Contact by sea is generally assumed to have been essential for much of the development of the ancient Mediterranean world. Raw materials and fertile land, easily reached by sea, attracted adventurers and settlers from the early Neolithic on. In the period of state government, especially Imperial Rome, