unit. This made the archaeologists who excavated the wreck believe that the all amphorae are loaded in a single warehouse — probably Cadiz — instead of being collected in harbours of different regions (Pomey 1997). Similar wrecks are Planier 7, Lazzareto and Ognino A.

The material evidence does not show the difference between privately inspired enterprises and imperially assisted trade. The ships carrying the *annona* shipment where mostly hired from private owners or *navicularii*. These shipments could have varied a lot in size: from the super-freighters transporting grain from Egypt to smaller river vessels, which had to supply the army outpost on the Rhine. But can one see the difference between ships that went straight to one destination — Pomey: direct route — and ships that went tramping along the coast — Pomey: redistribution route — picking up and selling goods at every harbour? Large shipments probably belonged to the category of ships sailing a direct route. Large vessels will not remain in the harbour to wait on some handy trade in the near future (Jurisic 2000). This kind of

port-to-port exchange was usually performed by smaller vessels of the coastal fleet. But this cargo did not have to be a homogenic cargo. Large vessels sailing a direct route, could also carry a mixture of cargo. In ancient texts, there seems to be a difference between the words *mercators* and *negotiators* (Peacock & Williams 1986). As *negotiators* chartered the whole ship, the former are merchants who hired part of the ship to transport its goods.

Circumstances in which cargoes were made up and shipped from the place of origin could have been complex. Most of these transports are loaded in an entrepôt of a major harbour, which can or cannot have an ample choice of goods. The economic possibilities and demands at the place of destination, the variety of supplies at the place of origin and the possibility of different merchants on a single ship would probably result in a mixed load. The evidence from shipwrecks indicates that it seems to be normal for Roman ships to carry a variety of goods (Parker 1990 a). Bulk cargoes from the south coast of Spain, must have been assembled at an entrepôt. Ships like Port Vendres B, Salines, Chiessi and Sud-Lavezzi B all have a mixed cargo, which must have been collected and loaded in a harbour like Cadiz. It is however possible that the shipments for the *annona* only consisted out of a single cargo or a cargo from a single region. But an edict of the 3rd century excludes secondary goods from port tax, which would have been very profitable for the shippers. These secondary goods will probably not have overwhelmed the *annona* cargo in amount, but it proves that a homogenic cargo must have been rare. A heterogenic shipment on the other hand does not equal a port-to-port trader. Not only where those big ships to large to moor in the smaller harbours, but it would have been too time consuming to rearrange the cargo. The severe stowing of the amphorae and other cargo has a double objective: cost-effectiveness by minimizing the cargo volume and securing it, so the amphorae would not shift or break as the ship rolled with the swell. If part of cargo of the amphorae is removed the whole will be unstable and has to be reorganised. It seems not logical that huge merchant ships like Madrague de Giens or Albenga will reorganise its cargo in every port when it delivers a few tens of amphorae a time (Pomey 1997). The wreck of Sud Perdito B has 48 ingots, each weighting 42 – 48 kilos, in the bottom of its keel with on top a cargo of amphorae. This is not a ship of a coastal vessel owned by a merchant who sailed from port to port. This rule can also be applied for the vessels with dolia.

The dolia ships are a special kind of transport that was used from mid 1st century BC to mid 1st century AD. They were specially developed to transport huge amount of wine. Filling the tanks of the dolia was not only faster but also safer, in so much as it avoided the need to handle the amphorae and risk that the cargo would shift and break (De Donato 2003). They are witnesses of the booming wine trade between Italy and Gaul. The vessels were about 15m long and were built to 10 to 15 dolia. The dolia have a height of 1.6 – 1.9 m and a capacity of 2000 – 2500 litres. All the dolia have the name of Pirani, which is a name from Minturnae, Campania. The large jars were fixed in the middle of the vessels and their weight/volume has been taken into account. They were not detachable and had to be secured tightly as even the slightest imbalance or shift in weight could capsize the vessel. The presence of repairs of molten lead proves that these vessels where used for some time. In the fore and aft of the ships was still space left, which usually is filled up with an additional cargo of amphorae, mostly Class 10 wine amphorae.

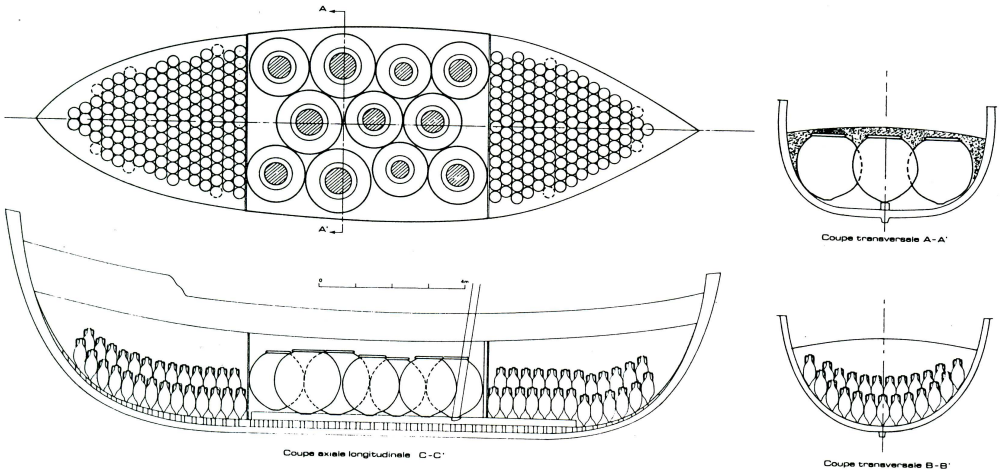

Figure 4: Hypothetical reconstruction of the shipwreck "Grand-Ribaud D" (Pomey 1997: p 185)

It would be illogical and economically unwise if the vessels carrying dolia would trade from port to port, unloading a few hundreds of litres of wine and continue to sail with less and less cargo, which would decrease the profits of its voyage. The vessels probably made journeys to transport cargoes in bulk, from a region of production to a principle harbour in a direct route.

By the end of the 1st century AD, the dolia ships became obsolete as the system was unwieldy and the presence of huge containers in the hold presented an obvious and real danger. The rupture of a dolium — filled with a liquid content — will pour rapidly the wine into the hold, which could have resulted in a sudden destabilisation and capsize of the vessel. In spite of the advantages, the fall in imports of Italian wine in favour of the Gaulish wines and the attendant risks resulted in the disappearance of the dolia ships (Marlier et al 2002).

Other kinds of transport are the small to medium vessels, which mainly performed the coastal navigation. They carried a variety of cargo, loaded at a single storehouse in a major harbour or collected along their routes in different ports. These vessels were mostly bound to a certain maritime region or economic influence of a major harbour, but it does not mean that they were not suitable for direct routes. They were capable to make long journeys and certainly could cross open seas. The ship Sud Perdito B probably measured under the 20 m. Culip D is a ship found of the coast of Catalonia with a cargo of Class 25 amphorae and ceramics from Baetica, sigillata from southern France and lamps from Rome. The ship is a small coastal vessel with a dimension of about 10 on 3 m and a capacity of 8 tons. If we try to reconstruct the navigational route followed by this vessel of the 1st century, it would be logical to think that it visited al the different places and bought or sold goods in the ports. However the excavations show that the goods have been stowed as one unit in one port (Pomey 1997). The cargo will have been loaded from the huge *horrea* or storehouses in the harbour of Narbonne and went south on its final journey. The ship had a number of smaller items in its hull, which were probably connected to the ship or its crew. A lot of those items have an Aegean origin. Was this ship a coaster distributing goods in the neighbouring smaller harbours? There is a good possibility that this ship had its home base in the Aegean. It came to Narbonne, maybe with a collection of Aegean products and loaded a number of Western Mediterranean goods for its way back. The position of the wreck is a bit south of the harbour of Narbonne, ready to make the crossing to the Strait of Bonifacia, the coast of Italy, Strait of Messina and around the Peloponnesus to the Aegean. Aegean amphorae where not unknown in southern France; In Lyon of the 1st century, the Gaulish amphorae take up to 75% of the total, but 17% are amphorae from the Aegean, which is much more then the ones from Spain or Italy (Liou 1990). This could indicate that in spite of their size small vessels

were capable to maintain an inter-regional long-distance route. The wreck of Les Roches d'Aurelle — France — on the other hand was probably a small, local coaster. The cargo existed purely of local products, identifiable with the region of Fréjus. In contrast to the former ships, which have taken their cargo in a single harbour, the ship Saint-Gervais C probably collected its cargo at a series of ports of call. The cargo was made up of two different amphorae types from Beatica — Class 19 and Class 25 — probably loaded at Cadiz and some Gaulish wine amphorae — Class 27 —, which were probably loaded at the port of Narbonne. This ship was presumably on its way to the lower Rhône (Parker 1992 a) and from there to Gaul or further. A very good example of a ship tramping along different ports is the wreck at Valle Ponti. This Adriatic shipwreck was loaded with a varied cargo of Spanish lead ingots, a consignment of coarse pottery, bronze vessels, votive models, lamps, boxwood logs and amphorae from Kos, Chian and Italy (Parker 1992 a). The ships equipment included baskets, bags, tools and even a weight and a bronze balance. This ship was probably involved in the port-to-port sale of goods.

As amphorae are typical products for seaborne commerce, their distribution patterns can indicate the extent of Roman trade. The distributions of the amphorae in the Roman empire can be divided in local — Class 28 to 30 —, regional — Class 10, Class 25, Class 36 — and empire-wide — Class 2, Class 3 to 5 — presence. Empire-wide distributions appear in a period between the second Punic War and the end of the Republic, but exchange within the empire was for the most part on a regional level (Woolf 1992). What does emerge from the distribution of amphorae is the role of the army (Parker 1973): from the 1st century AD the frontier army was settled in more or less permanent positions. It demanded a large and constant supply of its customary foodstuffs. Fish and oil constituents were shipped from Spain.

Although, ancient trade routes can be reconstructed with the aid of distribution maps, the presence or absence of amphorae cannot always be used as a straight indicator of trade. Amphorae probably have passed through various stages of re-use and re-deposition before they definitively entered the archaeological record, which was noted by Herodotus.

Herodotus III.6 (Meijer et al 1992):
"*Throughout the year, from all parts of Greece and Phoenicia, wine is imported into Egypt in earthenware jars; yet one might say that not a single empty wine-jar is to be seen anywhere in the country... The major of each place has orders to collect all the jars from his town and send them to Memphis. The people of Memphis have to fill them with water and send them to this tract of desert in Syria.*"

This can significantly extend the life of certain types. An example of this can be found in the evidence of the Culip D, Procchio and Yassi Ada wrecks. The stoppers were each made out of amphorae sherds instead of proper made stoppers. However, this seems to be an exceptional practise (Parker 1992 b).

In the Late Empire, the distances between tax-payers and tax-consumers had to be shortened (Hopkins 1980). A smaller, strategic military reserve behind the frontiers made it easier to supply the army with taxes raised locally, because food raised as tax could not easily be transported. The taxes in kind required no transformation of local surplus into goods of lower volume. As a result the production and consumption of wine became increasingly regionalised (Keay 1992) and there is a decline in trade and in town markets from the 3rd century (Hopkins 1980, Whittaker 1983).

Clearly, it is not easy to suggest shipping routes on the basis of archaeological records found on land or in shipwrecks. Perhaps, if enough excavations and finds are published in enough detail, it will be possible to isolate with more certainty ceramic evidence for local, regional, short-distanced and long-distanced movement of goods and subsequently the identification of the shipping routes (Reynolds 1995). Only full excavation and publication of a site will present researchers the desired data. Those sites are in a minority (Parker 1984), emphasising the need.

VII. Roman economy and maritime commerce

The use of ceramics for an economic interpretation automatically assumes a meaningful relationship between the ceramic record and the economy in general (Tomber 1993). The amphorae, which have been found in the excavations of Ostia, indicate the changes in import. Those changes can probably be related to shifting economical powers over time (Figure 5).

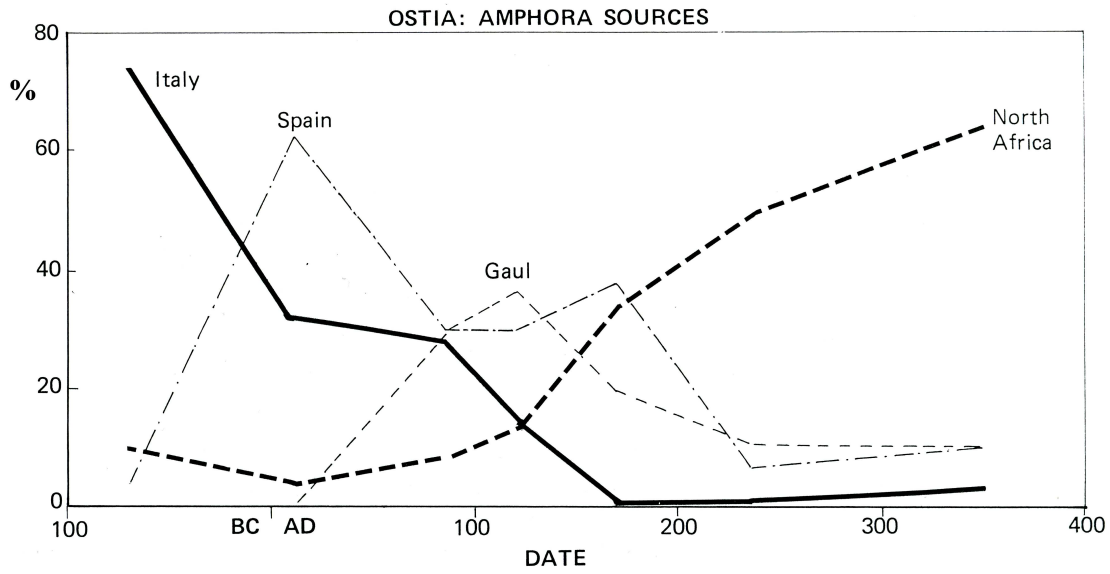

Figure 5: The different percentages of amphorae from each source over time (Greene 1986: p 15)

Amphorae found along the trade routes and their distribution on land is related to the prosperity of agricultural production. However, it must not be forgotten that amphorae also supplied a luxury market with goods such as high quality wines. Long-distance trade flourished throughout the Roman Period, but because of the climatic uniformity of the Mediterranean, there was only need for certain type of items: primarily subsistence and luxury goods. The pattern and volume of this trade was largely dependent on the fluctuating climate of the Mediterranean. Sharp inter-annual fluctuations of rainfall created local gluts or shortages (Hopkins 1980). But mechanisms like the *annona* and the military were also influencing the exchange of goods and providing routes for their transport.

The ceramic evidence can also be an indicator of the actual reliance on imports; the sharp increase in volume of imported ceramics between the 2nd and the 3rd century correlates with the growth in the provision of storage facilities in Ostia (Fulford 1987). It also fits with the written evidence, which says that there was a greater reliance on imported grain in general. Given the demand for surplus foodstuffs, the best way of ensuring a widespread distribution of manufactured goods, was to ship them alongside cargoes with foodstuffs. The production and export of African red slipware can be linked to the export of agricultural products (Carandini 1983). It was carried as space filler along the primary cargo. From the 1st century on, the route Carthage – Rome became one of the most important in the Mediterranean and it may have stimulated the production of other goods. This kind of correlative evidence reinforces the idea that the contributions of local agriculture to Rome have been underestimated as Etruria and Campania —well-known agricultural regions — correspond with Italy's most important sources of pottery. Cities with consistently low ratios of imports to locally made wares would be those in relatively more fertile regions. If the amount of 20 million *modii* of grain reached Rome every year, it is curious that so little proxy evidence has survived. Casson already noticed that after the conversion of Egypt into the Roman Empire, there was neither sign of an injection of abundant amounts of grain in the West nor an inevitable economic dislocation in the place of origin, Egypt (Fulford 1987). However, one should be careful with the direct correlation between the source of pottery and imported foods. A possibility is that pottery travelled out from Italy in the holds of the returning grain ships. The archaeological evidence in Berenice — Cyrenaica — indicates the importance of ceramic transport in returning grain ships. Cyrenaica not only on the way from Rome to Egypt, but was also a known supplier of grain: in the mid 1st century BC Pompey considered using grain from Cyrenaica in his campaign against Caesar (Caesar, Bell. Civ. 3.5: Fulford 1989). From 200 BC to 50 AD, 35 % of the black-glaze pottery is of Italian origin, whereas only 5% of the amphorae. In the Late Roman period however, 73% of the ware came from Tunisia. In this period Rome did not get any supplies from Egypt anymore and the importance of Italian pottery in places on the vessels route vanished. But redistribution of merchandise and the coastal trading character of the Mediterranean make it virtually impossible to reconstruct in detail the pattern of ancient commerce from archaeological evidence alone. Nevertheless is the correlation between African grain/oil and the comprehensive presence of African pottery in the

late 1st and 2nd century AD at Ostia and in the other places in the Western Mediterranean exceptional. Especially if one compares the data of the amphorae with the apparent unrelated information such as brick stamps. The largest collection of Italian brick of that period can be found in Carthage, which would probably have been brought with the returning empty ships.

A. The heydays of Italian export: 150 BC – 1 BC

During the Republic most trade in amphorae and probably commercial shipping was from Italy northwards along the coast of the Riviera (Whittaker 1989) and the East Adriatic. With the aid of big merchant ships such as the Madrague de Giens or the Albenga, Italy could transport enormous quantities of wine to Gaul in Class 3 to 5 amphorae from Campania and to the East in Class 8 amphorae from Apulia. But this did not mean that there were no modest ships transporting the same cargo (Laubenheimer 1990). The wreck found in Cavalière was only 9.5 m on 4.6 m and could only transport up to 400 amphorae.

The amount of amphorae found in shipwrecks indicates an overwhelming dominance of Italian goods (Appendix 3). Especially Class 3 to 5 and Class 8 amphorae are predominantly present. During the early empire, the camps of the Rhine frontier must have been a major market for these products (Paterson 1982). Italian products such as black-gloss pottery — Campanian B ware — are regularly found together with amphorae from Campania or Apulia (Appendix 3). Especially the Class 8 amphorae from Apulia must have been transported in bulk to the Western Mediterranean. They were probably shipped to Puteoli and from their redistributed with other wine amphorae to southern France. This would also explain the rather high amount of Rhodian amphorae found in relationship with Italian jars. Aegean merchants probably came with a shipment of Rhodian, Chian and Cnidian wine to Puteoli where the jars were stored in entrepôts until it was reloaded with other goods to a more western destination. What the merchants took back to the Aegean is less well known as there are for this period no shipwrecks found with Italian products. This redistribution pattern can probably also be applied for the African jars such as Class 32 and Dressel 26 amphorae. They were also transported to Puteoli where they where further distributed to Rome or other destinations.

In spite of the dominance of Italian amphorae, there are the first indications of an increasing influence from the Spanish province. The colonisation of Hispania and Narbonensis in the middle of the 1st century BC represents the starting point for provincial wine production and commercialisation (Tchernia 1986, Tchernia 1989), which will eventually take over the Italian production from the 1st century AD onwards. This can be seen in the fairly amount of Class 6 amphorae found at coasts of Catalonia and south France. Other Spanish products such as Class 14 and Class 16 with fish products indicate the growing economic importance of the Spanish province.

B. The shifting to the Spanish economy: 1 – 200 AD

Already from the reign of Augustus is there a decrease of export in Italian. The vineyards in Spain and Gaul developed to an extent that they were less dependent on Italian imports. The immigration of Italians/Romans in the new territories changed the political and economic power to the provinces and resulted in a competition of export and trade in the different provinces (Tchernia 1989). The north-east of Italy, more specifically the Po valley, became more open to Greek imports coming up from the Adriatic: ordinary wine from Crete, quality wine from Cos and Rhodes and high-quality wines from Chios and Asia Minor (Pomey 1997). Italy and more specifically Campania still mass-produced table wine — Class 10 — in the beginning of the first century. The dolia ships like Grand Ribaud D or Diano Marina are mainly found together with Class 10 wine amphorae. They are an excellent example of this booming wine trade. But towards the end of the 1st century the outcome of the competitive environment are more provincial imports to Italy than it exported. At the end of the 1st and during the 2nd century grain and Gallic wine made up the largest import of Rome (De Donato 2003). Italian wine growers protested against the competition from the Gauls, which were in their eyes nothing more than semi-Romanised provincials. In 92 AD, Emperor Domitian decreed that half the vineyards in Gaul had to be uprooted to protect the Italian industry (De Donato 2003). The wine trade however, was not seriously affected; in contrary Gallic wine amphorae have been discovered as far as India. The shift in wine production from Campania to Tarraconensis/south France can be found in Class 10 wine amphorae, which are found more frequently in shipwrecks with other Spanish amphorae in contrary to the 1st

century BC where this type was mainly found together with Italian products (Appendix 3). In spite of the West Mediterranean dominance in the wine trade, there were still exports of Apulian and Rhodian wines to some extent.

Spain produced in the 1st century AD the lion's share of the amphorae brought to Rome (Pomey 1997), which agrees with the information of shipwrecks. Wine came from Catalonia, garum and olive oil from southern Spain and metal from Lusitania and Beatica. In Cadiz and Seville, little coastal and river vessels brought the amphorae filled with oil to bigger ships, which brought the amphorae to Rome (Mattingly 1988). The ships used the routes along the coast and partly across the open sea using the islands to transport all the goods to Rome. The remains of this trade route can be found in huge mountain of amphorae sherd — Monte Testaccio with a height of 35 m —, which contains approximately 50 million of mostly Class 25 amphorae. The Spanish amphorae from Baetica and Tarraconensis are frequently found together. This probably means that they ships loaded with Baetican amphorae or metal sailed from Cadiz to harbours like Tarragona where they unloaded their cargo for redistribution or collected an extra shipment of amphorae from Tarraconensis before continuing their journeys. A good example is the wreck of Port Vendres B on the French-Spanish border. This Claudian site yielded a collection of Class 15 and Class 25 amphorae from Baetica, tin and lead ingots, Class 31 from Tarraconensis, pottery and glass from south Spain and even some Gaulish sigillata. It was probably a coastal vessel, which loaded its goods at Cadiz and Tarragona, before heading to south France. The answers why the Spanish oil production reached such a high level can probably be found in the high amount of shipwrecks with metal ingots from Baetica. The traffic in metal — tin and lead — from Baetica and Lusitania was undoubtedly vital and lucrative, acting as an attraction to shipping (Map 11). The transport of other goods could have arisen out of the shippers seeking for part-cargoes for the journey. The mixed cargoes were a less financial risk in case of shipwrecking. Most of the metal ingots of shipwrecks are found in combination of Baetican amphorae, which probably all have been loaded at entrepôts of Cadiz (Appendix 3).
Although Africa is important in the *annona* grain supply, there are only a small number of shipwrecks with African amphorae from the first centuries found. Panella's research on the excavations of Ostia indicates that there was already a substantial presence of African amphorae in the 1st century AD, which will progressively build-

up thereafter (Mattingly 1988). Maybe this striking low number of shipwrecks with African products of the 1st and 2nd century can be ascribed to the uneven distribution of wreck findings. A demonstration of this trade can be found in the survey of the Skerki Bank between Africa and Sicily, which yielded four wrecks of the 1st century with African amphorae.

C. The dominance of the African economy: 200 – 450 AD

During the 3rd century AD, the production of oil in Baetica rapidly decreased. The production in North Africa was stimulated, as there was still a need for large quantities of oil. Africa became the biggest producer of grain and oil for Rome (Pomey 1997, Whittaker 1989) and northern Tunisia was the main production area of amphorae (Appendix 3) (Keay 1984, Mattingly 1988). The archaeological evidence shows that the expansion of the Tunisian production in the 4th century was in part directed towards Rome — where it became the exclusive production area for the *annona* — (Keay 1984), but to a greater extent towards other major markets not connected with the food supply of the city of Rome (Reynolds 1995). Exported amphorae from North Africa occur in huge quantities in the regions of Italy, Spain and southern France from the 4th and 5th century (Kingsley & Decker 2001). The presence of African oil amphorae in Spain is evidence for sale of surpluses directly from North African ports by private landowners or merchants. It proves the existence of distinct markets for export goods and a separate distribution network based on regional ports and their respective shipping routes (Reynolds 1995). Tarracononesis had a flourishing local wine industry in the 2nd century AD and there were few imported foodstuffs. From the late 2nd century is there a decrease in wine industry and an increasing import of African oil. From the early 4th century to middle 5th century AD the local wine industry died out. The oil comes now solely from Tunisia. At the same time 25% of the imports are from Baetica (Keay 1984). The information derived from the shipwrecks indicates that in the 3rd and 4th century there seems to be a triangular traffic involving Africa, Spain and Italy (Parker 1990 b). Punta Ala A, Femmina Morta, Sobra, Cabrera A, Planier G, Lazaretto and Marzamemi F have a cargo with mixed Spanish and African amphorae (Appendix 3). The cargoes of the wrecks seem to have been a result of setting down and picking up goods along an extended route (Map 12). But later wrecks like Port-Vendres A and Randello only

have a Spanish consignment of Baetican and in particularly Lusitanian amphorae on board.

The disappearance of management labels on the amphorae such as stamps and graffiti identifying the name of the shipper or merchant is an indication of the breakdown of state control and the liberation of commerce (Kingsley 2004). There were still the large-scale shipments of the state controlled supply of oil and wheat. They were accompanied with other goods — probably secondary cargo — carried along the main cargo as extra profit, like the African Red Slip — ARS — fine wares. Dramont E and La Luque B are such an examples (Kingsley & Decker 2001). But small ships carrying modest cargoes became the most common in the Late Antiquity. Examples are: Randello with only 150 – 200 amphorae, Heliopolis with 700 amphorae, Dramont E with a capacity of 700 – 750 amphorae and Dor D which could only carry 5 tons. However, those small ships were not coasters by necessity, but were capable of open-sea navigation. The associated cargoes of the wrecks indicate that they were mostly long-distance traders.

The shipwrecks with a cargo of North African amphorae are entirely clustered in the western basin, thus showing a clear evidence of a split in maritime trade traditions following the division of the Roman Empire (Kingsley 2004). Alexandria was like any other metropolis a huge market for consumption. Its trade was primarily based on sea transportation. Overseas amphorae make up between 60 to 80% of the total count of containers. At the turn of the 4th century, there was a weakening of trade contact between Alexandria and the western provinces. This can be seen in the archaeological record as a decline of amphorae from the West. In contrast to the West, the Eastern Mediterranean had no single region, which had such a dominant role as North Africa. Although Egypt was from 330 AD the grain supplier for Byzantium, its famous wine — LR 7 — is found through out the Mediterranean, but in limited quantities. It was probably not exported as primary cargo (Kingsley & Decker 2001). The Black Sea, Aegean, Syria and Palestine became the economic powers of the East. In the western basin there are also several shipwrecks with eastern consignments are found, especially with Aegean and Palestine amphorae (Map 9).

D. The economic influence from the East: 450 – 700 AD

In the 5th century the eastern provinces heavily dominate trade. The archaeological record in Alexandria shows that there is only a small group of Western amphorae, primarily from Africa, such as Keay 25 and spatheia (Majcherek 2004). Cilicia, Cyprus and Antioch took care of the oil supplies for Alexandria and wine from Palestine was imported on a large scale. This phenomenon cannot be explained as nearby region, but more in terms of political and economy. This group of vessels also get an increasing frequency in other more western cities, as in the late 5th century there is also a quantitative reduction of African amphorae. This pattern can also be seen in the data of the shipwreck cargoes (Appendix 3). The Eastern Mediterranean — mainly Palestine — amphorae become dominant in the archaeological record. The routes used to transport Palestinian wine to the West and the character of the cargoes amongst it was shipped are very hard to reconstruct, as they are not many wrecks known with LR4 and LR5 amphorae between Greece and Sicily (Map 13). Several wrecks off southern Turkey indicate that large Palestinian consignments arrived in Asia Minor as homogenous cargoes (Kingsley 2001). These cargoes could have been broken up and stored in entrepôts somewhere in the Aegean according to the market. A wreck found off Corfu indicates that there was a trade of these amphorae to the West. It is possible that the vessels travelled via North Africa and that amphorae arrived in minor cargoes more westerly as the wreck of La Palu shows. Towards the end of antiquity, the Palestinian amphorae take 15 to 20% of the amphorae found in Spain and S-France.

These transformations of trade patterns coincide with fundamental changes on the political map of the Mediterranean. The Vandals conquered North Africa in 439 AD, but they continued the trade in oil and probably other commodities and a lot of their oil surplus went to the east coast of Spain (Keay 1984, Keay 1992). Examples of the changing trade patterns can be found in Tarraconenis from 450 to late 6th century AD: The archaeological evidence shows a sharp increase of African oil and East Mediterranean wine (Keay 1984). The loosening of ties with Rome and the invasions culminates in a decrease of the *annona* — the vandal invasion seized the African trade fleet — (Rougé 1981). On the other hand, the trade with the west from the eastern provinces became extremely profitable, as there was neither central authority nor tax to pay (Keay 1984). The reduction of amphorae manufacturing throughout the

Mediterranean meant also a decline in the concept of organised shipment of agricultural commodities. Circa 900 amphorae found in the Yassi Ada A, seem to come from different parts of the Mediterranean: the Black Sea, Palestine and the region of Antioch, but also from Africa. The disparate origins of the cargoes in Byzantine ships suggest that the ships were tramping the coast, buying and selling from port to port. This model would explain the highly mixed nature of the cargoes. It seems symptomatic of a decline of state control over commodity supplies (Arthur 1986). The maritime commerce will probably have been taken over by independent merchants, towns or ecclesiastic authorities. In the middle of the 6th century the Byzantine Empire started a reconquest of the Mediterranean. This results in a partial reconstruction of the ancient trade ties. In Alexandria there is an increase of amphorae from Gaza and an apparent decline in local amphorae production. As a result, the production in North Africa seems to have continued well into the 7th century AD until the Arab invasion of 690 AD into Tunisia, which strangled the agricultural production (Arthur 1986).

The 7th century AD was the scene of the decline of the large-scale amphorae production and probably a concomitant decline in agricultural surplus production in most of the Mediterranean World. This marked a decline in commercial shipping, which can also be found in ancient texts (Rougé 1981). The internal and external insecurity, combined with financial instability and political restrictions reduced the possibilities of long-distance trade (Greene 1986). Due to this governmental weakness, seafaring was hampered by piracy and invasions were also partially responsible for the change (Rougé 1981). This did not necessary mean the end of all trading, other instances such as landowners or the church, which became a considerable redistribution force, continued the trading patterns (Tomber 1993). In the Eastern Mediterranean and the Black Sea region the exchange of goods still existed, but the intensity and scale is less than the centuries before.

VIII. Difficulties encountered

Sometimes it can be impossible to obtain useful information. Problems in this area are: poor preservation of the original material, unequal distribution of reported sites and inadequate recording, study or publishing of the site (Parker 1984).

The references that I used to describe the finds of the amphorae originate mainly from Parker (1992 a). Additional information was found in journals, such as International Journal of Nautical Archaeology or other books such as Jurisic (2000) and McCann et al (2004) concerning shipwrecks. Those works deal with shipwrecks and what they can learn us about ancient history. One has to take into account that not all the information has the same exact, scientific standard. Especially in Parker's catalogue, there are some sites mentioned that are not more then vague reports of divers, who are not capable to recognize typologies of the amphorae they discovered. This information is insufficient. Consequently I only used the reports that had a reasonable good identification of amphorae types.
Amphorae themselves and their typology have their own long list of problems: confusing typologies, doubtful provenance, disputable content and the lack of quantified data. The analytical analyses can be a powerful tool in archaeology, but it needs reliable data. The size of the available data makes it possible to smooth the result by general statistics. When the information of wrecks increases, the patterns will become firmer.

There are difficulties in making a statistical study of ancient shipwrecks; Ships were lost in a great variety of circumstances and the survival changes of remains or their discovery are also distinct. The relationship between depositional setting and archaeological remains in a marine environment is different to that of terrestrial systems. Wreck sites go through a series of modification processes: wrecking, salvaging, disintegration — physical, biological and chemical — and eventually the excavation (Muckelroy 1978, Ward et al 1999). Each of these processes will eventually destroy and modify the wreck site and its cargo. The wide range of conditions in which the wrecks are found, from shallow waters to reefs or offshore depths, means that the cargoes may be preserved partly or complete. If ships are

found, there are dissimilar amounts of data available. Of the ancient wrecks 70% has been found in the West Mediterranean (Parker 1990 b). Large area in deep sea and particular coasts are still unexplored, as they are not favourable in finding or preserving coherent wrecks.

An intact shipwreck is like a historic document that represents an elective and deliberate choice of cargo for a journey to a specific destination (Pomey 1997). It mirrors a truthful economic and commercial situation of the point of origin and the point of destination. The merchant will only be able to load his ship with the goods present at starting port and he will probably ship it to a port where there is a demand for these goods. Every space available will be used — without endangering his ship — to enlarge the cost-effectiveness. This means that there will not be many unnecessary goods on board of a ship. Every object is part of the cargo or part of the ship's fitting except for a few objects, which probably belong to the crew or passengers on board. This is why it is important to find, log and examine every object found on a shipwreck and in the end to publish the acquired data and results.

IX. Conclusion

The above chapters made it clear that it is not always possible to derive certain conclusions from the data of archaeological material in shipwrecks. Confusing amphorae typologies, geographical uneven distribution of wreck sites and information that is hard to interpret due to vague reports are some of the problems, which cause restrictions in the research. The information that is available must also be treated carefully: the complexity of the maritime trade in Antiquity makes it not easy to extrapolate the navigational route of a vessel from the origins of archaeological material such as amphorae. Nevertheless, the combination of ancient texts with research of shipwrecks can provide researchers indications and general patterns in maritime economy. Although the Roman period is known for bulk cargoes, the evidence presented in chapter VI shows that the shiploads were mostly made up according to the ships available and other external factors. The information indicates that the vessels navigating during antiquity were for the greater part small to medium

sized ships, which carried cargoes made up from several sources. The broad picture of Roman economy is that of a market economy instead of tied economy. The evidence from shipwrecks points towards a relation with economic trends rather than political. Official state orders and especially the provisions of the army would nevertheless have their influences on the trading patterns. Chapter VII shows the relationship between the information derived from the cargoes in the shipwrecks and the known shifting of economical centres of gravities: in the first two centuries BC, the economical centre of the Western Mediterranean was in Italy. In the first centuries AD however, Spain became more important and Italy/Rome became more import-oriented. When the mining in Spain became less important, the economic stress became focused on North Africa, which became the major *annona* supplier. With the decline of the Roman Empire, the economy became more regionalised. Long-distance trading still existed but was mainly triggered in the Eastern Mediterranean.

The intention of this research is not on presenting new data, but rather in drawing different strands of evidence with the intention of stimulating and providing possible directions for future research. There is still much prospecting to be done in the unexplored areas, such the African coasts, but there is also a great need of desk-based research such as providing a tight amphorae typology or the examination and publications of existing wreck sites material.

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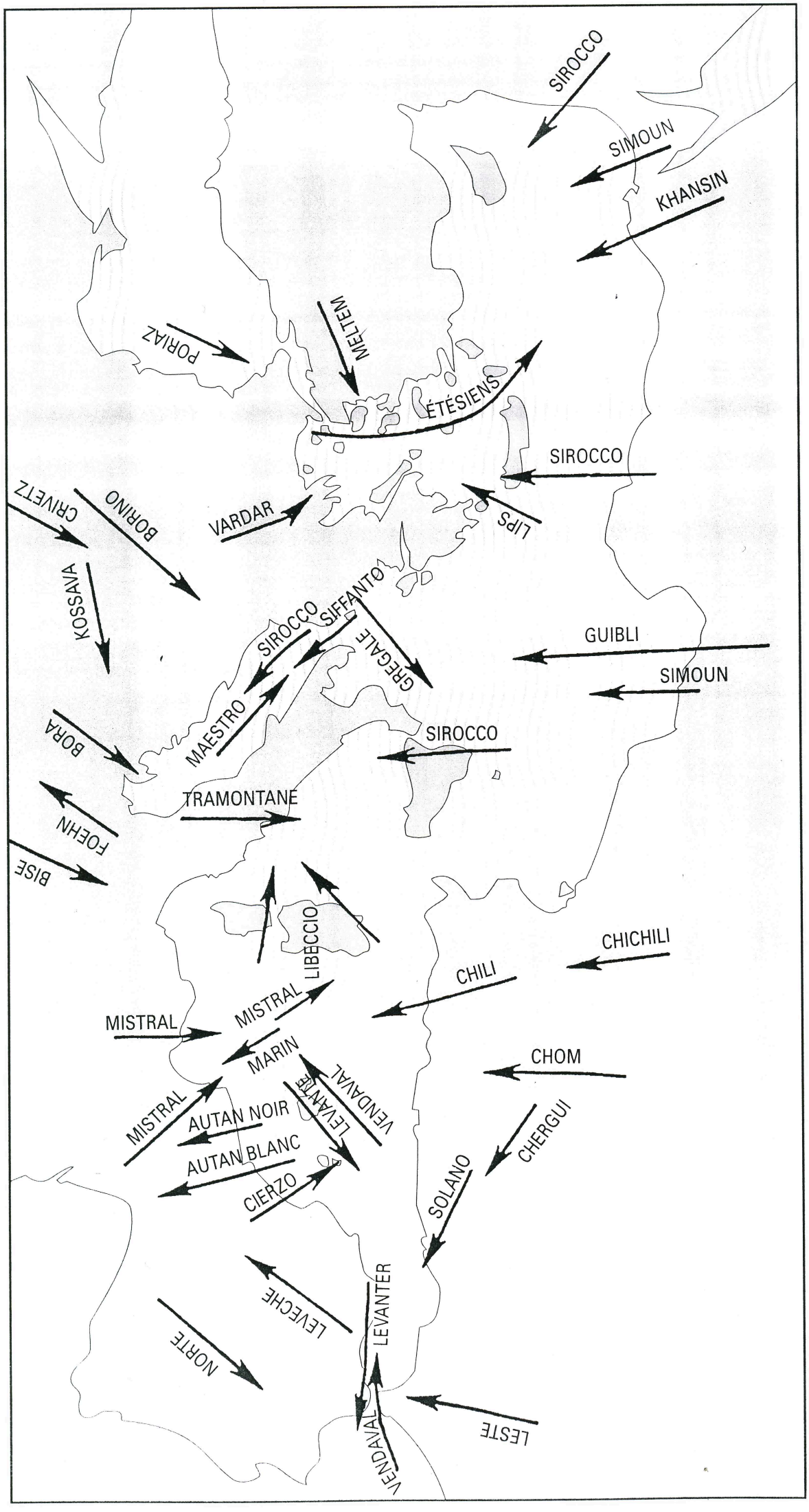
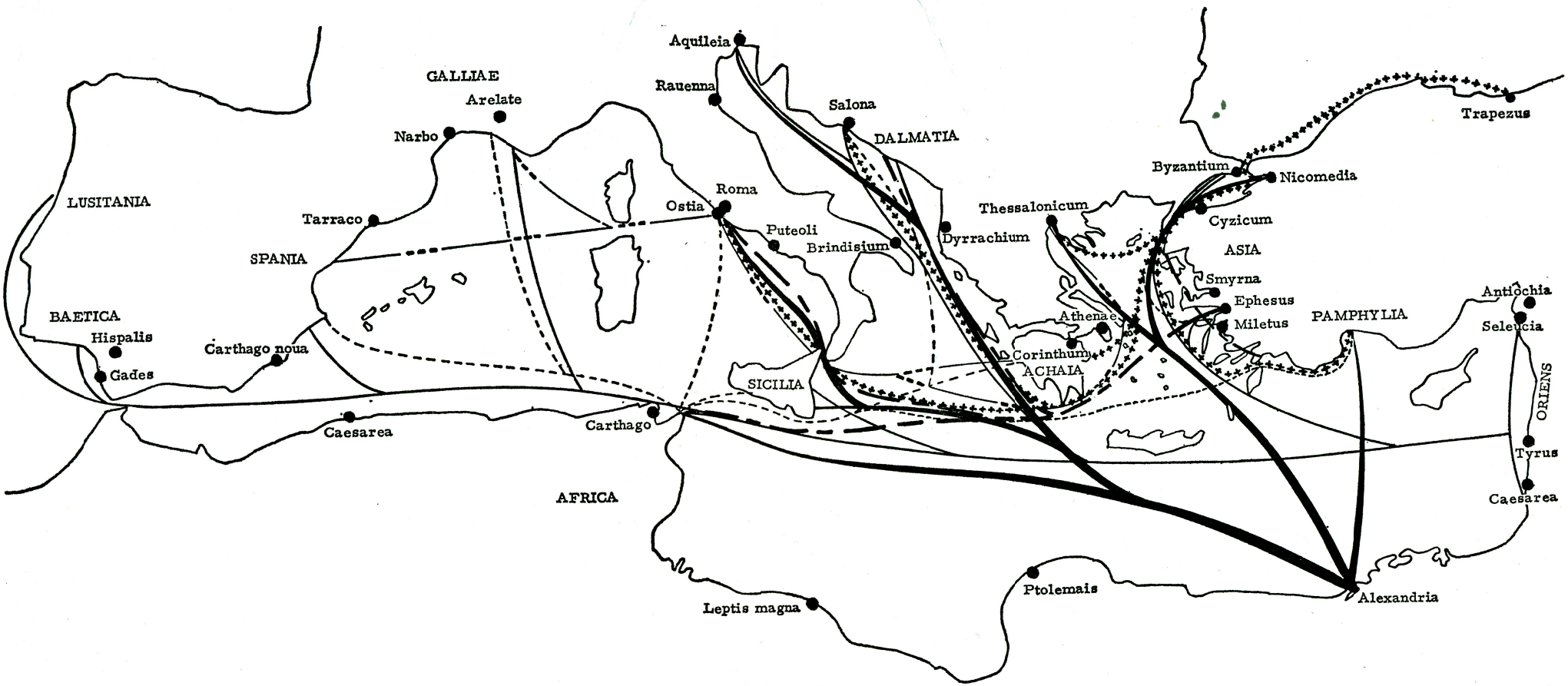
Map 1: Map of the Mediterranean basin with the most important harbours of the Roman period (After Pomey 1997: p 135)


OCÉAN ATLANTIQUE
LUSITANIE
ESPAGNE
TARRACONAISE
AQUITAINE
Ebre
Rhône
NARBONNAISE
Arles
Marseille
(Massilia)
Narbonne
Emporium
Tarragone
Fréjus
(Forum Julii)
GAULE CISALPINE
Corse
Aléria
Tibre
Ostie
Rome
ITALIE
Aquilée
Ravenne
Ancône
MER ADRIATIQUE
ILLYRIE
PANNONIE
Salone
DALMATIE
Dyrrachium
MACÉDOINE
Thessalonique
ÉPIRE
Tarente
Brindisi
Naples
Pouzzoles
MER TYRRHÉNIENNE
Olbia
Sardaigne
Baléares
Sagonte
Guadalquivir
Cadix (Gadès)
Colonnes d'Hercule
Tanger (Tingis)
Lixus
BÉTIQUE
Carthagène
MAURÉTANIE TINGITANE
MAURÉTANIE CESARIENNE
Caesarea
Hippo Regius
NUMIDIE
Utique
Carthage
Hadrumète
Palerme
Messine
Reggio
Sicile
Syracuse
Malte
Crotone
Corfou
MER IONIENNE
Nicopolis
Actium
ACHAÏE
Patras
Corinthe
Athènes
Le Pirée
Sparte
Naxos
Cos
Cnide
Rhodes
Cnossos
Gortyne
Crète
Carpathos
Rhodes
Halicarnasse
CARIE
Samos
Éphèse
Milet
Chios
Lesbos
Phocée
Eubée
MER ÉGÉE
Hellespont
Propontide
Cyzique
Byzance
THRACE
Philippe
Thasos
Pergame
MYSIE
ASIE
CAPPADOCE
GALATIE
LYDIE
PAMPHILIE
LYCIE
Myra
Laodicée
Tarse
CILICIE
Séleucie
Antioche
SYRIE
Salamine
Paphos
Chypre
Byblos
Sidon
Tyr
PALESTINE
JUDÉE
Césarée
Jérusalem
ARABIE
Péluse
Alexandrie
MARMARIQUE
CYRÉNAÏQUE
Ptolémaïs
Bérénice
Cyrène
Apollonia
GRANDE SYRTE
PETITE SYRTE
Sabratha
Oea
Lepcis Magna
TRIPOLITAINE
AFRIQUE PROCONSULAIRE
LYBIE
ÉGYPTE
Nil
MER ROUGE
Danube
DACIE
MÉSIE
Bosphore
Chersonèse
MER NOIRE (PONT-EUXIN)
Sinope
PONT
BITHYNIE
Nicomédie

Map 2: Map with the principal winds of the Mediterranean basin (Pomey 1997: p 26)


SIROCCO
SIMOUN
KHANSIN
PORIAZ
MELTEM
ÉTÉSIENS
SIROCCO
CRIVETZ
BORINO
VARDAR
LIPS
KOSSAVA
SIROCCO
SIFFANTÒ
GREGALE
GUIBLI
SIMOUN
MAESTRO
BORA
SIROCCO
TRAMONTANE
FOEHN
BISE
LIBECCIO
CHICHILI
CHILI
MISTRAL
MISTRAL
MARIN
CHOM
MISTRAL
AUTAN NOIR
LEVANTE
VENDAVAL
AUTAN BLANC
CIERZO
CHERGUI
SOLANO
LEVECHE
LEVANTER
NORTE
VENDAVAL
LESTE

Map 3: Map displaying the major navigation routes in the Mediterranean (Rougé 1966: p 88-89)



LÉGENDES :

Au départ d'Alexandrie.....

Au départ de l'Orient.....

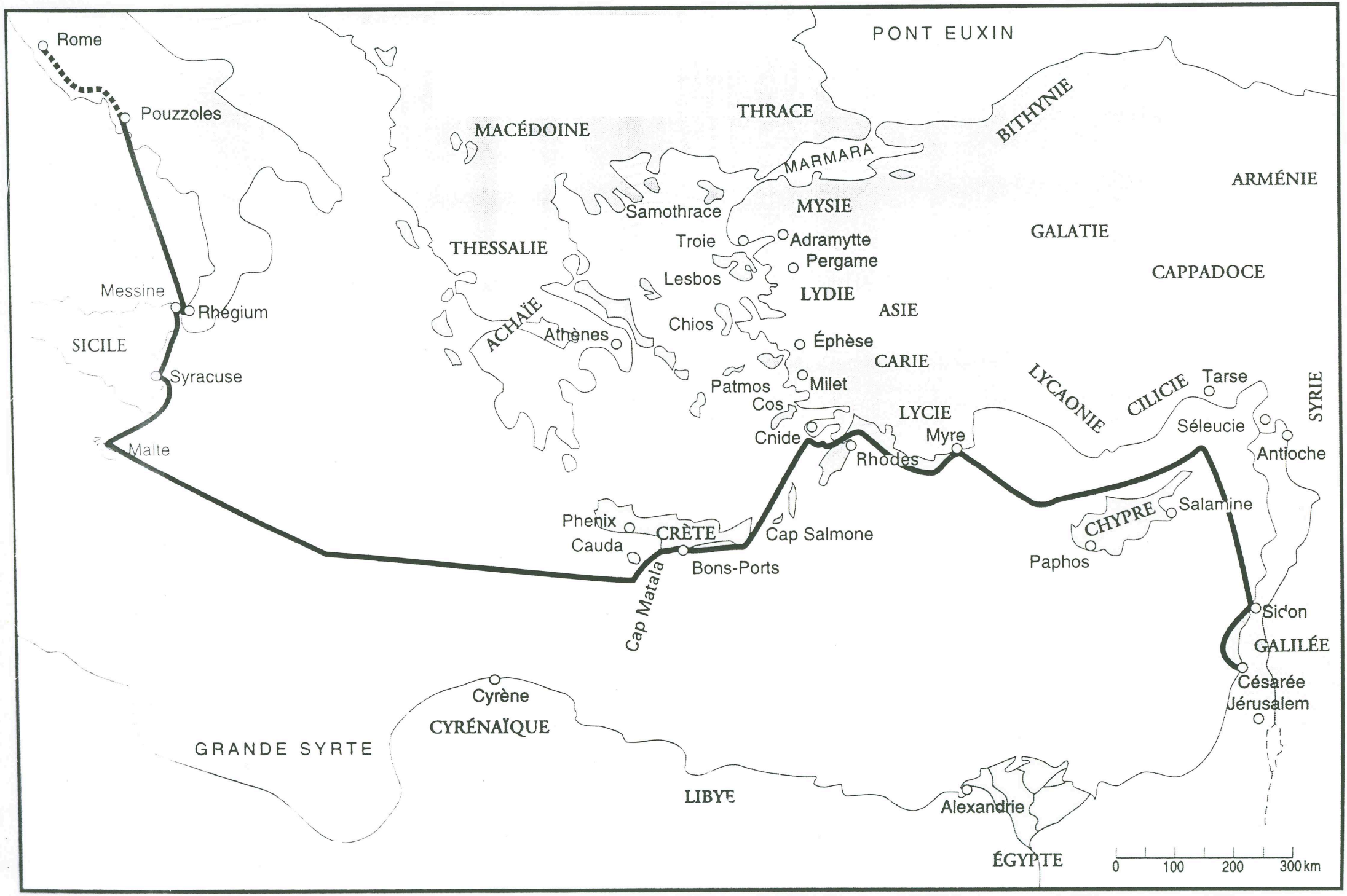
Au départ de l'Asie.....

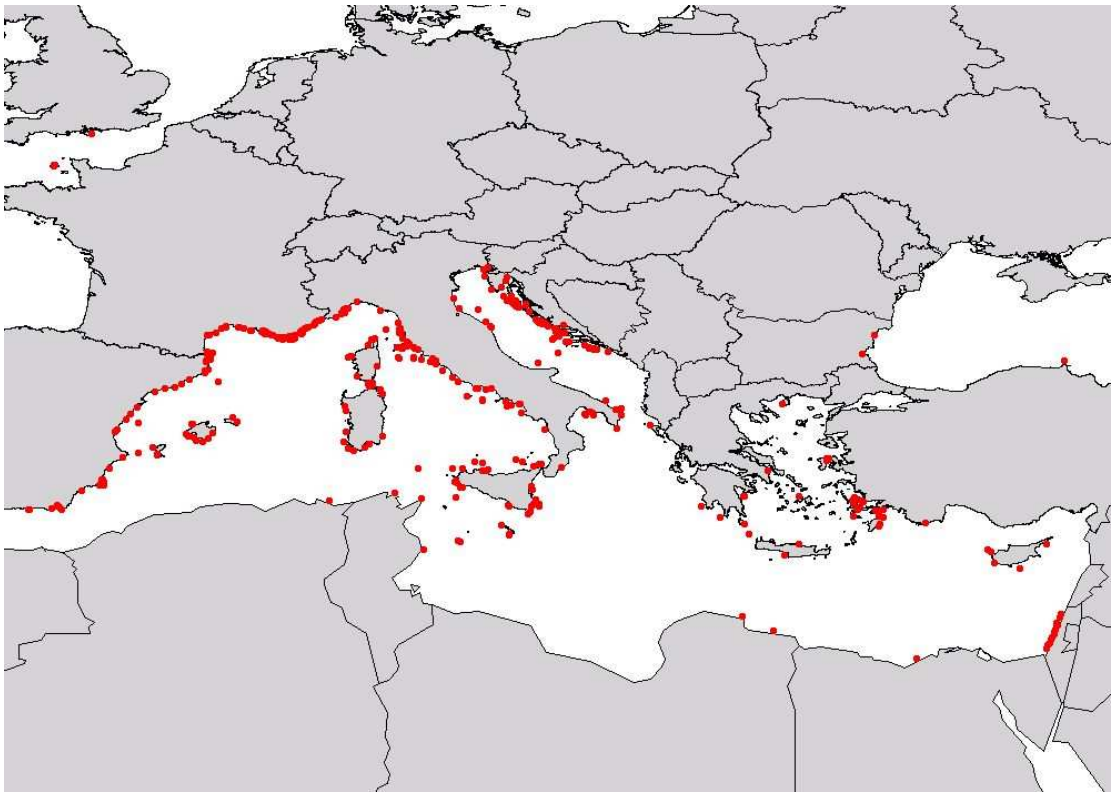
Au départ de l'Afrique.....

Au départ de Rome.....

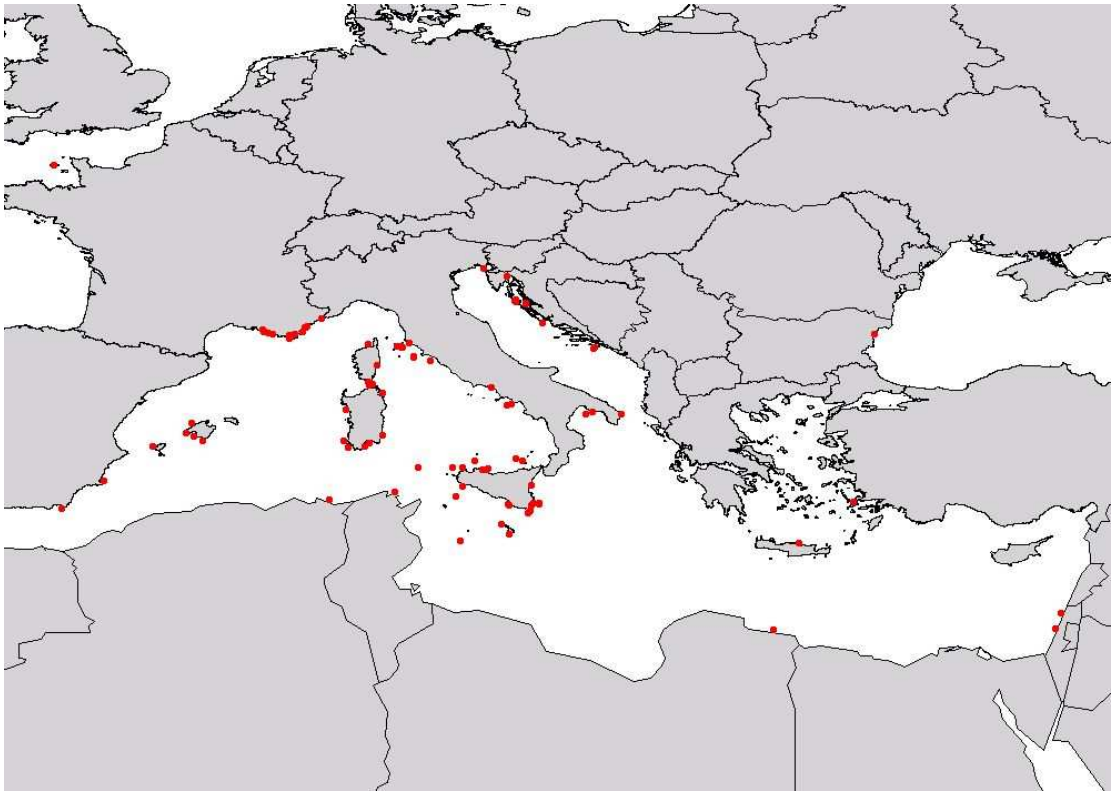
Au départ de Nicomédie.....

Map 4: Map depicting the journey of St-Paul from Caesarea Maritima to Rome (Pomey 1997: p 11)

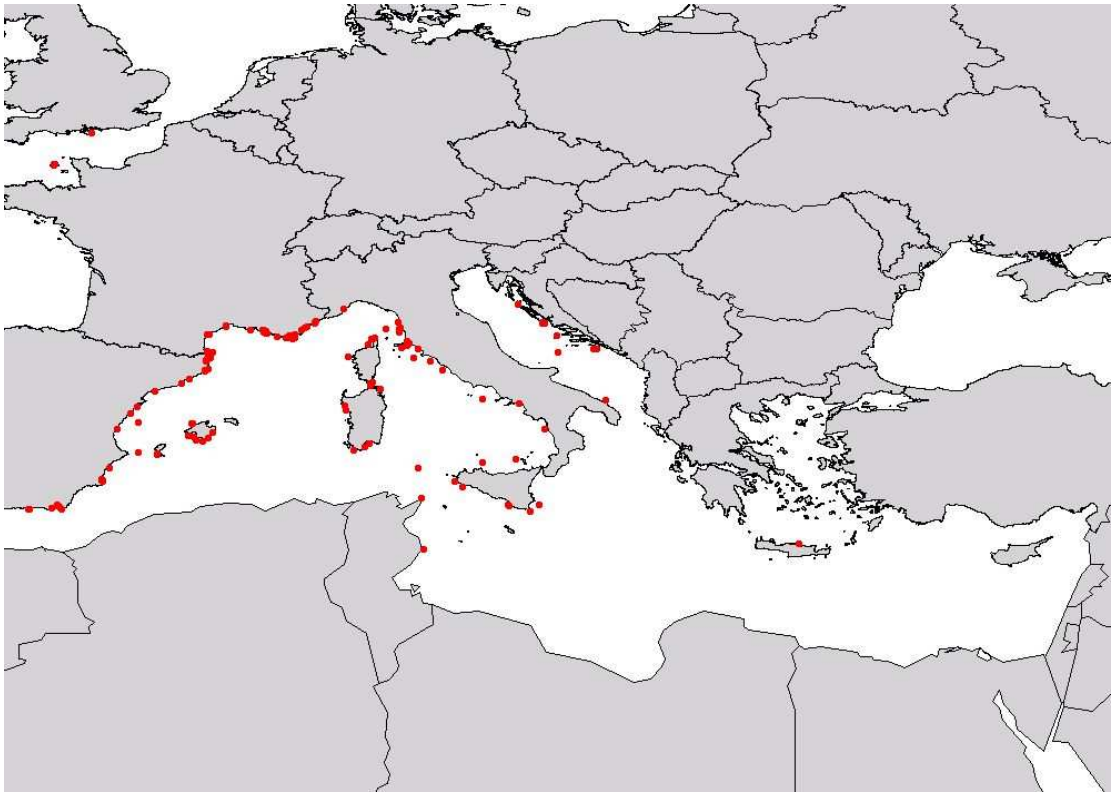

Rome
Pouzzoles
Messine
Rhegium
SICILE
Syracuse
Malte
MACÉDOINE
THRACE
PONT EUXIN
BITHYNIE
MARMARA
ARMÉNIE
Samothrace
MYSIE
THESSALIE
Troie
Adramytte
Pergame
GALATIE
CAPPADOCE
Lesbos
LYDIE
ASIE
ACHAÏE
Athènes
Chios
Éphèse
CARIE
Patmos
Milet
Cos
LYCIE
LYCAONIE
CILICIE
Tarse
SYRIE
Cnide
Myre
Séleucie
Rhodes
Antioche
Phenix
CRÈTE
Cap Salmone
CHYPRE
Salamine
Cauda
Bons-Ports
Paphos
Cap Matala
Sidon
GALILÉE
Césarée
Jérusalem
Cyrène
CYRÉNAÏQUE
GRANDE SYRTE
LIBYE
Alexandrie
ÉGYPTE
0
100
200
300 km



Map 5: Distribution of the shipwrecks with a consignment of amphorae

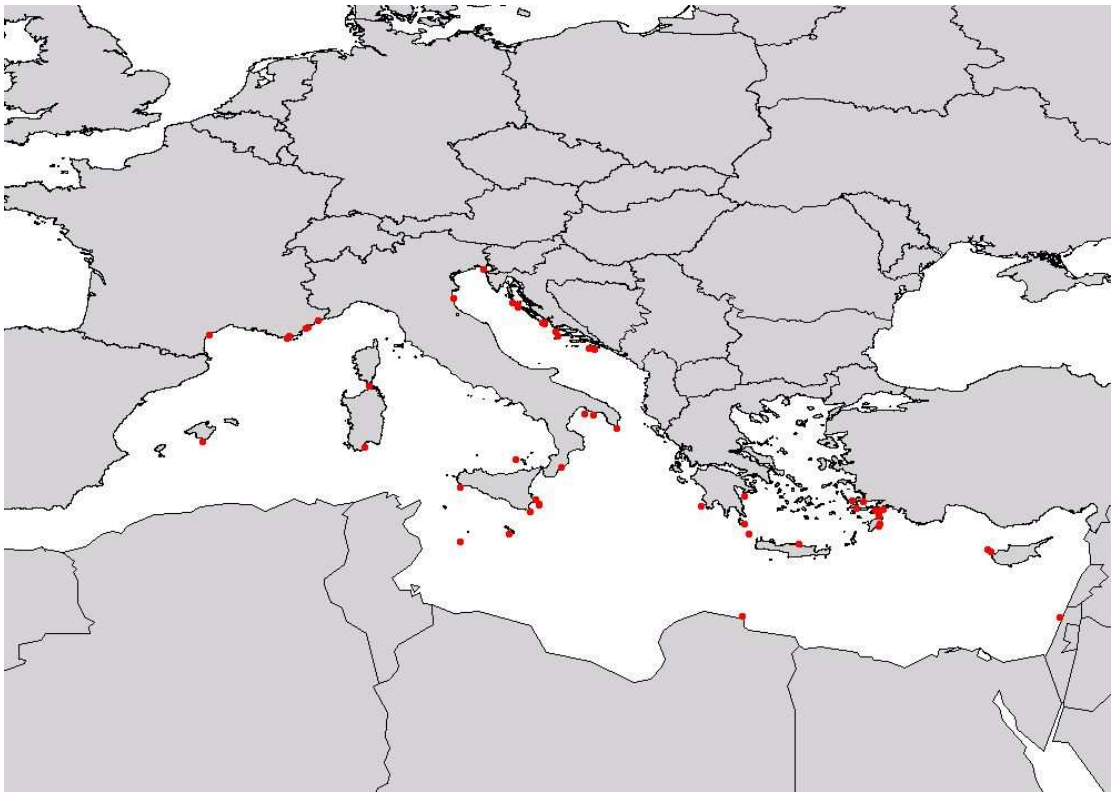


Map 6: Distribution of shipwrecks with a cargo of African amphorae

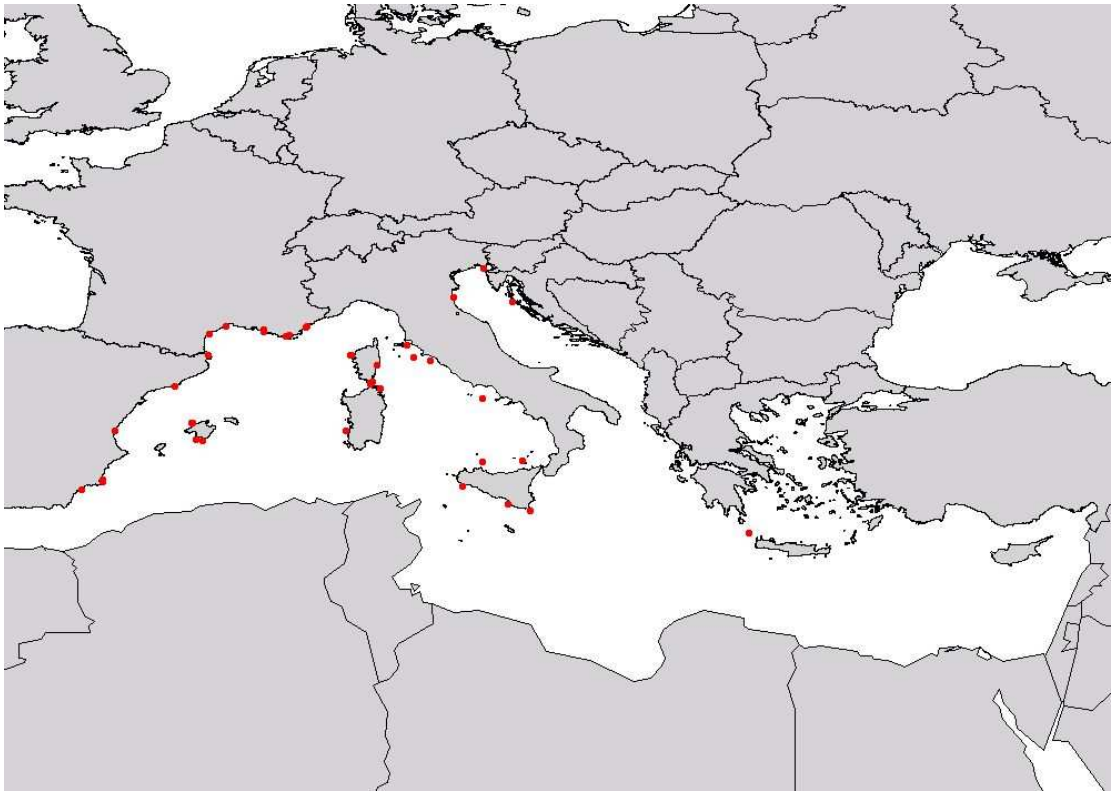


Map 7: Distribution of shipwrecks with a cargo of Spanish amphorae

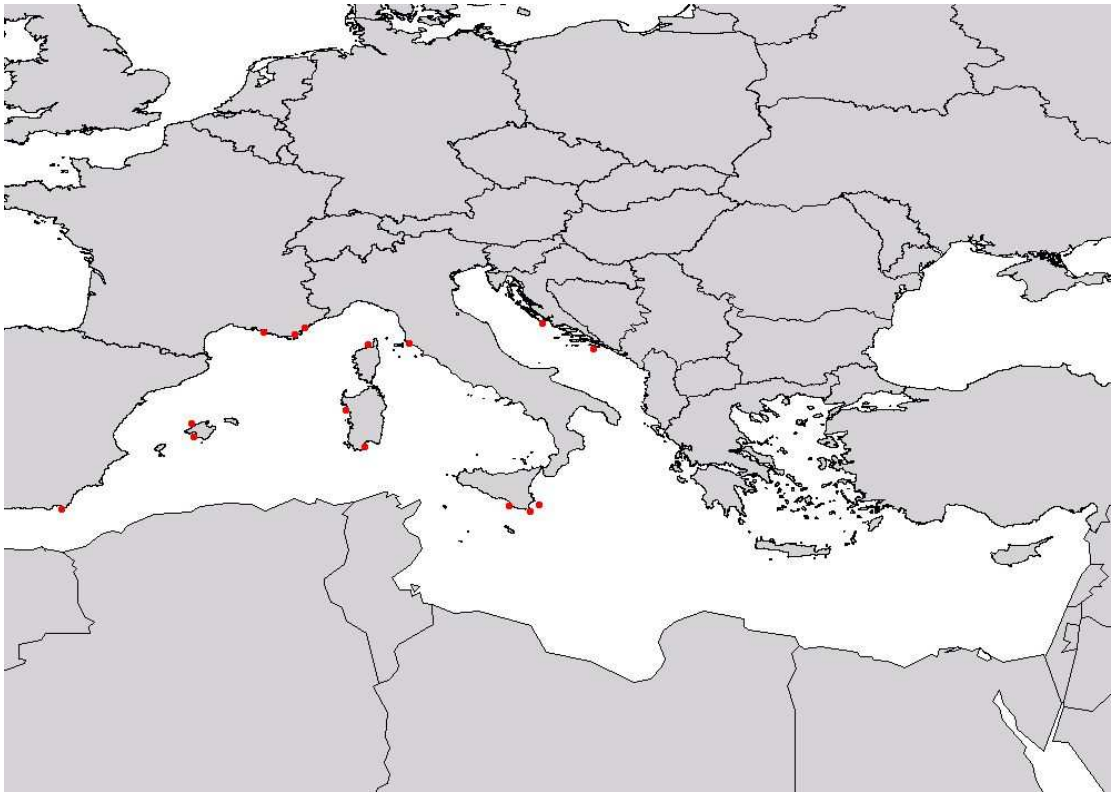
Map 8: Distribution of shipwrecks with a cargo of French amphorae



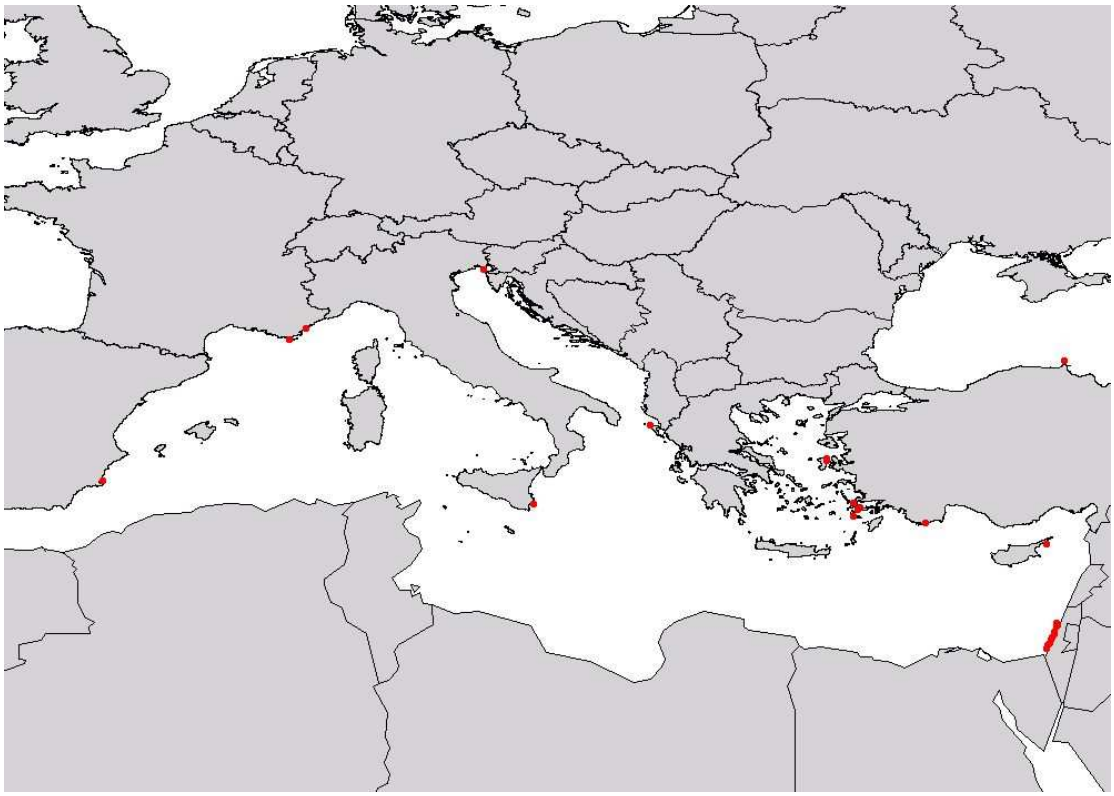
Map 9: Distribution of shipwrecks with a cargo of Aegean amphorae



Map 10: Distribution of shipwrecks with a cargo of metal ingots



Map 11: Distribution of shipwrecks with a cargo of African and Spanish amphorae

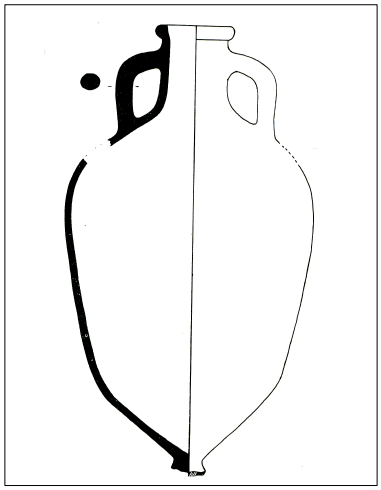


Map 12: Distribution of shipwrecks with a cargo of Levantine amphorae

Appendix 1

This appendix is a catalogue of the amphorae types, which have been found in the different shipwrecks. The information comes mainly out of the book of Peacock & Williams (1986). The drawings are from the same book and from Sciallano & Sibella (1994).

Class 1



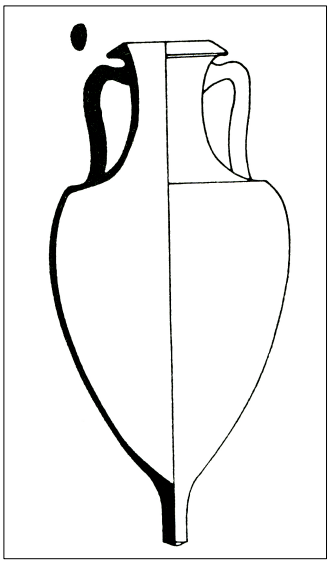
Description: Cylindrical neck with thickened plain rim, oval body and knobbed base. The handles are round in section.

Other naming: Brindisi, Ostia 56, Panella 2

Origin: Brindisi (Italy)

Date: 125 – 50 BC

Class 2



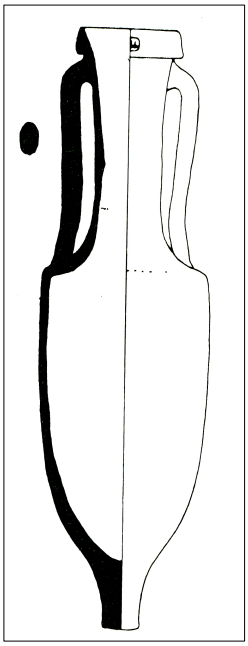
Description: Cylindrical neck, carinated shoulder and a triangular rim. A pear-shaped body with a solid spike. The handles are ovoid.

Other naming: Greco-Italic, Will A to E, Lamboglia 4, Republicaine 1

Origin: Western Mediterranean

Date: Will A: 400 – 275 BC, Will B/C: 225 – 175 BC, Will D/E: 200 – 130 BC

Class 3



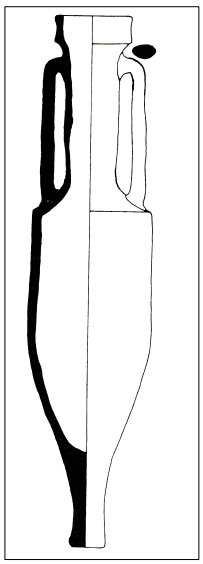
Description: Short triangular rim, cylindrical body and rounded shoulder wit a short stump spike. The handles are rod-like.

Other naming: Dressel 1A, Ostia 20, Panella 1

Origin: Italy

Date: 130 – 50 BC

Class 4

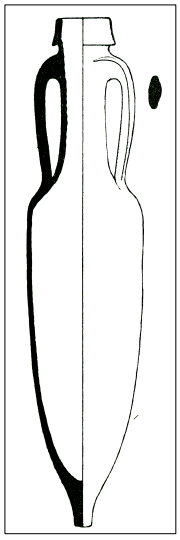


Description: Thick, vertical collar rim and heavy cylindrical body with a solid chinky spike. The handles are oval-shaped and rod-like.

Other naming: Dressel 1B, Ostia 20, Camulodunum 181, Panella 1
Origin: Italy principally Campania

Date: 75 – 10 BC

Class 5



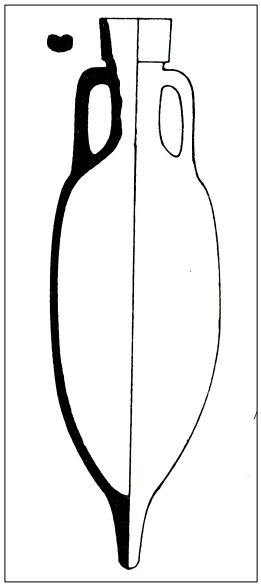
Description: High collar rim with narrow mouth, long spindle shaped body with a short spike. The handles are ribbed.

Other naming: Dressel 1C, Panella 1

Origin: Campania

Date: 125 – 25 BC

Class 6



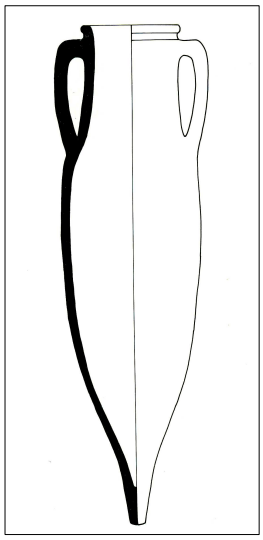
Description: High vertical rim with cylindrical neck, ovoid body and a solid spike. The handles are rounded with distinctive vertical groove.

Other naming: Pascual 1

Origin: Northeastern Spain

Date: 50 BC – 75 AD

Class 7



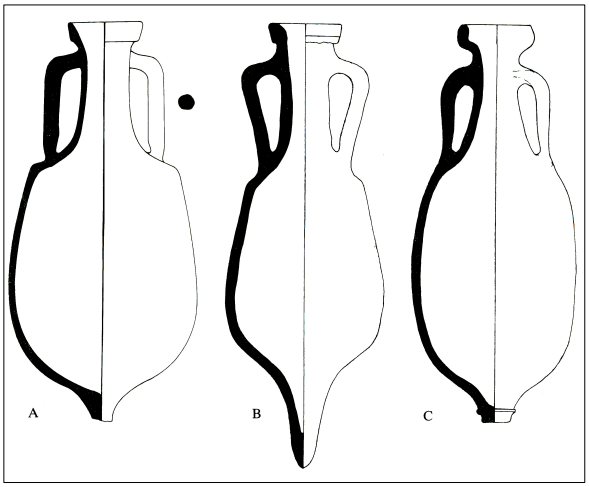
Description: A wide mouth with single/double-rounded rim underneath which is a deep groove, broad neck, cylindrical body and solid spike. The handles are oval-shaped.

Other naming: Dressel 21-22, Ostia 54

Origin: Italy

Date: 1 – 100 AD

Class 8



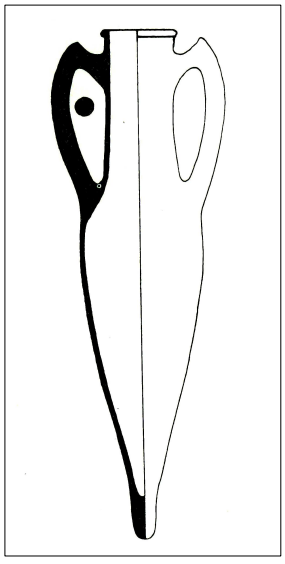
Description: thickened rim, which slightly overhangs — Lamboglia 2 (A)—, high cylindrical neck, thick-walled bag-shaped body with carination on shoulder and pointed spike. The handles are thick and oval.

Other naming: Lamboglia 2 (A), Dressel 6A (B-C)

Origin: Lamboglia 2: Apulia, Dressel 6A: Istria

Date: Lamboglia 2: 200 – 50 BC, Dressel 6A: 1 – 100 AD

Class 9



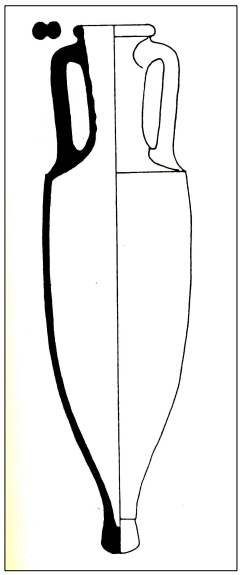
Description: Cylindrical neck, rounded rim, tapering body with solid spike. The single rod-handles rise to sharp peak.

Other naming: Rhodian, Ostia 65, Camulodunum 184

Origin: Aegean, probably Rhodes

Date: 50 BC – 125 AD

Class 10



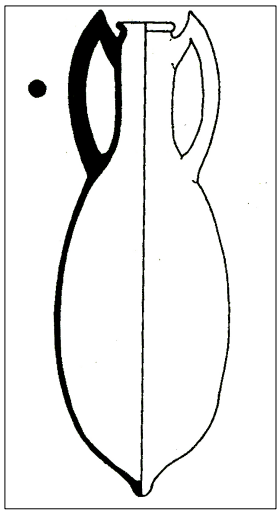
Description: Rounded rim, pronounced carinated shoulder and solid base. The handles are long and bifid.

Other naming: Koan, Dressel 2 – 4, Ostia 51, Camulodunum 182 – 183, ER 4

Origin: Italy, Spain, South France, Aegean and even England

Date: 25 BC – 150 AD

Class 11



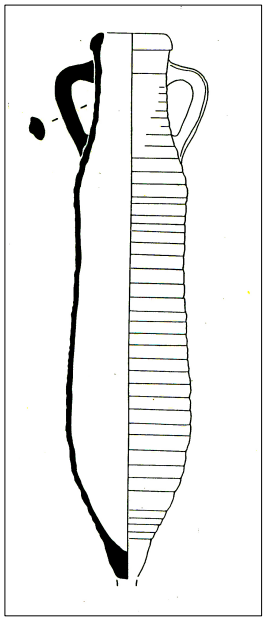
Description: High neck with distinctive step, elongated body with button toe. The bifid handles are heavy and steeply arched with a peak higher as the rim.

Other naming: Pseudo-Koan, ER 2, Dressel 43?

Origin: Crete?

Date: 1 – 200 AD

Class 13



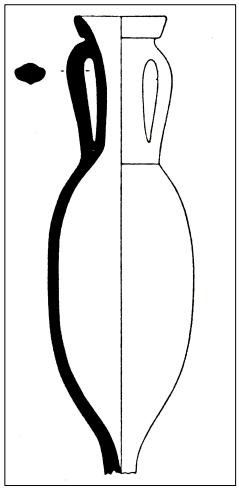
Description: Large, thick rounded rim, horizontal ribbing on the body and small, solid spike. The handles are short, semi-circular and ridged.

Other naming: Richborough 527

Origin: Campania, South France?

Date: 1 – 125 AD

Class 14



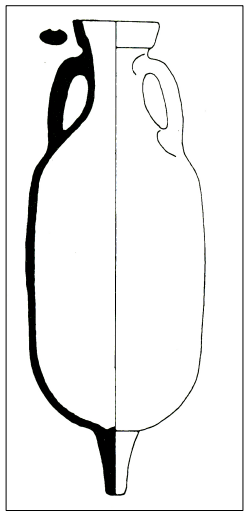
Description: Short everted rim, long slim neck with cylindrical body and short, solid spike. The handles are ovoid.

Other naming: Dressel 12, Beltran 3, Ostia 52

Origin: South Spain, Baetica

Date: 50 BC – 175 AD

Class 15



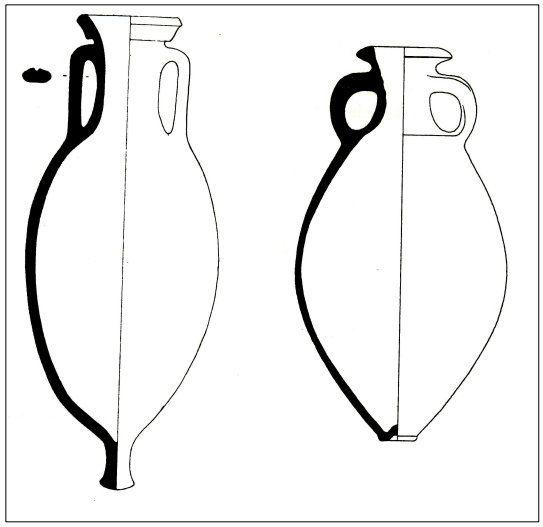
Description: Everted collar rim, cylindrical body and solid, conical spike. The handles are oval with deep, vertical groove.

Other naming: Haltern 70, Camulodunum 185

Origin: Baetica

Date: 50 BC – 50 AD

Class 16



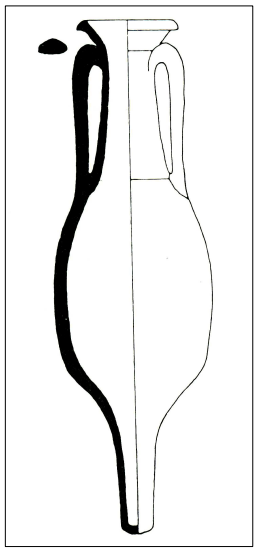
Description: Ovoid body with variations in rim and spike. The handles have medium furrow or groove.

Other naming: Dressel 7 – 11, Beltran 1, Panella 3

Origin: Baetica, but also Gaul?

Date: 25 BC – 100 AD

Class 17



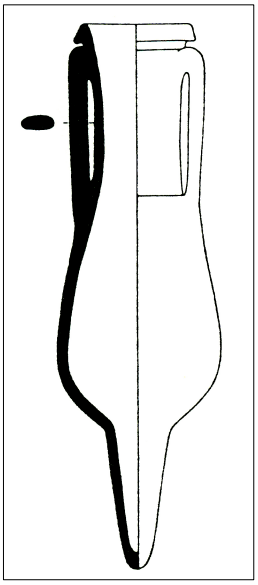
Description: Bell mouth with a thickened, short rim, heavy cylindrical neck, radish-shaped body and long, hollow spike. The handles are long and flattened.

Other naming: Beltran 1, Camulodunum 186 A

Origin: Baetica

Date: 25 BC – 125 AD

Class 18



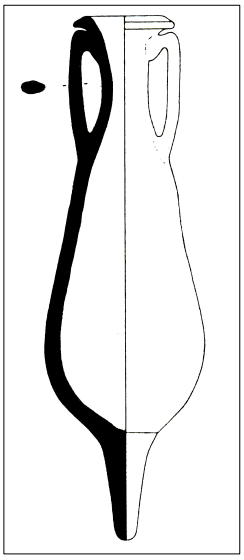
Description: Broad neck, hooked rim and a body that widens towards the base with a long, hollow spike. The handles are long, curved and flattened.

Other naming: Dressel 38, Beltran 2A, Ostia 63, Camulodunum 186C, Pélichet 46

Origin: Baetica

Date: 75 – 125 AD

Class 19



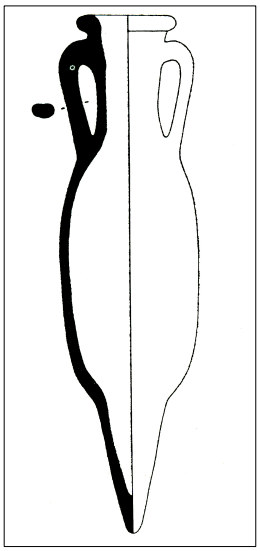
Description: Thick, everted rim with tapering lip, wide neck and widening body towards the base. The long spike can be hollow or solid. The handles are long and sharply bent over below the rim.

Other naming: Beltran 2B, Ostia 58

Origin: Baetica

Date: 35 – 150 AD

Class 20



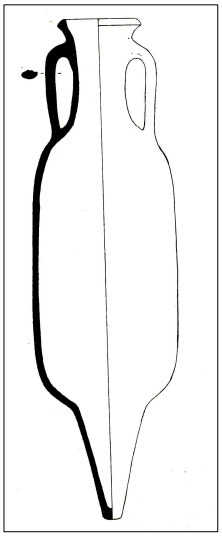
Description: Thickisch, beaded rim, cylindrical body and a long, hollow spike. The handles have a shallow groove down the centre.

Other naming: Dressel 14, Beltran 4A, Ostia 62

Origin: Baetica

Date: 25 – 250 AD

Class 21



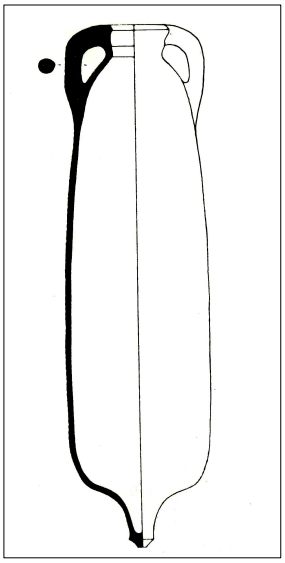
Description: Everted rim, small neck, cylindrical body and long, hollow spike. The handles have a narrow groove down the centre.

Other naming: Beltran 4B, Ostia 61

Origin: Lusitania

Date: 50 – 200 AD

Class 22



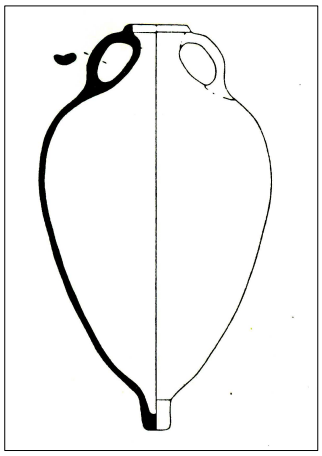
Description: Thickish, jutting rim, long cylindrical body with slight expansion at the base and short spike. The handles are thick and round.

Other naming: Almagro 50, Keay 22, Ostia 7

Origin: Lusitania, North Africa?

Date: 325 – 500 AD

Class 23



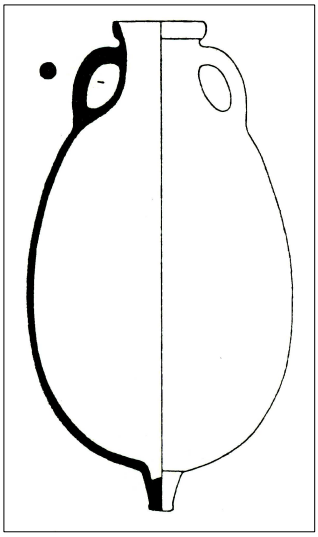
Description: Narrow neck, triangular rim and a high-shouldered piriform body with short spike. The handles are broad and sharply bent with a narrow groove in the middle.

Other naming: Almagro 51, Keay 23

Origin: Lusitania

Date: 200 – 450 AD

Class 24



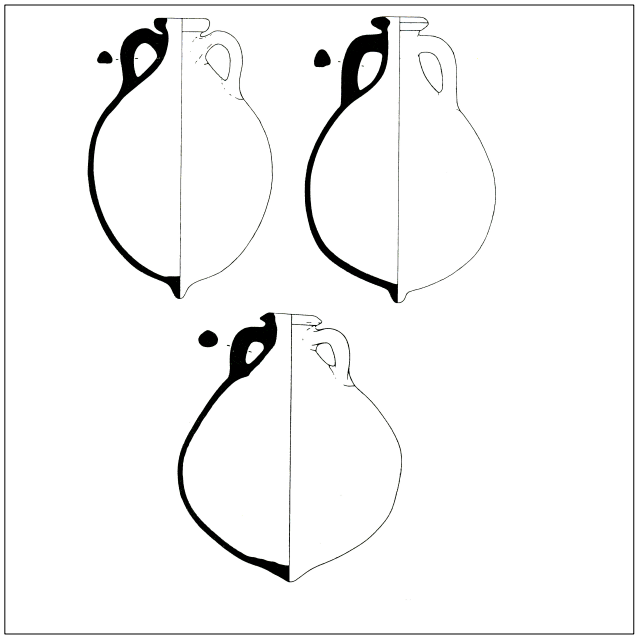
Description: Rounded rim, ovoid body and developed spike. Thin handles.

Other naming: Dressel 25, Haltern 71

Origin: Baetica

Date: 25 BC – 100 AD

Class 25



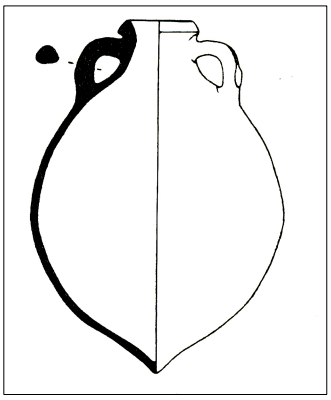
Description: Short neck, large, globular body and small basal knob. The handles are thick, sharply bent or oval shaped.

Other naming: Dressel 20, Beltran 5, Ostia 1

Origin: Baetica

Date: 35 – 300 AD

Class 26



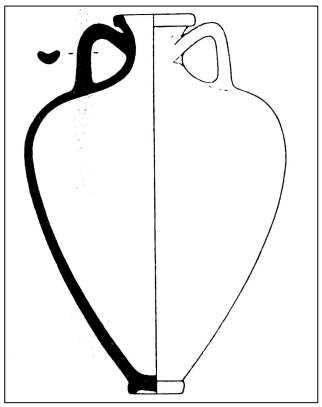
Description: Short, triangular rim, bulbous body and short spike. The handles are small and oval.

Other naming: Dressel 23, Keay 13

Origin: Baetica

Date: 200 – 400 AD

Class 27



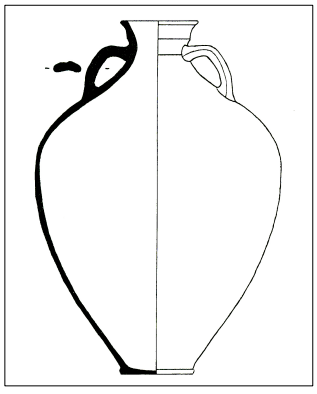
Description: Thick, rounded rim, short neck, broad, rounded shoulders and a tapering body to a narrow, flat base. The handles are short, crude, fat and have a central depression.

Other naming: Gauloise 4, Pélichet 47, Ostia 60, Pear-shaped Gaulish

Origin: South France

Date: 50 – 300 AD

Class 29



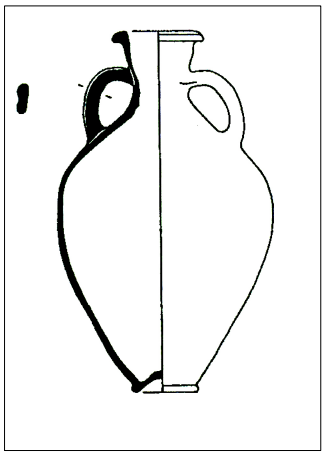
Description: Thickened rim, neck with external inflections, broad shoulders, tapering body and narrow, flat base with footring. The handles have a central groove.

Other naming: Gauloise 3

Origin: South France

Date: 1 – 100 AD

Class 30



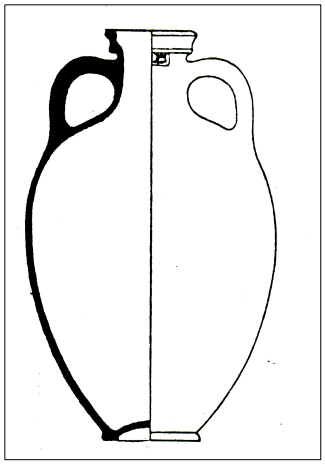
Description: Distinctive, broad, thick and flat rim, broadish, rounded shoulders and tapering body with a flat base. The handles are short, flat and have a central groove.

Other naming: Gauloise 5

Origin: South France

Date: 50 – 125 AD

Class 31



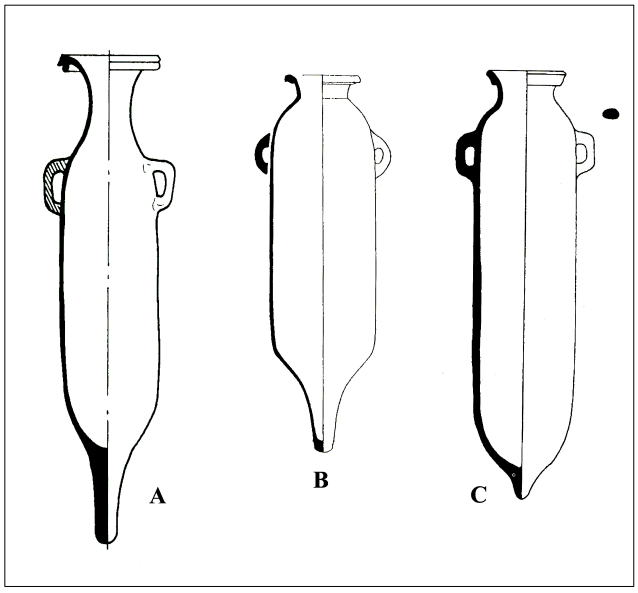
Description: "Pulley-wheel" rim, well-rounded body ending in a thick footring. The short, rounded handles have one or two furrows.

Other naming: Dressel 28

Origin: Tarraconensis, Baetica? France?

Date: 25 BC – 150 AD

Class 32



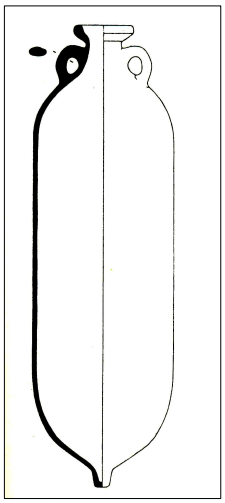
Description: Flaring rim and a long, cylindrical body with small handles and a hollow spike.

Other naming: Neo-punic, Maña C, Van der Werff (VdW) 1 to 3, Dressel 18

Origin: VdW 1(A): Morocco, VdW 2 (B): Tunisia, VdW 3 (C): Tripolitania

Date: 200 BC – 100 AD

Class 33



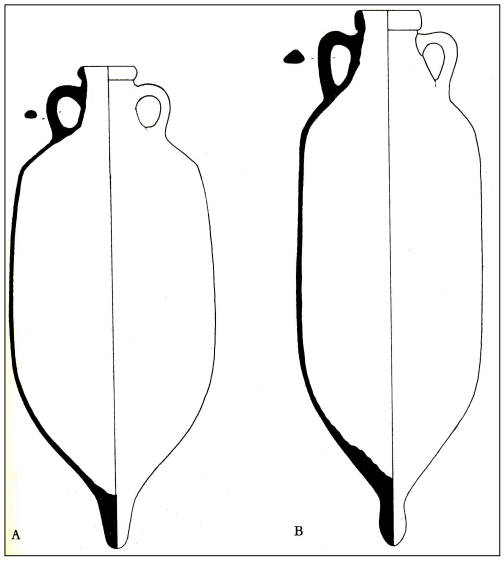
Description: Thick, everted rim, short, straight neck, long, cylindrical body with short, hollow spike. The handles are small and sharply bent.

Other naming: Africana 1, Beltran 57, Ostia 4, Keay 3

Origin: Tunisia

Date: 125 – 350 AD

Class 34



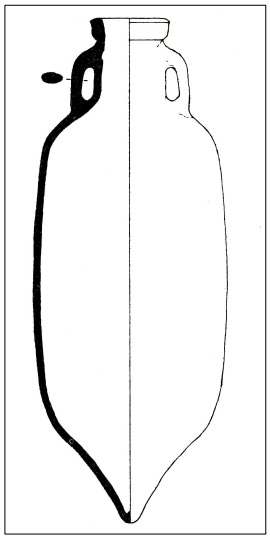
Description: Thick, upricht and round rim, long, cylindrical body and short spike. The handles are small and sharply bent.

Other naming: Africana 2, Beltran 56, Ostia 3, Keay 4 – 6

Origin: Tunisia

Date: 175 – 400 AD

Class 36



Description: Thick, concave rim, high, conical neck, long, cylindrical body with hollow, conical spike. The handles are short and thick.

Other naming: Tripolitanian 1, Ostia 64

Origin: Tripolitania

Date: 1 – 400 AD

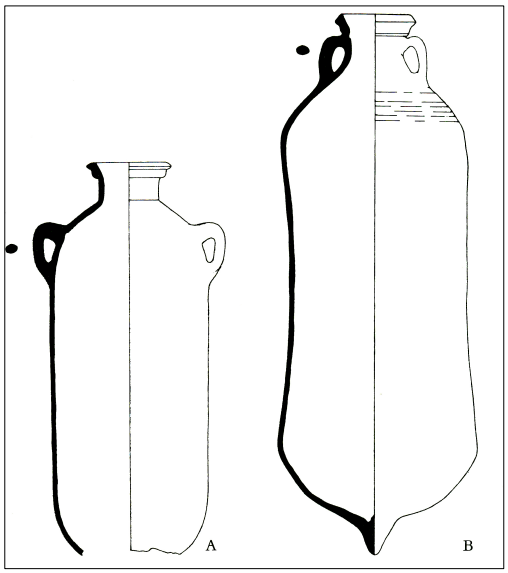
Class 37

Description: Thick, everted rim, Short upright neck, long, cylindrical body and short handles.

Other naming: Tripolitanian 2 – 3, Ostia 2 & 24, Dressel 41 – 42

Origin: Tripolitania

Date: 100 – 250 AD



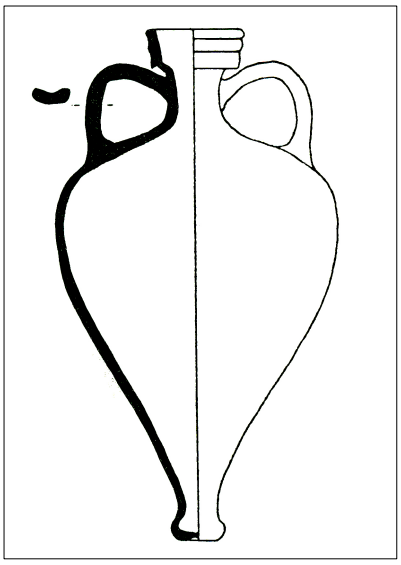
Class 38

Description: Upright rim, sometimes ribbed, short neck, pear-shaped body and small, bulbous, hollow base. The handles are sharply bent and sometimes ribbed.

Other naming: Dressel 30, Ostia 5, Keay 1, Panella 33, Pear-shaped Mauretanian

Origin: Mauretania

Date: 175 – 400 AD



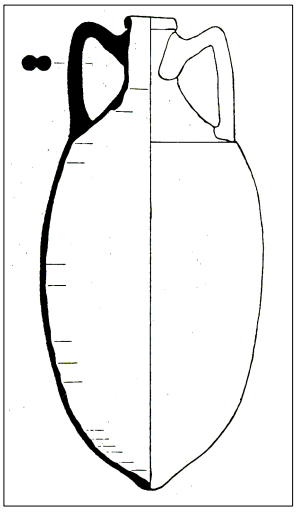
Class 39

Description: Thick rim, bulging neck, ovoid body and short, basal knob. The handles are arched and bifid.

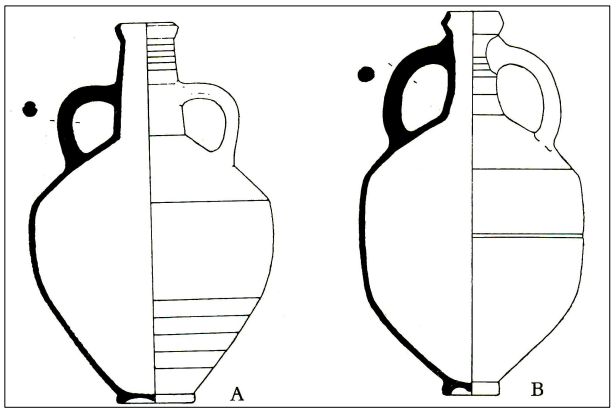
Other naming: ER 1

Origin: Aegean

Date: 25 – 150 AD



Class 40



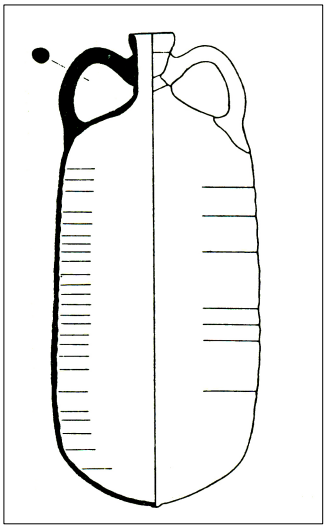
Description: Biconical or thick, slightly, inturned rim, narrow neck, carinated shoulder, vertical fluting and squat body with a footed base. The handles are rounded.

Other naming: MR 1, Panella 44 – 47

Origin: Mauretania

Date: 1 – 300 AD (Biconical rim) or 150 – 400 AD (inturned rim)

Class 41



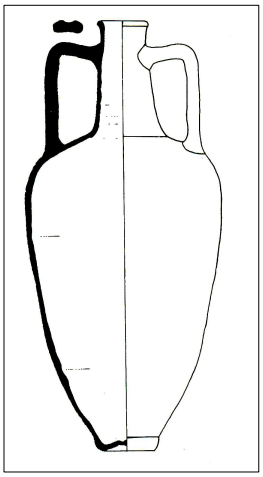
Description: Slightly convex rim with or without ridge, narrow neck, cylindrical body with roudend base and a small point. The handles are bowed.

Other naming: MR 2

Origin: Crete

Date: 1 – 275 AD

Class 42



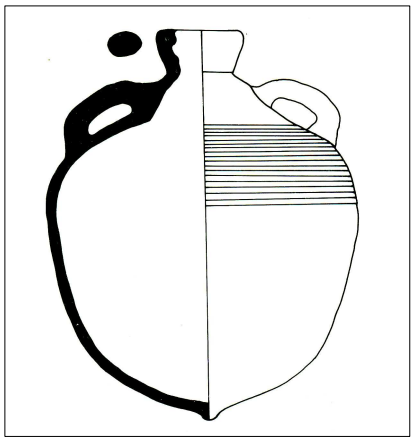
Description: Rounded rim, high neck, tapering body and flat base with footring. The handles are flatish with a shallow, central groove.

Other naming: MR 13, Panella 40 – 41, Pear-shaped Italian, Flat-bottomed Italian

Origin: Forlimpopoli?

Date: 225 – 375 AD, although evidence from wrecks places this amphora already in the first two centuries.

Class 43



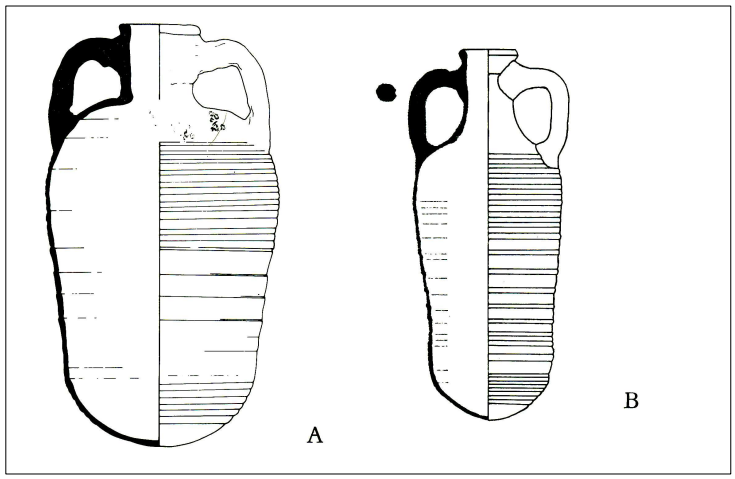
Description: High, everted rim, short, conical neck, a globular body with deep, horizontal grooving in the upper part and a small, basal knob. The handles are bowed.

Other naming: LR 2, Keay 65, Globular shape

Origin: Black Sea, Aegean?

Date: 300 – 600 AD

Class 44



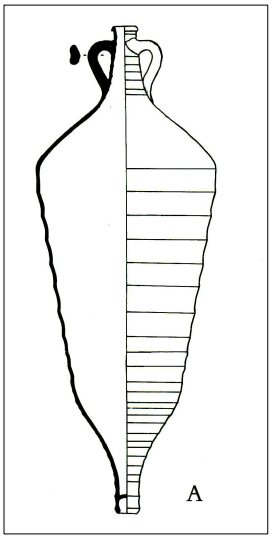
Description: Thick rim, stumpy handles, body tapering in the middle with ridging decoration, rounded base.

Other naming: LR 1, Keay 53, Baluster shape

Origin: Syria, Cyprus, Cilicia

Date: 425 – 650 AD

Class 45



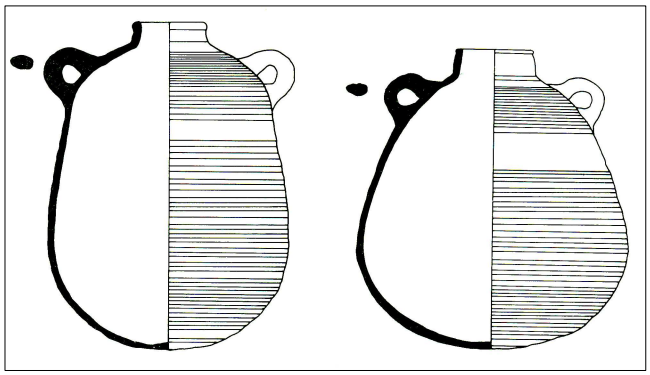
Description: Long, slender neck with short strap-handles, high rounded shoulder and a tapering solid foot.

Other naming: LR 10, LR 3

Origin: Asia Minor

Date: 375 – 575 AD

Class 46



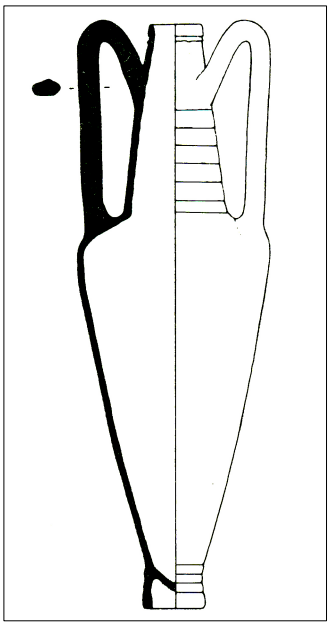
Description: No neck and a vertical rim rising from the shoulder, bag-shaped body and a rounded base. Ring handles.

Other naming: Palestinian

Origin: Palestine

Date: 400 – 600 AD

Class 47



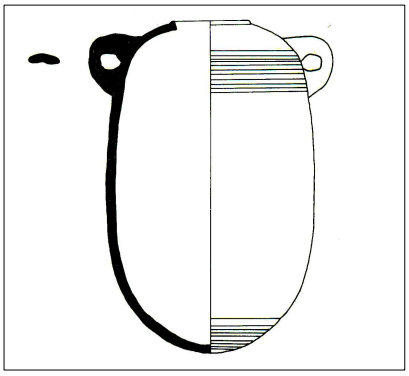
Description: Narrow rim with sharp flange below it. High, thick conical neck, tapering body and tubular, hollow base. The handles are thick, broad and steeply arched above the rim.

Other naming: Kapitan 2, MR 7, Ostia 6

Origin: Aegean

Date: 200 – 400 AD

Class 48



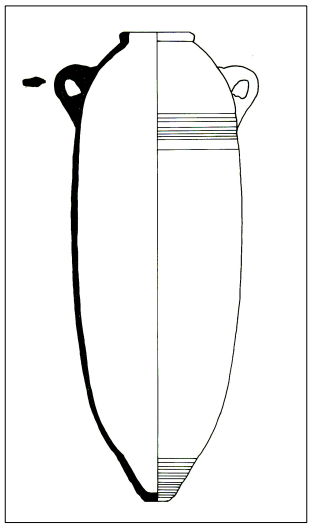
Description: Small, thichened rim, heavy bag-shaped body with rounded base. Ring handles on the shoulder.

Other naming: Zemer 53

Origin: Palestine

Date: 200 – 400 AD

Class 49



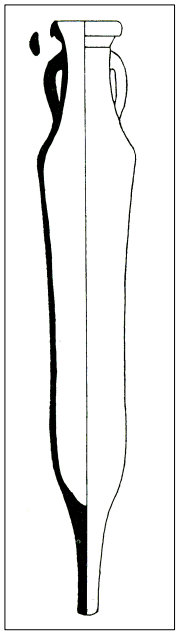
Description: Small, everted rim with loop handles on the shoulders and a narrow, cylindrical body. The base can be rounded or flat.

Other naming: LR 4, Almagro 54

Origin: Palestine

Date: 300 – 600 AD

Class 51



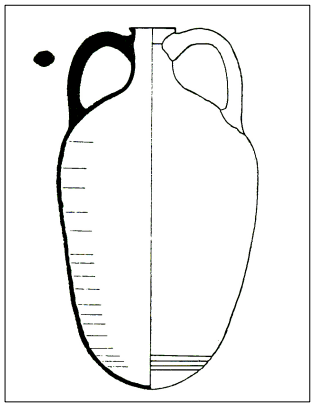
Description: Everted rim with short handles, high neck, long narrow body with long, tapering spike.

Other naming: LR 8, Spatheion, Keay 25

Origin: North Africa, Cartagena? Although this amphorae are mainly found in company with African amphorae, which would favour a African origin.

Date: 375 – 550 AD

Class 54



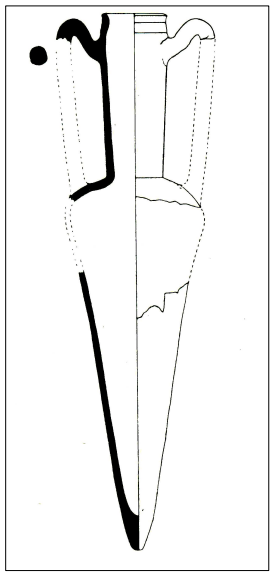
Description: Thick, everted rim and conical neck, bag-shaped body with rounded base. The handles are thick, oval and from the top of the neck to the shoulder raising with the rim.

Other naming: LR 13

Origin: /

Date: 600 – 800 AD

Class 56



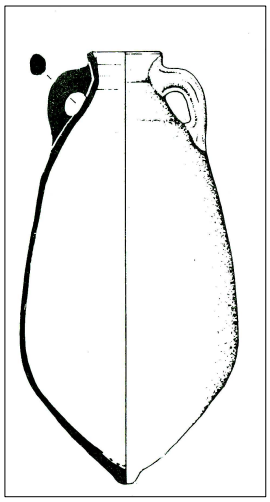
Description: Long, cylindrical neck, body tapers to end in solid spike. The handles are thick, round and steeply arched.

Other naming: Kapitan 2, Ostia 9

Origin: Aegean, Italy? Half of the amphorae found in shipwrecks are in combination with Class 47 of also Aegean origin.

Date: 175 – 300 AD

Class 58



Description: Everted rim, piriform body, elliptic handles and a pointed spike.

Other naming: Almagro 55, Keay 15

Origin: Baetica

Date: 200 – 400 AD

Class 63

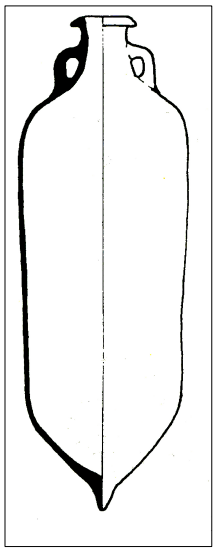
Description: Large, upright rim, bag-shaped body with rounded base and rounded handles on the shoulder.

Other naming: LR 5

Origin: Palestine

Date: 400 – 700 AD

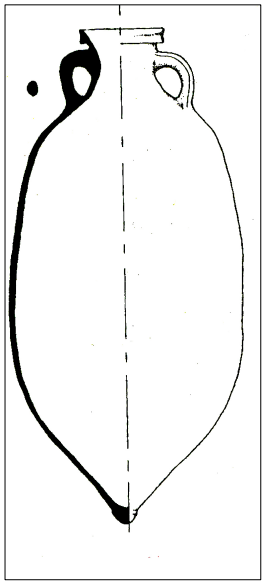
Keay 35



Description: Triangular rim, short neck, long, cylindrical body and a short pike. The handles are small.

Origin: Africa

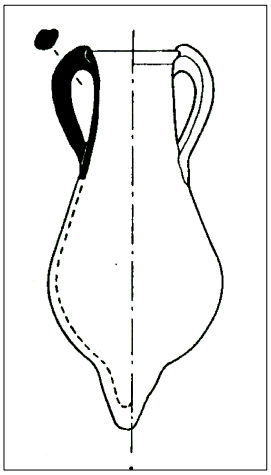
Dressel 26



Description: Vertical collar rim, ovoid body and basal knob. The handles are short and flattened.

Origin: Tripolitania

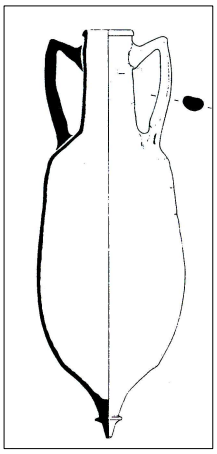
Beltran 72



Description: Wide mouth with everted rim, broad neck and a body that widens towards the base with a short hollow spike. The handles are thick and rounded.

Origin: Lusitania

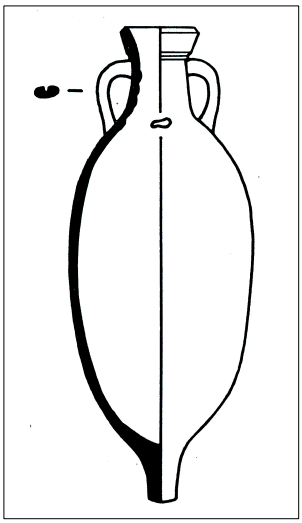
Cnidian



Description: Small rounded rim, high neck, slight carinated shoulder and elongated body with a pointed spike. The handles are heavy, arched and they have a shallow groove.

Origin: Cnidos

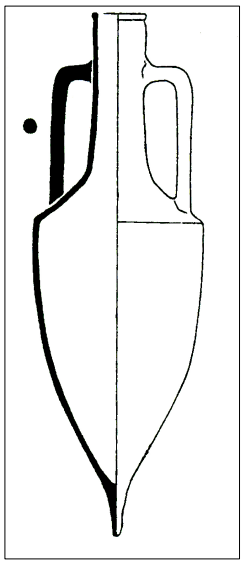
Tarraconensis I



Description: These amphorae resemble the Apulian amphorae, but the stamp — L. Volteil — indicates that it has been fabricated in Spain. This amphora has a thickened rim, with grooves underneath. The body has an ovoid form and ends in a solid spike. The handles have a medium groove.

Origin: Tarraconensis

Chian



Description: Rounded rim and a high neck, a pronounced carinated shoulder, tapering body with a long spike. The handles are long and round.

Origin: Chios

Name	Place of origin	Name	Place of origin
African	Africa	Keay 42	Tunisia
Beltran 68		Keay 49	
Beltran 72	Lusitania	Keay 52	Eastern Mediterranean
Carrot amphorae		Keay 61	Tunisia
Chian	Chios	Keay 62	Tunisia
Cnidian	Cnidos	Keay 81	Tunisia or Libya
Crete	Crete	Kingsholm 117	
Cylindrical	Africa	Koan	Cos
Cylindrical	Africa	M230 Robinson	
Dressel 17		Massilian	South France
Dressel 24		Nubian	Africa
Dressel 26		Ovoidal	
Dressel 29		Panella 34	
Dressel 35-36	Aegean	Panella 36	
Dressel 37	Baetica	Pascual 2	Spain
Dressel 44-45		Pear-shaped	
Egyptian biconical	Egypt	Pear-shaped Etrurian	Italy
Flat bottomed		Pompei X	Campania
Flat bottomed Sicilian	Sicily	Portorecanato	
Gaulish	Gaul	Punic	
Gauloise 2	S-France	Riley D377	
Globular		Robinson K114	
Hispanic spindle shaped	Spain	Schoene 8	
Ibizan	Balearics	Sinopian	Black Sea
Keay 16	Baetica	Skerki Bank 1	
Keay 32	Tunisia	Tarraconensis I	Tarraconensis
Keay 35	Tunisia	Thasian	Thasos

Table with other amphorae types and there presumable place of origin

Appendix 2

This appendix is a list of the shipwrecks with a proposed begin and end date, XY coordinates and their cargoes. The wrecks are only those wrecks in which amphorae were found.

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Acque Chiare	300	450	17,48815	40,26052	C51
Addaya	-150	-25	4,12	40,1	Dressel 1
Agde B	-200	-100	3,27	43,16	C10
Agde B	-200	-100	3,27	43,16	C2
Agde B	-200	-100	3,27	43,16	C4
Agde B	-200	-100	3,27	43,16	C9
Agde D	-100	-1	3,27	43,15	C5
Agde D	-100	-1	3,27	43,15	Ceramics
Agde E	75	125	3,28	43,15	C25
Agde E	75	125	3,28	43,15	Metal
Aigua Blava	-50	25	3,10245	41,80401	C6
Aigua Blava	-50	25	3,10245	41,80401	Dressel 37
Ain El Gazala	200	400	23,07657	32,69698	C47
Akandia A	-50	100	28,15838	36,12878	C9
Albenga	-100	-80	8,3442	44,12134	C8
Albenga	-100	-80	8,3442	44,12134	C4
Albenga	-100	-80	8,3442	44,12134	Ceramics
Alexandria A			29,55	31,13	Dressel 6
Algajola	-150	-100	8,5	42,37	C3
Algajola	-150	-100	8,5	42,37	Metal
Almadraba	100	200	0,06458	38,61052	C10
Ametlla de Mar A	-25	75	0,56658	40,46884	C10
Ametlla de Mar A	-25	75	0,56658	40,46884	C14
Ametlla de Mar C	1	300	0,56658	40,47884	C25
Amoladeras			-0,70241	37,72411	C3
Amoladeras			-0,70241	37,72411	Metal
Amoladeras			-0,70241	37,72411	Tiles
Ancona	-150	-25	13,73111	43,44608	C8
Antikythera A	-80	80	23,30969	35,77864	C10
Antikythera A	-80	80	23,30969	35,77864	C8
Antikythera A	-80	80	23,30969	35,77864	C9
Antikythera A	-80	80	23,30969	35,77864	Ceramics
Antikythera A	-80	80	23,30969	35,77864	Glass
Antikythera A	-80	80	23,30969	35,77864	Metal
Aragnon	1	50	5,59045	43,15992	C8
Aragnon	1	50	5,59045	43,15992	Flat bottomed
Arap Adasi	-100	-1	28,28348	36,69154	C9
Ardenza	1	100	10,29724	43,335	C20
Arenys de Mar			2,52198	41,48259	C6
Areopolis	-100	-1	22,22	36,4	C8
Argentario			11,55917	42,29227	Dolia
Arles	1	100	4,53013	43,37349	C27
Ayios Stephanos	550	650	26,19066	38,58714	C44
Ayios Stephanos	550	650	26,19066	38,58714	C48
Bacoli A	-50	100	14,80854	40,57989	C10
Bacoli B	100	200	14,78741	40,5968	C25

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Bagaud A (Ile d'Hyeres)	200	275	6,22	43,1	C38
Bagaud A (Ile d'Hyeres)	200	275	6,22	43,1	C47
Bagaud A (Ile d'Hyeres)	200	275	6,22	43,1	C51
Bagaud A (Ile d'Hyeres)	200	275	6,22	43,1	C56
Bagaud B	-110	-100	6,22	43,1	C3
Bagaud B	-110	-100	6,22	43,1	Ceramics
Bagaud B	-110	-100	6,22	43,1	Metal
Bagaud C	75	200	6,22	43,1	C25
Bagaud C	75	200	6,22	43,1	Gaulish
Baie De L'amitié	50	100	3,28	43,16	C25
Baie De L'amitié	50	100	3,28	43,16	Ceramics
Baie De L'amitié	50	100	3,28	43,16	Metal
Bajo de dentro	-100	-1	-0,68241	37,67411	C8
Bajo de dentro	-100	-1	-0,68241	37,67411	Metal
Bajo de la Barra	1	100	-0,68241	37,68411	C16
Bajo de la campana B	1	100	-0,70241	37,73411	C19
Bajo de la campana B	1	100	-0,70241	37,73411	C20
Bajo de la campana B	1	100	-0,70241	37,73411	Ovoidal
Balise du prêtre B	1	100	9,15369	41,37287	C10
Balise du prêtre B	1	100	9,15369	41,37287	C7
Balise du prêtre C	290	340	9,15369	41,37287	C34
Baratti	-150	-25	10,41724	43,035	Dressel 1
Baska	-100	-1	14,46	44,58	C8
Basse du Verhuge	-140	-130	6,44	43,14	C2
Basses du Can	-125	-100	6,42	43,14	C3
Ben Afeli	85	95	-0,23864	39,57	C10
Ben Afeli	85	95	-0,23864	39,57	Metal
Benicarlo	1	50	0,31903	40,22032	C10
Benicarlo	1	50	0,31903	40,22032	C15
Benicarlo	1	50	0,31903	40,22032	C25
Bera	50	50	1,60059	41,15689	C10
Bergeggi	10	60	8,27165	44,08728	C15
Bodrum	-100	-1	27,23	37,12	C10
Bon Porté B	-150	-100	6,39	43,1	C2
Bon Porté B	-150	-100	6,39	43,1	C3
Boulouris	1	300	6,82599	43,408	C25
Cabo de Gata	175	325	-2,2161	36,679	C22
Cabo de Gata	175	325	-2,2161	36,679	C33
Cabo de Mar	1	300	-8,96979	42,31086	C19
Cabrera A	300	325	2,61903	39,83703	C22
Cabrera A	300	325	2,61903	39,83703	C23
Cabrera A	300	325	2,61903	39,83703	C34
Cabrera A	300	325	2,61903	39,83703	Tiles
Cabrera A	300	325	2,61903	39,83703	Beltran 72
Cabrera C	225	225	2,61903	39,83703	C25
Cabrera C	225	225	2,61903	39,83703	C26

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Cabrera C	225	225	2,61903	39,83703	C34
Cabrera C	225	225	2,61903	39,83703	Beltran 68
Cabrera C	225	225	2,61903	39,83703	Beltran 72
Cabrera D	1	15	2,62903	39,83703	C10
Cabrera D	1	15	2,62903	39,83703	C16
Cabrera D	1	15	2,62903	39,83703	Metal
Cabrera E	-10	25	2,60903	39,83703	C10
Cabrera E	-10	25	2,60903	39,83703	Metal
Cadiz B	-100	-40	-6,2	36,31	C10
Cadiz C	1	250	-6,2	36,31	C25
Cadiz C	1	250	-6,2	36,31	Dolia
Cadiz D	-25	25	-6,2	36,31	C14
Cadiz D	-25	25	-6,2	36,31	C16
Cadiz D	-25	25	-6,2	36,31	C19
Caesarea A	350	500	34,74349	32,48188	C49
Caesarea B	175	275	34,75436	32,38913	C49
Caesarea Cove	-125	-75	34,8344	32,69137	C10
Caesarea Cove	-125	-75	34,8344	32,69137	C9
Caesarea Cove	-125	-75	34,8344	32,69137	Cnidian
Cagliari A	1	300	9,2	39,1	C27
Cagliari B	200	350	9,2	39,1	African
Cal Cativa	-50	25	3,13	42,21	C6
Cala Cupa	75	125	10,86672	42,29524	C36
Cala Cupa	75	125	10,86672	42,29524	C25
Cala Cupa	75	125	10,86672	42,29524	C27
Cala Cupa	75	125	10,86672	42,29524	C42
Cala di li Francesi	-100	100	9,20671	41,25243	Dolia
Cala Mindola	-100	-25	12,40293	37,73827	C4
Cala Mindola	-100	-25	12,40293	37,73827	C5
Cala Rossana	1	50	13,40216	40,74473	C16
Cala Rossana	1	50	13,40216	40,74473	Metal
Cala Vellana	50	60	4,30955	39,93601	C10
Cala Vellana	50	60	4,30955	39,93601	Ceramics
Cala Vellana	50	60	4,30955	39,93601	Ovoidal
Camarina A	175	200	14,37361	36,82798	C33
Camarina A	175	200	14,37361	36,82798	Ceramics
Camarina A	175	200	14,37361	36,82798	Metal
Camarina A	175	200	14,37361	36,82798	Stones
Cap Bear A	-50	25	3,31219	42,29324	C6
Cap Bear C	-50	-25	3,3004	42,34705	C14
Cap Bear C	-50	-25	3,3004	42,34705	C4
Cap Bear C	-50	-25	3,3004	42,34705	C6
Cap Bear C	-50	-25	3,3004	42,34705	Tarraconensis I
Cap Benat A	30	190	6,68955	43,31026	C21
Cap Benat A	30	190	6,68955	43,31026	Ibizan
Cap Benat B	-125	-75	6,68955	43,31026	C5

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Cap Benat B	-125	-75	6,68955	43,31026	Dolia
Cap Benat C	1	50	6,68955	43,31026	C15
Cap Benat C	1	50	6,68955	43,31026	C27
Cap Benat D	-130	-110	6,69272	43,31746	C3
Cap Blanc	295	325	2,66678	39,36168	Beltran 72
Cap Blanc	295	325	2,66678	39,36168	C23
Cap Blanc	295	325	2,66678	39,36168	C34
Cap Bon A	1	100	11,14048	37,09824	C15
Cap Bon B	-75	100	11,14048	37,09824	C10
Cap Camarat A	-100	-25	6,71048	43,24473	C4
Cap Camarat A	-100	-25	6,71048	43,24473	Ovoidal
Cap Camarat B	-75	-25	6,71048	43,24473	C4
Cap Camarat B	-75	-25	6,71048	43,24473	C8
Cap Camarat B	-75	-25	6,71048	43,24473	Dressel 26
Cap Croisette	200	400	5,45907	43,17931	African
Cap de Creus	-50	25	3,19176	43,13266	C6
Cap de Garde	285	365	7,72715	37,01487	C34
Cap del Vol	-10	5	3,13844	42,15913	C6
Cap del Vol	-10	5	3,13844	42,15913	Ceramics
Cap Gros A	-100	-50	7,16319	43,57077	C3
Cap Gros A	-100	-50	7,16319	43,57077	C4
Cap Gros C	-50	-25	7,17956	43,57062	C10
Cap Gros C	-50	-25	7,17956	43,57062	C16
Cap Gros C	-50	-25	7,17956	43,57062	C6
Cap Gros C	-50	-25	7,17956	43,57062	C8
Cap Gros Collioure	-50	25	3,20481	42,36381	C6
Cap Leucate A	1	275	3,19623	42,52706	C25
Cap Leucate B	-50	100	3,19711	42,52706	C10
Cap Negret	-110	-90	1,17	39	C32
Cap Negret	-110	-90	1,17	39	C4
Cap Roux B	-120	-80	6,92527	43,44836	C3
Cap Roux B	-120	-80	6,92527	43,44836	C8
Cap Roux B	-120	-80	6,92527	43,44836	C9
Cap Sicié	-75	-70	5,85129	43,03888	C8
Cap Sicié	-75	-70	5,85129	43,03888	Ovoidal
Cap Tailliat	-100	100	6,39	43,1	C3
Cap Tailliat	-100	100	6,39	43,1	Ceramics
Cape Andreas B	600	700	34,35	35,4	C54
Cape Andreas C	450	650	34,35	35,4	C44
Cape Andreas E	450	650	34,35	35,4	C44
Cape Izmetiste	100	150	16,23	43,1	C10
Cape Izmetiste	100	150	16,23	43,1	Stones
Cape Izmetiste	100	150	16,23	43,1	Tiles
Cape Kiti B	-10	40	33,37	34,48	Dressel 6
Capo Carbonara B	200	275	9,67901	39,37656	C33
Capo di Torre Cavallo	-150	-50	18,35782	40,38423	C8

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Capo di Torre Cavallo	-150	-50	18,35782	40,38423	Dressel 1
Capo Enfola	-150	-100	10,32498	42,70523	C3
Capo Granitola A	225	275	12,59651	37,48542	C47
Capo Granitola A	225	275	12,59651	37,48542	Stones
Capo Graziano A	-160	-140	14,66258	38,52298	C2
Capo Graziano A	-160	-140	14,66258	38,52298	C3
Capo Graziano A	-160	-140	14,66258	38,52298	C9
Capo Graziano A	-160	-140	14,66258	38,52298	Ceramics
Capo Graziano C	1	10	14,66258	38,52298	C10
Capo Graziano C	1	10	14,66258	38,52298	C15
Capo Graziano C	1	10	14,66258	38,52298	C16
Capo Graziano C	1	10	14,66258	38,52298	C25
Capo Graziono H	-100	-50	14,66258	38,52298	C8
Capo Graziono M	150	250	14,66258	38,52298	C33
Capo Graziono M	150	250	14,66258	38,52298	C34
Capo Mele	-150	-150	8,16991	43,92898	C3
Capo Plaia	200	275	13,56	38,1	C33
Capo Plaia	200	275	13,56	38,1	C36
Capo Rasocolmo C	-150	-75	15,30107	38,2879	C3
Capo San Alessio	100	300	15,21	37,54	C40
Capo Sant Andrea A	-60	-35	10,83194	42,7018	C4
Capo Sant Andrea A	-60	-35	10,83194	42,7018	Ovoidal
Capo Sant Andrea B	-125	-100	10,882	42,64874	C3
Capo Sant Andrea B	-125	-100	10,882	42,64874	C4
Capo Sant Andrea B	-125	-100	10,882	42,64874	C5
Capo Testa A	1	75	9,62502	41,119	C15
Capo Testa A	1	75	9,62502	41,119	C16
Capo Testa B	-75	-25	9,62502	41,109	C4
Capo Testa B	-75	-25	9,62502	41,109	Dolia
Capo Testa B	-75	-25	9,62502	41,109	Metal
Caprera	100	200	9,25861	41,26195	C25
Carmel Beach A	300	400	34,67101	32,23261	C38
Carqueiranne	-75	-25	5,91751	43,04793	C4
Carro B	-125	-75	5,36106	43,25814	C3
Carro C	1	275	5,36106	43,25814	C25
Cassidaigne	-100	-1	5,19748	43,28849	C10
Cassidaigne	-100	-1	5,19748	43,28849	C4
Cassidaigne	-100	-1	5,19748	43,28849	Dressel 44-45
Cassis	-100	-1	5,61691	43,14551	C4
Castillo	1	100	-0,72241	37,77411	C18
Catalans	350	350	5,35374	43,23871	C23
Catalans	350	350	5,35374	43,23871	C26
Catalans	350	350	5,35374	43,23871	Beltran 72
Cattolica	-100	-25	12,53381	44,15072	C8
Cavalière/Lavandou	-125	-75	6,82272	43,38892	C10
Cavalière/Lavandou	-125	-75	6,82272	43,38892	C3

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Cavalière/Lavandou	-125	-75	6,82272	43,38892	C5
Cavalière/Lavandou	-125	-75	6,82272	43,38892	C8
Cavalière/Lavandou	-125	-75	6,82272	43,38892	Coan
Cavalière/Lavandou	-125	-75	6,82272	43,38892	Punic
Cavallo A	40	60	9,25867	41,3571	C10
Cavallo A	40	60	9,25867	41,3571	Glass
Caveaux A	-125	-75	5,32374	43,20801	C3
Caveaux B	-125	-100	5,32374	43,20801	C5
Cavtat	-100	-25	18,08351	42,52752	C8
Cecina	-125	-75	10,39724	43,205	C5
Cervo	-50	100	8,2883	43,98112	C10
Chia	200	275	8,62485	38,87658	C25
Chiessi	60	85	10,59772	42,74359	C10
Chiessi	60	85	10,59772	42,74359	C15
Chiessi	60	85	10,59772	42,74359	C18
Chiessi	60	85	10,59772	42,74359	C19
Chiessi	60	85	10,59772	42,74359	C25
Chiessi	60	85	10,59772	42,74359	Metal
Chiessi	60	85	10,59772	42,74359	Ibizan
Chrétienne A	-150	-100	6,88381	43,41672	C3
Chrétienne A	-150	-100	6,88381	43,41672	C8
Chrétienne B	50	200	6,88381	43,41672	C19
Chrétienne D	325	375	6,88381	43,41672	C23
Chrétienne D	325	375	6,88381	43,41672	C26
Chrétienne D	325	375	6,88381	43,41672	Beltran 72
Chrétienne D	325	375	6,88381	43,41672	Ovoidal
Chrétienne H	15	20	6,88381	43,41672	C10
Chrétienne H	15	20	6,88381	43,41672	C25
Chrétienne H	15	20	6,88381	43,41672	C16
Chrétienne H	15	20	6,88381	43,41672	Punic
Chrétienne I	1	100	6,88381	43,41672	C16
Chrétienne I	1	100	6,88381	43,41672	C31
Chrétienne I	1	100	6,88381	43,41672	Dressel 26
Chrétienne J	-125	-75	6,88381	43,41672	C5
Chrétienne J	-125	-75	6,88381	43,41672	Metal
Cikat	-100	100	14,4602	44,36917	C8
Ciotat C	-125	-75	5,79856	43,04007	C3
Circeo C	-150	-1	13,53804	41,14113	Dressel 1
Circeo D	-25	25	13,23804	41,16113	C10
Circeo D	-25	25	13,23804	41,16113	Dolia
Circeo E	200	400	13,73804	41,15113	C34
Colonia de Sant Jordi A	-100	-100	3	39,18	C10
Colonia de Sant Jordi A	-100	-100	3	39,18	C3
Colonia de Sant Jordi A	-100	-100	3	39,18	C5
Colonia de Sant Jordi A	-100	-100	3	39,18	C8
Colonia de Sant Jordi A	-100	-100	3	39,18	Ceramics

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Colonia de Sant Jordi A	-100	-100	3	39,18	Dolia
Colonia de Sant Jordi A	-100	-100	3	39,18	Cnidian
Colonia de Sant Jordi A	-100	-100	3	39,18	Punic
Colonia de Sant Jordi C	250	300	3	39,18	C34
Columbretes	-25	75	0,64007	39,88175	C16
Conillera	30	190	1,30891	38,70987	C21
Corfu	300	500	19,62671	39,81403	C63
Cueva del Jarro B	50	100	-3,44902	36,65241	C19
Cueva del Jarro B	50	100	-3,44902	36,65241	C25
Cükertme B	-100	-1	27,47	37	Cnidian
Culip A	-50	25	3,17	42,19	C6
Culip C	-50	25	3,17	42,19	Pascual 2
Culip D	70	80	3,17	42,19	C25
Culip D	70	80	3,17	42,19	Ceramics
Culip E	50	100	3,17	42,19	C18
Datça B	650	725	27,3589	36,66697	C43
Datça B	650	725	27,3589	36,66697	C44
Datça C	275	325	27,32075	36,72126	C56
Datça C	275	325	27,32075	36,72126	Robinson K114
Delphinion	400	600	26,19176	38,47648	C44
Delphinion	400	600	26,19176	38,47648	Riley D377
Denia	150	225	0,62182	38,75563	C25
Dhia A	1	100	25,17022	35,38163	C10
Dhia A	1	100	25,17022	35,38163	C24
Dhia A	1	100	25,17022	35,38163	C9
Dhia A	1	100	25,17022	35,38163	C32
Dhia A	1	100	25,17022	35,38163	Nubian
Dhrapi	-250	-50	23,15	37,15	C9
Diano Marina	50	50	8,1883	43,96112	C16
Diano Marina	50	50	8,1883	43,96112	C10
Diano Marina	50	50	8,1883	43,96112	Ceramics
Diano Marina	50	50	8,1883	43,96112	Dolia
Dor A	600	650	34,64202	32,15436	C49
Dor A	600	650	34,64202	32,15436	C63
Dor D	575	600	34,72174	32,33339	C49
Dor D	575	600	34,72174	32,33339	C63
Dor E	500	700	34,63115	32,05945	C49
Dor F	600	650	34,57317	31,94133	C63
Dor G	600	650	34,52968	31,83771	C63
Dragonera A	200	275	2,40678	39,48168	C34
Dragonera B	-100	-25	2,39678	39,48168	C4
Dramont A	-50	-50	6,83599	43,408	C6
Dramont A	-50	-50	6,83599	43,408	C10
Dramont A	-50	-50	6,83599	43,408	C32
Dramont A	-50	-50	6,83599	43,408	C4
Dramont A	-50	-50	6,83599	43,408	C8

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Dramont B	1	25	6,83599	43,408	C10
Dramont B	1	25	6,83599	43,408	Tarraconensis I
Dramont C	-125	-100	6,83599	43,408	C4
Dramont C	-125	-100	6,83599	43,408	C5
Dramont C	-125	-100	6,83599	43,408	C8
Dramont C	-125	-100	6,83599	43,408	Ceramics
Dramont C	-125	-100	6,83599	43,408	Metal
Dramont D	40	50	6,83599	43,408	C16
Dramont D	40	50	6,83599	43,408	C10
Dramont D	40	50	6,83599	43,408	C16
Dramont D	40	50	6,83599	43,408	C9
Dramont D	40	50	6,83599	43,408	Kingsholm 117
Dramont E	420	425	6,83599	43,408	C49
Dramont E	420	425	6,83599	43,408	C51
Dramont E	420	425	6,83599	43,408	Keay 35
Dramont F	400	400	6,82599	43,408	C23
Dramont F	400	400	6,82599	43,408	C51
Dramont F	400	400	6,82599	43,408	Cylindrical
Dramont F	400	400	6,82599	43,408	Keay 52
Drazica	-50	-1	14,52	44,47	C10
Drazica	-50	-1	14,52	44,47	C8
Dunas del Pinatar	1	250	-0,73241	37,77411	C25
Eloro A	300	350	15,11	36,5	C51
Embiez	-150	-50	5,78448	43,06012	C5
Escolletes A	200	300	-0,71241	37,73411	C23
Escolletes B	200	500	-0,71241	37,73411	C46
Escombreras	-140	-100	-0,82144	37,55827	C3
Esculls	-100	-25	-0,71241	37,77411	C5
Esculls	-100	-25	-0,71241	37,77411	Ceramics
Espines	-25	50	-0,71241	37,72411	C16
Esquillade	-150	-100	6,364	43,08002	C3
Estérel	-100	-100	6,0847	43,01531	C10
Estérel	-100	-100	6,0847	43,01531	C4
Estérel	-100	-100	6,0847	43,01531	C5
Estérel	-100	-100	6,0847	43,01531	C3
Estérel	-100	-100	6,0847	43,01531	C5
Est-Perduto	1	50	9,32717	41,37992	C10
Est-Perduto	1	50	9,32717	41,37992	Ibizan
Fano	-200	-1	13,55072	43,64989	C8
Femmina Morta	325	325	14,39361	36,79798	C23
Femmina Morta	325	325	14,39361	36,79798	C26
Femmina Morta	325	325	14,39361	36,79798	C33
Femmina Morta	325	325	14,39361	36,79798	C34
Femmina Morta	325	325	14,39361	36,79798	Ceramics
Femmina Morta	325	325	14,39361	36,79798	Cylindrical
Femmina Morta	325	325	14,39361	36,79798	Keay 81

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Filicudi Porto	475	550	14,66258	38,52298	Keay 62
Fontanamare A	290	310	8,24869	39,17697	C34
Fontanamare A	290	310	8,24869	39,17697	Ceramics
Fos A	-50	-25	4,7731	43,32947	C14
Fos A	-50	-25	4,7731	43,32947	C4
Fos A	-50	-25	4,7731	43,32947	Ceramics
Fos B	1	100	4,7731	43,32947	Dressel 6
Fourmigue A	-125	-75	6,07663	43,03761	C3
Fourmigue A	-125	-75	6,07663	43,03761	Ceramics
Fourmigue C	-80	-60	6,07789	43,04415	C4
Fourmigue C	-80	-60	6,07789	43,04415	C8
Fourmigues	50	50	6,07002	43,04161	C10
Freu d'en Valento	-50	25	2,21852	41,34297	C6
Gandolfo	90	110	-2,33977	36,7802	C18
Gandolfo	90	110	-2,33977	36,7802	C20
Gandolfo	90	110	-2,33977	36,7802	Dressel 17
Garoupe A	10	35	7,16319	43,57077	C10
Garoupe A	10	35	7,16319	43,57077	Dolia
Garoupe B	-100	-25	7,17956	43,58062	C4
Garoupe C	140	200	7,17956	43,58062	C25
Genoa	-130	-110	8,76585	44,38148	C10
Genoa	-130	-110	8,76585	44,38148	C3
Genoa	-130	-110	8,76585	44,38148	Ceramics
Gibraltar	1	100	-5,34975	36,07897	C16
Giglio Porto	200	225	10,86672	42,28524	C38
Giglio Porto	200	225	10,86672	42,28524	C34
Giglio Porto	200	225	10,86672	42,28524	Metal
Giraglia			9,40413	43,01651	C10
Giraglia			9,40413	43,01651	C25
Giraglia			9,40413	43,01651	C29
Giraglia			9,40413	43,01651	Dolia
Givat Olga	500	700	34,4717	31,74133	C49
Glavat	-25	-1	17,40597	42,66174	C10
Glavat	-25	-1	17,40597	42,66174	C8
Glavat	-25	-1	17,40597	42,66174	C9
Goica	-25	50	16,24	43,1	C10
Goica	-25	50	16,24	43,1	Dressel 6
Goica	-25	50	16,24	43,1	Dressel 1
Golfet	-100	-75	3,15	42,2	C3
Golfet	-100	-75	3,15	42,2	C5
Gorgona A	1	100	9,81647	43,36249	C16
Gorgona A	1	100	9,81647	43,36249	C18
Gospa Prizidnica	-50	-50	16,21	43,29	C8
Grado	200	200	13,45841	45,5941	C11
Grado	200	200	13,45841	45,5941	C33
Grado	200	200	13,45841	45,5941	C34

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Grado	200	200	13,45841	45,5941	C36
Grado	200	200	13,45841	45,5941	C46
Grado	200	200	13,45841	45,5941	C56
Grado	200	200	13,45841	45,5941	Glass
Grado	200	200	13,45841	45,5941	Metal
Graham Bank A	-150	-100	12,41	37,11	C3
Graham Bank B	375	450	12,41	37,11	Cylindrical
Graham Bank B	375	450	12,41	37,11	Keay 32
Grand Avis	-100	-75	6,27	43,1	C4
Grand Avis	-100	-75	6,27	43,1	Ceramics
Grand Bassin B	-110	-90	3,70095	43,37707	C3
Grand Bassin B	-110	-90	3,70095	43,37707	Ceramics
Grand Congloué B	-110	-80	5,40501	43,17377	C3
Grand Congloué B	-110	-80	5,40501	43,17377	Ceramics
Grand Congloué B	-110	-80	5,40501	43,17377	Punic
Grand Congloué C	-50	-50	5,40501	43,17377	C14
Grand Congloué C	-50	-50	5,40501	43,17377	Ovoidal
Grand Congloué C	-50	-50	5,40501	43,17377	Tarraconensis I
Grand Radeau	-45	-35	4,32266	43,41672	Dressel 1
Grand Ribaud A	-120	-100	6,14311	43,01113	C3
Grand Ribaud A	-120	-100	6,14311	43,01113	C5
Grand Ribaud A	-120	-100	6,14311	43,01113	Ovoidal
Grand Ribaud D	-10	-1	6,14311	43,01113	C10
Grand Ribaud D	-10	-1	6,14311	43,01113	C16
Grand Ribaud D	-10	-1	6,14311	43,01113	C6
Grand Ribaud D	-10	-1	6,14311	43,01113	C9
Grand Ribaud D	-10	-1	6,14311	43,01113	Dolia
Grand Rouveau	50	50	5,77448	43,06012	C10
Grand Soufre	-100	-25	5,34163	43,19265	C4
Grande Grenille	-150	-25	7,17956	43,58062	Dressel 1
Gravisca	50	50	11,47917	42,17227	C16
Gravisca	50	50	11,47917	42,17227	Metal
Greben A	-25	-1	14,67359	44,24072	C10
Gros Mur	-100	-25	6,1247	43,01531	C4
Grotticelle	-50	-50	13,41216	40,74473	Dressel 1
Guardias Viejas	50	125	-2,39977	36,8002	C16
Guardias Viejas	50	125	-2,39977	36,8002	C20
Guardias Viejas	50	125	-2,39977	36,8002	C25
Guardis B	1	25	3	39,18	C10
Guardis B	1	25	3	39,18	C16
Guardis B	1	25	3	39,18	C6
Guernsey	275	300	-2,49983	49,435	C38
Guernsey	275	300	-2,49983	49,435	C58
Guernsey	275	300	-2,49983	49,435	Ceramics
Gusteranski	75	200	15,64401	43,5702	C19
Gusteranski	75	200	15,64401	43,5702	C34

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Gusteranski	75	200	15,64401	43,5702	C42
Gusteranski	75	200	15,64401	43,5702	Ceramics
Gusteranski	75	200	15,64401	43,5702	Keay 16
Gusteranski	75	200	15,64401	43,5702	Portorecanato
Heliopolis A	300	400	6,25	43,1	C45
Hormigas	425	550	-0,67241	37,68411	Keay 35
Hornillo	-80	-50	-1,4851	37,38779	C31
Hornillo	-80	-50	-1,4851	37,38779	C5
Hornillo	-80	-50	-1,4851	37,38779	Metal
Host B	1	100	16,06496	43,02108	Dressel 35-36
Ile-Rousse	50	50	8,56	42,38	C10
Ile-Rousse	50	50	8,56	42,38	Dolia
Ile-Rousse	50	50	8,56	42,38	Metal
Ilot Barthelemy	-125	-100	6,66982	43,17727	C3
Ilot Barthelemy	-125	-100	6,66982	43,17727	C5
Ilot Barthelemy	-125	-100	6,66982	43,17727	C8
Ilot Barthelemy	-125	-100	6,66982	43,17727	Ovoidal
Ilovik	120	120	14,5102	44,33917	C10
Ilovik	120	120	14,5102	44,33917	C11
Ilovik	120	120	14,5102	44,33917	C42
Ilovik	120	120	14,5102	44,33917	Ceramics
Ilovik	120	120	14,5102	44,33917	Metal
Imera	285	350	13,42006	38,12798	African
Imperia	-100	-25	7,9825	43,81518	C4
Ince Ada	1	100	28,13	36,41	C11
Iskandil Burnu A	575	575	27,2	36,42	C45
Iskandil Burnu A	575	575	27,2	36,42	C49
Iskandil Burnu A	575	575	27,2	36,42	C63
Iskandil Burnu A	575	575	27,2	36,42	Ceramics
Isla Pedrosa	-150	-140	3,1941	42,42999	C3
Isla Pedrosa	-150	-140	3,1941	42,42999	Ceramics
Isla Pedrosa	-150	-140	3,1941	42,42999	Stones
Isla Pedrosa	-150	-140	3,1941	42,42999	Ovoidal
Isla Pedrosa	-150	-140	3,1941	42,42999	Punic
Isle of Wight	1	100	-1,1031	50,60439	C15
Isola delle Correnti	200	400	15,20167	36,78909	C34
Isola delle Correnti	200	400	15,20167	36,78909	Stones
Ist	-100	100	14,71359	44,22072	C8
Jarre	10	50	5,36219	43,19208	C25
Jaumegarde A	-100	-25	6,93818	43,43145	C4
Jaz	-25	-1	15,78401	43,5102	C10
Jaz	-25	-1	15,78401	43,5102	C8
Karabagla	1	100	27,14	37	C9
Karabagla	1	100	27,14	37	Ceramics
Karantunic	-150	-1	15,14	44	C8
Kekova Oludeniz	400	600	29,88	36,18	C63

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Kioni Bay			32,3	35,1	C27
Kioni Bay			32,3	35,1	C9
Kizilagac Adasi	400	600	27,41	36,74	C63
Komiza	1	200	15,99496	43,00108	Egypt
Kopa			13,74824	44,83081	C8
Kopiste	1	100	16,5103	42,90647	C10
Kopiste	1	100	16,5103	42,90647	C8
Koppo	-100	-1	32,16	35,2	C9
Koppo	-100	-1	32,16	35,2	Dolia
Korcula	-150	-150	17,18597	42,76174	C8
Koromasna	1	100	15,61401	43,5802	C11
Koromasna	1	100	15,61401	43,5802	C39
Koromasna	1	100	15,61401	43,5802	C41
Krava	1	200	16,13	43,4	C10
Krava	1	200	16,13	43,4	C42
Krbar			15,38401	43,71597	Dressel 29
Kurba Vela	-150	-1	15,52401	43,60597	C8
Kvarner Gulf	1	100	14,10144	44,9366	C10
Kythera	-50	110	23,1574	36,11634	C9
Ladispoli A	1	15	12,3	41,57	C15
Ladispoli A	1	15	12,3	41,57	C10
Ladispoli A	1	15	12,3	41,57	Dolia
Lampedusa A	300	350	12,57569	35,47693	C34
Lampedusa A	300	350	12,57569	35,47693	C47
Lampedusa A	300	350	12,57569	35,47693	Globular
Lampedusa A	300	350	12,57569	35,47693	Panella 34
Lampedusa A	300	350	12,57569	35,47693	Pear-shaped
Lampedusa B	-100	-100	12,57569	35,47693	C9
Lampione	-100	-1	12,51513	35,49735	C4
Lampione	-100	-1	12,51513	35,49735	C8
Lastovo B	-150	-150	16,6203	42,91647	C8
Lastovo C	-100	-1	16,6203	42,91647	C8
Lastovo D	-100	-1	16,6203	42,91647	C8
Lastovska	-25	-1	17,37597	42,65174	C8
Lastovska	-25	-1	17,37597	42,65174	C9
Laurons B	175	200	5,2391	43,29797	C36
Laurons B	175	200	5,2391	43,29797	Gaulish
Laurons C	200	300	5,2391	43,29797	C25
Laurons C	200	300	5,2391	43,29797	C27
Lavezzi (Balise)	45	75	9,25772	41,32666	C10
Lavezzi (Balise)	45	75	9,25772	41,32666	C20
Lavezzi (Balise)	45	75	9,25772	41,32666	C25
Lavezzi A	25	50	9,25772	41,32666	C15
Lavezzi A	25	50	9,25772	41,32666	C16
Lavezzi A	25	50	9,25772	41,32666	C20
Lavezzi A	25	50	9,25772	41,32666	C25

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Lavezzi A	25	50	9,25772	41,32666	C30
Lavezzi A	25	50	9,25772	41,32666	Glass
Lavezzi A	25	50	9,25772	41,32666	Metal
Lavezzi A	25	50	9,25772	41,32666	Pear-shaped Et
Lavezzi B	40	70	9,25772	41,32666	C16
Lavezzi B	40	70	9,25772	41,32666	C25
Lavezzi B	40	70	9,25772	41,32666	Ceramics
Lavezzi B	40	70	9,25772	41,32666	Metal
Lavezzi C	50	100	9,25772	41,32666	C20
Lavezzi C	50	100	9,25772	41,32666	Dressel 17
Lavezzi D	100	150	9,25772	41,32666	C19
Lavezzi D	100	150	9,25772	41,32666	C20
Lavezzi D	100	150	9,25772	41,32666	C25
Lavezzi F	300	325	9,25772	41,32666	C38
Lavezzi F	300	325	9,25772	41,32666	C40
Lavezzi F	300	325	9,25772	41,32666	Cylindrical
Lazzaretto	320	320	8,34799	40,35283	C22
Lazzaretto	320	320	8,34799	40,35283	C23
Lazzaretto	320	320	8,34799	40,35283	C25
Lazzaretto	320	320	8,34799	40,35283	C34
Lazzaretto	320	320	8,34799	40,35283	Cylindrical
Lido di Sant Anna	-150	-25	17,48815	40,26052	C8
Lindos A	-50	100	28,14821	36,04211	C9
Lirica	1	100	17,34597	42,70174	C8
Little Russel A	75	125	-2,5054	49,45725	C19
Little Russel A	75	125	-2,5054	49,45725	Tiles
Little Russel B	1	75	-2,48056	49,45169	C16
Lokunji	1	100	14,3602	44,47917	C10
Luque B	300	325	5,33163	43,22645	Ceramics
Luque B	300	325	5,33163	43,22645	African
Luque B	300	325	5,33163	43,22645	Globular
Macchia Tonda	50	100	11,92926	41,81401	C20
Macchia Tonda	50	100	11,92926	41,81401	C27
Madrague de Giens	-70	-50	6,11383	43,05921	C10
Madrague de Giens	-70	-50	6,11383	43,05921	C15
Madrague de Giens	-70	-50	6,11383	43,05921	C36
Madrague de Giens	-70	-50	6,11383	43,05921	C6
Madrague de Giens	-70	-50	6,11383	43,05921	C8
Madrague de Giens	-70	-50	6,11383	43,05921	C9
Madrague de Giens	-70	-50	6,11383	43,05921	Chian
Madrague de Giens	-70	-50	6,11383	43,05921	Dressel 26
Madrague de Giens	-70	-50	6,11383	43,05921	Punic
Madrague de Giens	-70	-50	6,11383	43,05921	Thasian
Madrague de Giens	-70	-50	6,11383	43,05921	C3
Madrague de Giens	-70	-50	6,11383	43,05921	C4
Madrague de Giens	-70	-50	6,11383	43,05921	Ceramics

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Madrague de Giens	-70	-50	6,11383	43,05921	Metal
Magnons A	-50	50	5,77448	43,06012	C10
Magnons A	-50	50	5,77448	43,06012	C14
Magnons A	-50	50	5,77448	43,06012	C16
Maharac	1	100	17,58597	42,62174	C9
Maharac	1	100	17,58597	42,62174	Ceramics
Mahdia	-80	-50	11,22041	35,19068	C10
Mahdia	-80	-50	11,22041	35,19068	C14
Mahdia	-80	-50	11,22041	35,19068	C3
Mahdia	-80	-50	11,22041	35,19068	C4
Mahdia	-80	-50	11,22041	35,19068	Stones
Mahdia	-80	-50	11,22041	35,19068	Punic
Maïtre A	-150	-25	5,34712	43,2011	C8
Maïtre B	125	125	5,34712	43,2011	C25
Maïtre C	-110	-90	5,36219	43,19208	C3
Maïtre D	-125	-75	5,36219	43,19208	C3
Majorca	100	200	3,4	39,5	C25
Mal di Ventre	-50	-50	8,32233	39,57303	Dressel 1
Mal di Ventre	-50	-50	8,32233	39,57303	Metal
Mala Palagruza	-25	50	16,20227	42,47514	Dolia
Mali Frasker	1	100	13,72824	44,84081	C8
Mandalya Gulf A	-50	50	27,25	37,1	C10
Maraone	-100	-1	12,43293	37,73827	C10
Maratea A	50	50	15,71782	39,6303	C10
Maratea B	25	260	15,69782	39,6503	C25
Maratea C	200	400	15,69782	39,6503	C22
Margarida	-150	-100	3,6	41,4	C3
Margarida	-150	-100	3,6	41,4	C5
Marisma de las Mesas	-200	-1	-6,11	36,48	Dressel 1
Marritza	75	125	8,3006	40,52697	C10
Marritza	75	125	8,3006	40,52697	C16
Marsa Lucch	500	650	24,2063	32,15643	C51
Marseillan Plage A	-125	-75	5,2687	43,31918	C3
Marseillan Plage B	50	100	5,2687	43,31918	C25
Marseillan Plage B	50	100	5,2687	43,31918	Metal
Marzamemi A	200	250	15,50167	36,84909	C47
Marzamemi A	200	250	15,50167	36,84909	C56
Marzamemi A	200	250	15,50167	36,84909	Stones
Marzamemi A	200	250	15,50167	36,84909	African
Marzamemi D	325	350	15,50167	36,85909	C34
Marzamemi D	325	350	15,50167	36,85909	Beltran 68
Marzamemi D	325	350	15,50167	36,85909	Cylindrical
Marzamemi F	275	300	15,50167	36,84909	C22
Marzamemi F	275	300	15,50167	36,84909	C23
Marzamemi F	275	300	15,50167	36,84909	C34
Marzamemi G	-150	-150	15,50167	36,85909	C8

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Marzamemi G	-150	-150	15,50167	36,85909	C9
Marzamemi G	-150	-150	15,50167	36,85909	Cnidian
Masa d'Or	-100	-25	3,18	42,19	C4
Masa d'Or	-100	-25	3,18	42,19	C8
Matala	-50	110	24,62916	34,96661	Schoene 8
Mateille A	400	425	3,86405	43,44762	C23
Mateille A	400	425	3,86405	43,44762	C26
Mateille A	400	425	3,86405	43,44762	Metal
Mateille B	1	100	3,87666	43,45603	C16
Medas A	-125	-75	3,13	42,2	C3
Medas B	-50	25	3,13	42,2	C6
Mellieha	200	250	14,38398	35,74398	C56
Mellieha	200	250	14,38398	35,74398	Glass
Methone C	200	250	21,51141	36,81176	C47
Methone C	200	250	21,51141	36,81176	Stones
Miladou	-150	-50	6,2388	42,9813	C3
Miladou	-150	-50	6,2388	42,9813	C4
Miladou	-150	-50	6,2388	42,9813	C5
Miladou	-150	-50	6,2388	42,9813	Punic
Miramar	-50	-25	-6,93288	34,06438	Tiles
Miramar	-50	-25	-6,93288	34,06438	Ovoidal
Mlin	1	200	16,14	43,27	C10
Mlin	1	200	16,14	43,27	C42
Mlin	1	200	16,14	43,27	C9
Mljet B	75	100	17,39597	42,66174	C13
Mljet B	75	100	17,39597	42,66174	C41
Mljet B	75	100	17,39597	42,66174	C7
Mljet B	75	100	17,39597	42,66174	Ceramics
Mljet B	75	100	17,39597	42,66174	Glass
Mljet B	75	100	17,39597	42,66174	Crete
Molat	-100	100	14,76359	44,17072	C8
Monaco A	200	250	7,43999	43,72381	C34
Monaco A	200	250	7,43999	43,72381	C38
Monaco B	-150	-150	7,43999	43,72381	C2
Monaco C	-100	-25	7,43999	43,72381	C8
Monaco C	-100	-25	7,43999	43,72381	Ovoidal
Monaco D	-150	-150	7,43999	43,72381	C2
Montecristo	100	250	10,26721	42,30989	C27
Montecristo E	-100	-25	10,33246	42,29442	C4
Morovnik	300	425	14,62416	44,40919	African
Mortorius	30	55	9,19	39,11	C15
Mortorius	30	55	9,19	39,11	C16
Mortorius	30	55	9,19	39,11	C17
Mrcara	1	100	16,5603	42,90647	C10
Murter	-150	-1	15,54401	43,66597	C8
Napoli	200	250	14,31484	40,50288	C33

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Naregno	200	400	10,21503	42,70283	African
Nau Perduda	-60	-40	3,10245	41,81401	C4
Nau Perduda	-60	-40	3,10245	41,81401	C8
Nau Perduda	-60	-40	3,10245	41,81401	Stones
Negres	150	150	3,11245	41,82401	C19
Negres	150	150	3,11245	41,82401	C25
Neseber B	500	625	27,50216	42,46104	C43
Niolon	1	100	5,27558	43,26871	C10
Niolon	1	100	5,27558	43,26871	Glass
Noce (Fiume)	-50	100	15,70782	39,6303	C10
Nora	300	400	9,04626	38,98729	C22
Nora Harbour			9,04626	38,98729	C19
Nora Harbour			9,04626	38,98729	C34
Nora Harbour			9,04626	38,98729	C47
Nueva Tabara			-0,4392	38,18349	C10
Nueva Tabara			-0,4392	38,18349	C23
Nueva Tabara			-0,4392	38,18349	C25
Nueva Tabara			-0,4392	38,18349	C26
Nueva Tabara			-0,4392	38,18349	C34
Nueva Tabara			-0,4392	38,18349	C6
Ognina (Catania) A	-150	-25	15,25875	37,42076	C8
Ognina A	215	230	15,16	36,58	C25
Ognina A	215	230	15,16	36,58	C33
Ognina A	215	230	15,16	36,58	C47
Ognina A	215	230	15,16	36,58	C56
Ognina A	215	230	15,16	36,58	Glass
Ognina West	-100	-25	15,16	36,58	C8
Olbia A	-200	-1	9,71012	40,96578	C3
Olbia A	-200	-1	9,71012	40,96578	C32
Olbia A	-200	-1	9,71012	40,96578	C4
Olbia A	-200	-1	9,71012	40,96578	C42
Olbia A	-200	-1	9,71012	40,96578	C5
Olib A	300	425	14,66416	44,35919	African
Olib B	25	125	14,73359	44,25072	C18
Omisalj	-150	-50	14,26505	45,15536	C10
Omisalj	-150	-50	14,26505	45,15536	C8
Oscellucia	20	50	8,43	42,34	C25
Ostia	-50	50	12,5	41,4	Dolia
Ouest de Plane	-150	-50	5,38219	43,18152	C3
Ouest de Plane	-150	-50	5,38219	43,18152	C5
Ouest de Plane	-150	-50	5,38219	43,18152	C8
Ovrat	1	100	17,42597	42,65174	C10
Ovrat	1	100	17,42597	42,65174	C9
Pag	200	300	15	44,3	C34
Pag Area	275	300	15,00507	44,26844	Cylindrical
Palagruza A	-50	-50	16,19227	42,47514	C14

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Palagruza A	-50	-50	16,19227	42,47514	C4
Palagruza A	-50	-50	16,19227	42,47514	C8
Palagruza B	75	75	16,19227	42,47514	C10
Palagruza B	75	75	16,19227	42,47514	C13
Palagruza B	75	75	16,19227	42,47514	C15
Palagruza B	75	75	16,19227	42,47514	C18
Palagruza B	75	75	16,19227	42,47514	Ceramics
Palamos	-80	-30	3,08245	41,75401	Ceramics
Palamos	-80	-30	3,08245	41,75401	Tarraconensis I
Palombina Vecchia	-100	-50	13,68111	43,45608	C1
Palombina Vecchia	-100	-50	13,68111	43,45608	Ovoidal
Palu	500	600	6,2212	42,9813	C49
Palu	500	600	6,2212	42,9813	C63
Palu	500	600	6,2212	42,9813	Keay 62
Pampelonne	300	350	6,42	43,13	C23
Pampelonne	300	350	6,42	43,13	Cylindrical
Pampelonne	300	350	6,42	43,13	Globular
Pampelonne	300	350	6,42	43,13	Pear-shaped
Panarea (Alberti)	50	100	15,5	38,37	C11
Panarea (Alberti)	50	100	15,5	38,37	C10
Panarelli	-150	-70	15,6	38,38	C3
Paros A	1	100	25,16828	37,16854	C10
Paros B	-50	150	25,16828	37,16854	Dressel 6
Parzanj	1	100	16,19	43,1	C10
Parzanj	1	100	16,19	43,1	C16
Parzanj	1	100	16,19	43,1	Hispanic spindl
Parzanj	1	100	16,19	43,1	Panella 34
Pedagne A			18	40,7	Dressel 1
Pedagne B			18	40,7	C25
Pefkos	400	700	28,3	36,4	C43
Pelegrin	1	200	16,22	43,11	C9
Pelegrin	1	200	16,22	43,11	Ceramics
Peljesac	200	400	17,58597	42,66174	C34
Percheles	1	100	-2,31977	36,7702	C16
Perduta	15	25	9,29582	41,36853	C10
Perejil	-150	-150	-5,30999	36,07555	C3
Pernat B	-200	-100	14,19	44,57	C8
Pesaro	-125	-25	13,25	44,1	C8
Petit Congloué	40	60	5,39839	43,17941	C10
Petit Congloué	40	60	5,39839	43,17941	C29
Petit Congloué	40	60	5,39839	43,17941	Dolia
Pian di Spille	350	500	11,45917	42,16227	Keay 52
Pian di Spille	350	500	11,45917	42,16227	C51
Pianosa A	50	100	10,33578	43,41174	C10
Pianosa A	50	100	10,33578	43,41174	C19
Pianosa A	50	100	10,33578	43,41174	C25

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Pianosa A	50	100	10,33578	43,41174	C27
Piedra Negra	75	150	3,19	42,19	C25
Pierre Plates	300	325	6,2657	43,01411	Cylindrical
Pisa Lion Wreck			10,25275	43,5965	Massilian
Pisa Lion Wreck			10,25275	43,5965	Punic
Pisa Wreck B			10,25275	43,5965	C15
Pisa Wreck B			10,25275	43,5965	C16
Pisa Wreck B			10,25275	43,5965	C8
Pisa Wreck C	-25	25	10,25275	43,5965	C10
Pisa Wreck D			10,25275	43,5965	Dolia
Pisa Wreck D			10,25275	43,5965	Stones
Pisa Wreck E			10,25275	43,5965	C10
Pisa Wreck E			10,25275	43,5965	C16
Pisa Wreck E			10,25275	43,5965	C19
Pisa Wreck E			10,25275	43,5965	Dolia
Plane A	-50	-50	5,39219	43,18152	C4
Plane A	-50	-50	5,39219	43,18152	C8
Plane A	-50	-50	5,39219	43,18152	Ceramics
Plane D	-100	-25	5,39219	43,18152	C4
Plane D	-100	-25	5,39219	43,18152	C5
Plane E	-50	-1	5,48907	43,16931	C8
Planier A	1	15	5,29275	43,21193	C10
Planier B	150	150	5,29275	43,21193	C25
Planier B	150	150	5,29275	43,21193	Metal
Planier C	-60	-40	5,29275	43,21193	C1
Planier C	-60	-40	5,29275	43,21193	C4
Planier C	-60	-40	5,29275	43,21193	C8
Planier G	300	350	5,29275	43,21193	C22
Planier G	300	350	5,29275	43,21193	C23
Planier G	300	350	5,29275	43,21193	C34
Planier G	300	350	5,29275	43,21193	Keay 61
Plavac A	-25	25	15,73401	43,6002	C10
Plavac A	-25	25	15,73401	43,6002	C9
Plavac A	-25	25	15,73401	43,6002	Ceramics
Plemmirio B	200	200	15,2	36,59	C36
Plemmirio B	200	200	15,2	36,59	C38
Plemmirio B	200	200	15,2	36,59	C33
Plemmirio B	200	200	15,2	36,59	C34
Plemmirio B	200	200	15,2	36,59	Metal
Point Pomegues	-100	100	5,32374	43,20801	C3
Point Pomegues	-100	100	5,32374	43,20801	Ceramics
Pointe de Galere	1	50	6,24	43,1	C15
Pointe de Galere	1	50	6,24	43,1	Tiles
Pointe Debie A	1	100	5,34163	43,22645	C10
Pointe Debie A	1	100	5,34163	43,22645	C16
Pointe Debie A	1	100	5,34163	43,22645	C19

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Pointe Debie A	1	100	5,34163	43,22645	C25
Pointe Debie A	1	100	5,34163	43,22645	Gaulish
Pointe du Blé	-100	-25	6	43	C4
Pointe du Brouil	-140	-130	6,3445	43,078	C2
Pointe Lequin C	50	70	6,1047	43,01531	C10
Pointe Lequin C	50	70	6,1047	43,01531	C16
Pointe Lequin C	50	70	6,1047	43,01531	Gaulish
Pointe Moussure	-150	-100	6,4	43,11	C3
Pomegues B	-200	-1	5,32374	43,20801	C10
Ponte d'Oro	50	50	10,60238	42,89384	C10
Ponte d'Oro	50	50	10,60238	42,89384	C15
Ponte d'Oro	50	50	10,60238	42,89384	C16
Ponte d'Oro	50	50	10,60238	42,89384	C17
Ponte d'Oro	50	50	10,60238	42,89384	C25
Port-La-Nouvelle	1	120	3,36882	42,50586	C25
Port-Miou	400	425	5,61691	43,15551	Ceramics
Port-Miou	400	425	5,61691	43,15551	Cylindrical
Porto Azzurro A	250	300	10,41498	42,66523	C34
Porto Azzurro A	250	300	10,41498	42,66523	Ceramics
Porto Azzurro B	50	100	10,41498	42,66523	C10
Porto Azzurro B	50	100	10,41498	42,66523	C16
Porto Azzurro B	50	100	10,41498	42,66523	C36
Porto Azzurro B	50	100	10,41498	42,66523	Ceramics
Porto Badisco	-60	-40	18,54782	40,40423	C8
Porto Badisco	-60	-40	18,54782	40,40423	Stones
Porto Cheli	500	600	23,11	37,18	C43
Porto Cristo	50	70	3,2	39,32	C10
Porto Cristo	50	70	3,2	39,32	Ceramics
Porto Cristo B	20	100	3,2	39,32	C15
Porto Cristo B	20	100	3,2	39,32	C25
Porto Ercole A	-150	-100	11,12	42,23	C3
Porto Ercole A	-150	-100	11,12	42,23	C8
Porto Ercole A	-150	-100	11,12	42,23	Punic
Porto Ercole B	-150	-100	11,12	42,23	C3
Porto Palo	-150	-1	15,50167	36,79909	C8
Port-Vendres A	400	400	3,23392	42,37263	C22
Port-Vendres A	400	400	3,23392	42,37263	C23
Port-Vendres A	400	400	3,23392	42,37263	Robinson M230
Port-Vendres B	42	48	3,23392	42,37263	C15
Port-Vendres B	42	48	3,23392	42,37263	C18
Port-Vendres B	42	48	3,23392	42,37263	C25
Port-Vendres B	42	48	3,23392	42,37263	C31
Port-Vendres B	42	48	3,23392	42,37263	Glass
Port-Vendres B	42	48	3,23392	42,37263	Metal
Port-Vendres C	150	150	3,23392	42,37263	C27
Port-Vendres C	150	150	3,23392	42,37263	Metal

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Port-Vendres C	150	150	3,23392	42,37263	Pear-shaped Et
Port-Vendres D	-50	25	3,23392	42,37263	C6
Port-Vendres D	-50	25	3,23392	42,37263	Dolia
Port-Vendres E	-50	25	3,23392	42,37351	C10
Port-Vendres E	-50	25	3,23392	42,37351	C6
Povile	275	400	14,32516	45,2858	C34
Povile	275	400	14,32516	45,2858	Cylindrical
Povile	275	400	14,32516	45,2858	Globular
Pozzino	-120	-80	10,41724	43,035	C10
Pozzino	-120	-80	10,41724	43,035	C3
Pozzino	-120	-80	10,41724	43,035	Ceramics
Pozzino	-120	-80	10,41724	43,035	Glass
Praiano			14,46484	40,55288	C33
Praiano			14,46484	40,55288	C34
Prasso	400	700	26,27088	38,56229	C43
Premuda A	1	100	14,64359	44,24072	C8
Premuda B	400	700	14,60359	44,24072	C43
Procchio	160	200	10,31498	42,68523	C27
Procchio	160	200	10,31498	42,68523	C33
Procchio	160	200	10,31498	42,68523	Glass
Procida	-150	-25	14,26484	40,65288	Dressel 1
Pudrimel Norte	50	150	-0,70241	37,70411	C19
Pudrimel Norte	50	150	-0,70241	37,70411	C20
Pudrimel Sur	-150	-50	-0,70241	37,70411	C5
Pudrimel Sur	-150	-50	-0,70241	37,70411	Ceramics
Punta ala	250	250	10,70238	42,80384	C25
Punta ala	250	250	10,70238	42,80384	C34
Punta ala	250	250	10,70238	42,80384	C38
Punta ala	250	250	10,70238	42,80384	Ceramics
Punta ala	250	250	10,70238	42,80384	Dolia
Punta Blanca	-50	50	3,19	42,19	C6
Punta Cerra	200	275	10,42498	42,66523	C33
Punta Cerra	200	275	10,42498	42,66523	C34
Punta Cerra	200	275	10,42498	42,66523	Pear-shaped
Punta Chiappa	-150	-25	9,62677	44,06226	Dressel 1
Punta Crapazza	200	300	14,88258	38,45298	C33
Punta Crapazza	200	300	14,88258	38,45298	Metal
Punta de Algas	-100	-50	-0,71241	37,77411	C8
Punta de Algas	-100	-50	-0,71241	37,77411	Ceramics
Punta de la Mona	175	250	-3,44902	36,65241	C25
Punta del Fenaio	200	325	10,83672	42,30524	C34
Punta del Vapor A	1	100	-3,44902	36,65241	C16
Punta della Contessa A	-100	-25	18,45782	40,36423	C8
Punta della Madonna	-175	-75	10,27498	42,69523	C3
Punta dell'Arco	-100	-50	13,39216	40,73473	C4
Punta dell'Arco	-100	-50	13,39216	40,73473	Metal

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Punta Entina	1	150	-2,36977	36,8202	C20
Punta Falconaia	100	300	10,38498	42,70523	C38
Punta Glavina A	-100	-25	14,53	44,42	C8
Punta Glavina B			14,52	44,42	Dressel 1
Punta Licosa	-150	-25	14,85009	40,26834	C5
Punta Palom	-100	-1	3,10245	41,81401	Dressel 1
Punta Palom	-100	-1	3,10245	41,81401	Punic
Punta Patedda	-15	20	17,47815	40,26052	C8
Punta Penne A	-150	-25	17,48815	40,27052	C8
Punta Penne B	150	225	17,48815	40,27052	C42
Punta Prima	70	100	3,22683	41,86962	C16
Punta Raisi	100	300	13,6	38,15	C40
Punta Salina	-150	-150	3,28408	42,23825	Punic
Punta Scaletta	-140	-130	11,65917	42,19227	C3
Punta Scaletta	-140	-130	11,65917	42,19227	C8
Punta Scaletta	-140	-130	11,65917	42,19227	Ceramics
Punta Scario C	-100	-1	12,45293	37,67827	C4
Punta Scario C	-100	-1	12,45293	37,67827	C8
Punta Scario D	-150	-75	12,45293	37,67827	C3
Punta Sottile B	-150	-1	12,59569	35,47693	C8
Puntas	90	140	-3,42902	36,66241	C25
Qawra	200	275	14,41398	35,73398	C34
Raf Raf	-125	-125	10,15123	37,28179	C32
Raf Raf	-125	-125	10,15123	37,28179	C5
Raf Raf	-125	-125	10,15123	37,28179	C8
Raf Raf	-125	-125	10,15123	37,28179	Ovoidal
Raf Raf	-125	-125	10,15123	37,28179	Punic
Randello	325	325	14,37361	36,82798	C22
Randello	325	325	14,37361	36,82798	African
Ratino	325	350	9,17369	41,35287	C34
Redona	1	100	2,78678	39,24168	C17
Redona	1	100	2,78678	39,24168	Metal
Rhaphina	-100	-1	24	38,1	C10
Rhone Delta	-20	-20	4,83702	43,31615	C10
Rhone Delta	-20	-20	4,83702	43,31615	Dolia
Rhone Delta	-20	-20	4,83702	43,31615	Stones
Riace	1	100	16,32	38,23	C10
Riace	1	100	16,32	38,23	C9
Riou C	-120	-90	5,36924	43,16983	C3
Riou C	-120	-90	5,36924	43,16983	C5
Riou C	-120	-90	5,36924	43,16983	Ceramics
Roche Fouras	-150	-100	6,41	43,11	C5
Roches d'Aurelles	80	100	6,69109	43,186	C25
Roches d'Aurelles	80	100	6,69109	43,186	C30
Roches d'Aurelles	80	100	6,69109	43,186	Ceramics
Roches d'Aurelles	80	100	6,69109	43,186	Tiles

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Roches d'Aurelles	80	100	6,69109	43,186	Gaul 2
Roquetas del Mar A			-2,6	36,7	Dressel 1
Roquetas del Mar B			-2,6	36,7	C18
Roquetas del Mar B			-2,6	36,7	C20
Roquetas del Mar B			-2,6	36,7	C25
Rovinj	-50	100	13,62841	45,6641	Dressel 6
Sagunt	-25	75	-0,15542	39,62433	C16
Saint gervais B	600	625	4,7731	43,32947	C63
Saint Gervais C	149	154	4,7731	43,32947	C19
Saint Gervais C	149	154	4,7731	43,32947	C25
Saint Gervais C	149	154	4,7731	43,32947	C27
Saint Gervais D	20	150	4,7731	43,32947	C19
Saint Gervais D	20	150	4,7731	43,32947	C25
Saint Honorat	160	200	7,20043	43,62767	C25
Saint Tropez B	-25	75	6,63098	43,28649	C10
Saint Tropez B	-25	75	6,63098	43,28649	Ovoidal
Sainte Marguerite	-100	-50	7,13802	43,53267	C3
Sainte Marguerite	-100	-50	7,13802	43,53267	C4
Saintes Maries-de-la-Mer A	-100	-25	4,36266	43,41672	C4
Salines	70	80	3	39,18	C16
Salines	70	80	3	39,18	C25
Salines	70	80	3	39,18	Metal
Salou	50	125	1,22987	41,06225	C25
San Ferreol	-110	-80	-0,72241	37,77411	C10
San Ferreol	-110	-80	-0,72241	37,77411	C8
San Ferreol	-110	-80	-0,72241	37,77411	C9
San Ferreol	-110	-80	-0,72241	37,77411	Chian
San Ferreol	-110	-80	-0,72241	37,77411	Ovoidal
San Ferreol	-110	-80	-0,72241	37,77411	C4
San Ferreol	-110	-80	-0,72241	37,77411	Ceramics
San Nicola	-25	25	12,39293	37,70827	C25
San Nicola	-25	25	12,39293	37,70827	C31
Sancak Burun	-25	100	27,57179	36,98034	C9
Sant Antioco A	275	300	8,39708	38,93204	C34
Sant Antioco A	275	300	8,39708	38,93204	Ceramics
Sant Antoni	1	50	1,33891	38,71987	C16
Sant Antoni	1	50	1,33891	38,71987	C5
Santa Maria	200	300	9,32301	41,28294	C34
Santa Severa	-50	-25	11,67989	42,0803	C10
Santa Severa	-50	-25	11,67989	42,0803	C4
Santa Severa	-50	-25	11,67989	42,0803	C8
Sarah Ky	-300	-1	27,99972	36,65057	C9
Sardinia	200	300	9,17025	42,7685	C22
Sardinia	200	300	9,17025	42,7685	C25
Sardinia	200	300	9,17025	42,7685	C34
Savudrija	-140	-1	13,49352	45,3337	C2

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Scedro B	-75	-25	16,4	43,5	C8
Scialandro A	-150	-100	12,65117	38,21771	C3
Scialandro B	1	300	12,65117	38,21771	C40
Scole A	365	380	10,86672	42,28524	Cylindrical
Sdot Yam	400	600	34,88151	32,79009	C51
Sdot Yam C	400	600	34,41734	31,62321	C49
Secanion	-10	40	7,36104	43,69655	C25
Secanion	-10	40	7,36104	43,69655	Tiles
Secca dei Mattoni	-100	-50	12,84277	40,8739	C4
Secca dei Mattoni	-100	-50	12,84277	40,8739	C5
Secca dei Mattoni	-100	-50	12,84277	40,8739	C8
Secca dei Mattoni	-100	-50	12,84277	40,8739	Ceramics
Secca del Palo	-150	-25	10,36498	42,70523	Dressel 1
Secca della Croce	1	100	10,85672	42,30524	C10
Secche di Ugento A	-60	100	18,39704	39,6971	C9
Secche di Ugento B	-150	-25	18,39704	39,6971	Dressel 1
Secche di Ugento C	600	700	18,39704	39,6971	Globular
Serce Limani C	-150	-100	28,19009	36,61083	C9
Serce Limani C	-150	-100	28,19009	36,61083	Ceramics
Serce Limani D	-300	-1	28,19009	36,61083	C9
Sete	-50	-25	3,52383	43,24497	C8
Shab Rumi	-50	100	37,53878	19,00659	C10
Silba A	300	425	14,59416	44,38919	African
Silba B	1	100	14,74359	44,25072	C9
Sinope B			35	42,2	C44
Sinope B			35	42,2	Sinopian
Skarda A	-100	100	14,66359	44,22072	C8
Skerki Bank Alley II			10,99569	38,21647	C27
Skerki Bank Alley II			10,99569	38,21647	C33
Skerki Bank Alley II			10,99569	38,21647	C40
Skerki Bank Isis	375	400	10,99569	38,21647	C33
Skerki Bank Isis	375	400	10,99569	38,21647	C34
Skerki Bank Isis	375	400	10,99569	38,21647	C38
Skerki Bank Isis	375	400	10,99569	38,21647	C51
Skerki Bank Isis	375	400	10,99569	38,21647	Keay 35
Skerki Bank Isis	375	400	10,99569	38,21647	Keay 42
Skerki Bank North A	50	75	10,99569	38,21647	C10
Skerki Bank North B	75	100	10,99569	38,21647	C25
Skerki Bank North Wreck 1	-150	-100	10,99569	38,21647	C2
Skerki Bank North Wreck 2	350	450	10,99569	38,21647	SK 1
Skerki Bank North Wreck 3	350	450	10,99569	38,21647	C51
Skerki Bank North Wreck 3	350	450	10,99569	38,21647	Keay 42
Skerki Bank North Wreck 3	350	450	10,99569	38,21647	SK 1
Skerki Bank North Wreck 4	375	450	10,99569	38,21647	Keay 35
Skerki Bank North Wreck 4	375	450	10,99569	38,21647	Keay 49
Skerki Bank Wreck B	75	100	10,99569	38,21647	C10

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Skerki Bank Wreck B	75	100	10,99569	38,21647	C36
Skerki Bank Wreck B	75	100	10,99569	38,21647	Ceramics
Skerki Bank Wreck B	75	100	10,99569	38,21647	Crete
Skerki Bank Wreck B	75	100	10,99569	38,21647	Egypt
Skerki Bank Wreck B	75	100	10,99569	38,21647	Pompei X
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C10
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C14
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C3
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C32
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C4
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C5
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	C8
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	Ceramics
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	Dressel 26
Skerki Bank Wreck D	-80	-50	10,99569	38,21647	Flat bottomed
Skerki Bank Wreck F	50	50	10,99569	38,21647	C10
Skerki Bank Wreck F	50	50	10,99569	38,21647	C16
Skerki Bank Wreck F	50	50	10,99569	38,21647	C32
Skerki Bank Wreck F	50	50	10,99569	38,21647	C38
Skerki Bank Wreck F	50	50	10,99569	38,21647	Ceramics
Skerki Bank Wreck F	50	50	10,99569	38,21647	Stones
Skerki Bank Wreck F	50	50	10,99569	38,21647	FB Sicilian
Skerki Bank Wreck G	50	50	10,99569	38,21647	C10
Skerki Bank Wreck G	50	50	10,99569	38,21647	C16
Skerki Bank Wreck G	50	50	10,99569	38,21647	C31
Skerki Bank Wreck G	50	50	10,99569	38,21647	C32
Skerki Bank Wreck G	50	50	10,99569	38,21647	Ceramics
Skerki Bank Wreck G	50	50	10,99569	38,21647	FB Sicilian
Skolj Od Volam	1	100	13,74824	44,83081	C8
Skoljic	50	200	14,3202	44,43917	C10
Skoljic	50	200	14,3202	44,43917	C42
Skoljic	50	200	14,3202	44,43917	Ceramics
Skoljic	50	200	14,3202	44,43917	Portorecanato
Sobra	320	340	17,54597	42,61174	C22
Sobra	320	340	17,54597	42,61174	C34
Sobra	320	340	17,54597	42,61174	C40
Sobra	320	340	17,54597	42,61174	Cylindrical
Sorres A	-150	-75	1,96458	41,2251	C3
Sorres B	25	100	1,96458	41,2251	C10
Sorres B	25	100	1,96458	41,2251	Dolia
Sorres B	25	100	1,96458	41,2251	Metal
Spargi	-120	-100	9,18671	41,25243	C31
Spargi	-120	-100	9,18671	41,25243	C3
Spargi	-120	-100	9,18671	41,25243	C4
Spargi	-120	-100	9,18671	41,25243	C9
Spargi	-120	-100	9,18671	41,25243	Ceramics

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Spargi	-120	-100	9,18671	41,25243	Stones
Spargi	-120	-100	9,18671	41,25243	Dressel 26
Spargi	-120	-100	9,18671	41,25243	Ovoidal
Stanici-Celina	-100	-25	16,44	43,24	C8
Stori Stoni	-125	-75	16,23	43,1	C8
Sud-Lavezzi A	375	425	9,25535	41,3048	C22
Sud-Lavezzi A	375	425	9,25535	41,3048	C23
Sud-Lavezzi A	375	425	9,25535	41,3048	C26
Sud-Lavezzi A	375	425	9,25535	41,3048	Beltran 72
Sud-Lavezzi A	375	425	9,25535	41,3048	Flat bottomed
Sud-Lavezzi B	10	30	9,25535	41,3048	C31
Sud-Lavezzi B	10	30	9,25535	41,3048	C15
Sud-Lavezzi B	10	30	9,25535	41,3048	C16
Sud-Lavezzi B	10	30	9,25535	41,3048	C25
Sud-Lavezzi B	10	30	9,25535	41,3048	Metal
Sud-Lavezzi C	15	25	9,25772	41,32666	C10
Sud-Lavezzi C	15	25	9,25772	41,32666	C20
Sud-Lavezzi C	15	25	9,25772	41,32666	C6
Sud-Perduto A	-25	25	9,31002	41,36039	C14
Sud-Perduto B	1	15	9,31002	41,36039	C14
Sud-Perduto B	1	15	9,31002	41,36039	C16
Sud-Perduto B	1	15	9,31002	41,36039	C25
Sud-Perduto B	1	15	9,31002	41,36039	C31
Sud-Perduto B	1	15	9,31002	41,36039	Metal
Supetar	-25	-1	15,71566	43,54455	Dolia
Supetarska			15,71566	43,54455	C16
Supetarska			15,71566	43,54455	C9
Sveti Andrija	1	150	15,84558	43,48354	C10
Sveti Andrija	1	150	15,84558	43,48354	C13
Tanger B	1	100	-5,95678	35,76094	C16
Tanger B	1	100	-5,95678	35,76094	C18
Tantura A	415	530	34,34487	31,50509	C63
Taranto C	1	100	17,22	40,22	C10
Taranto C	1	100	17,22	40,22	C9
Taranto C	1	100	17,22	40,22	Tiles
Taravo	-150	-25	8,74422	41,62823	C8
Tcerny Nos	375	500	27,98041	43,15284	C51
Terracina	-150	-1	13,15804	41,18113	Dressel 1
Terrasini A	25	50	13,39496	38,40982	C15
Terrasini A	25	50	13,39496	38,40982	C16
Terrasini A	25	50	13,39496	38,40982	C17
Terrasini A	25	50	13,39496	38,40982	Metal
Terrauza	200	200	15,37757	37,02322	C47
Terrauza	200	200	15,37757	37,02322	C56
Thalassinies Spilies	500	700	32,40779	34,6987	43
Thasos B	-100	-1	24,52969	40,56969	C8

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Tiboulen de Maire	100	100	5,34712	43,2011	C10
Tiboulen de Maire	100	100	5,34712	43,2011	C16
Tiboulen de Maire	100	100	5,34712	43,2011	C18
Tiboulen de Maire	100	100	5,34712	43,2011	C20
Tiboulen de Maire	100	100	5,34712	43,2011	C25
Tiboulen de Maire	100	100	5,34712	43,2011	C27
Tiboulen de Maire	100	100	5,34712	43,2011	C31
Tijascica	1	100	15,68401	43,5902	C10
Tijascica	1	100	15,68401	43,5902	C8
Titan	-50	-45	6,3507	42,99761	C4
Titan	-50	-45	6,3507	42,99761	C14
Titan	-50	-45	6,3507	42,99761	C16
Toro	1	50	2,47678	39,41168	C16
Torre Chianca	250	250	17,53	40,16	C11
Torre Chianca	250	250	17,53	40,16	Stones
Torre dell' Orso	200	400	18,56009	40,18113	C34
Torre dell' Orso	200	400	18,56009	40,18113	C37
Torre Derribada	-200	-100	-0,66474	37,59491	C2
Torre Guaceto	-100	-1	17,39815	40,28052	C8
Torre la Sal	-130	-110	0,17639	40,02236	C3
Torre la Sal	-130	-110	0,17639	40,02236	C5
Torre la Sal	-130	-110	0,17639	40,02236	C8
Torre Santa Sabina	-25	100	17,34815	40,31052	C10
Torre Santa Sabina	-25	100	17,34815	40,31052	Ceramics
Torre Sgarrata	180	205	17,24	40,19	C36
Torre Sgarrata	180	205	17,24	40,19	Sarcophagi
Torre Sgarrata	180	205	17,24	40,19	Stones
Torre Valdaliga	1	20	11,01312	42,62671	C10
Torre Valdaliga	1	20	11,01312	42,62671	C16
Tour Sainte Marie A	30	55	9,29	43	C14
Tour Sainte Marie A	30	55	9,29	43	C15
Tour Sainte Marie A	30	55	9,29	43	C16
Tour Sainte Marie A	30	55	9,29	43	C18
Tradelière	-20	-10	7,28595	43,67655	C16
Tradelière	-20	-10	7,28595	43,67655	C10
Tradelière	-20	-10	7,28595	43,67655	C4
Tradelière	-20	-10	7,28595	43,67655	Dressel 6
Tradelière	-20	-10	7,28595	43,67655	C9
Tradelière	-20	-10	7,28595	43,67655	Ceramics
Tradelière	-20	-10	7,28595	43,67655	Glass
Tradelière	-20	-10	7,28595	43,67655	Chian
Tradelière	-20	-10	7,28595	43,67655	Flat bottomed
Tradelière	-20	-10	7,28595	43,67655	Kingsholm 117
Tramerka	1	100	14,72359	44,18072	C9
Trapani	200	300	12,28	38,2	C38
Tre Senghe	-25	-25	15,4802	42,13508	C10

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Tre Senghe	-25	-25	15,4802	42,13508	Dressel 6
Tre Senghe	-25	-25	15,4802	42,13508	C8
Tre Senghe	-25	-25	15,4802	42,13508	Flat bottomed
Triscina B	-150	-130	12,66651	37,49542	C3
Triscina B	-150	-130	12,66651	37,49542	C8
Triscina C	400	500	12,66651	37,49542	C51
Triscina C	400	500	12,66651	37,49542	Cylindrical
Triscina D	25	125	12,66651	37,49542	C19
Triscina D	25	125	12,66651	37,49542	Metal
Tuna	100	200	3,10245	41,81401	C19
Ullastres	-50	25	3,09245	41,77401	C6
Ustica A	-100	-1	13,1	38,43	C32
Ustica A	-100	-1	13,1	38,43	Dressel 24
Vachetta A	1	75	9,16369	41,34287	C10
Vada A	-100	-100	10,37724	43,245	C4
Vada A	-100	-100	10,37724	43,245	C5
Vada A	-100	-100	10,37724	43,245	Ceramics
Vada C	1	100	10,32724	43,235	C10
Vada D	1	100	10,32724	43,215	C16
Valle Ponti	-25	-1	12,34937	44,49721	C10
Valle Ponti	-25	-1	12,34937	44,49721	Dressel 6
Valle Ponti	-25	-1	12,34937	44,49721	Ceramics
Valle Ponti	-25	-1	12,34937	44,49721	Metal
Valle Ponti	-25	-1	12,34937	44,49721	Chian
Valle Ponti	-25	-1	12,34937	44,49721	Panella 36
Varazze	-100	-50	8,4138	44,1462	C4
Veliki Skolj	1	200	17,63597	42,60174	C18
Veliki Skolj	1	200	17,63597	42,60174	C8
Veliki Skolj	1	200	17,63597	42,60174	Ceramics
Veliki Skolj	1	200	17,63597	42,60174	Sarcophagi
Vendicari	375	625	15,30167	36,88909	C43
Vendicari	375	625	15,30167	36,88909	C44
Vendicari	375	625	15,30167	36,88909	C51
Ventotene B	-50	-50	13,40216	40,72473	C4
Verudica	1	100	13,71824	44,85081	C42
Vignale	307	310	9,49601	41,97191	Metal
Vignale	307	310	9,49601	41,97191	Cylindrical
Villepey	110	160	6,4574	43,04201	C25
Villepey	110	160	6,4574	43,04201	C27
Vis A	-125	-75	16,1	43,4	C8
Vis A	-125	-75	16,1	43,4	Ceramics
Vis B	-150	-25	16,11	43,4	Dressel 1
Vis C	-150	-150	16,13	43,4	C2
Vis C	-150	-150	16,13	43,4	C8
Vratnicka	1	100	17,62597	42,60174	C10
Vulcano	-100	-80	14,90258	38,43298	C4

Ship	Begin	End	X_COORD	Y_COORD	Cargo
Xlendi A	-150	-75	14,12	36,1	C3
Xlendi A	-150	-75	14,12	36,1	C8
Xlendi A	-150	-75	14,12	36,1	C32
Xlendi B	1	100	14,12	36,1	C10
Xlendi C	350	450	14,12	36,1	C51
Yassi Ada A	626	626	27,19934	36,93666	C43
Yassi Ada A	626	626	27,19934	36,93666	C44
Yassi Ada A	626	626	27,19934	36,93666	C49
Yassi Ada A	626	626	27,19934	36,93666	C51
Yassi Ada B	375	425	27,18949	36,90073	C46
Yassi Ada B	375	425	27,18949	36,90073	Ovoidal
Yassi Ada B	375	425	27,18949	36,90073	Cylindrical
Zirje	250	450	15,62401	43,5902	C22
Zut	-150	-25	15,43401	43,68597	C8

Appendix 4

This appendix is a bibliography, which have been used in order to create the database of shipwrecks and the amphorae typology.

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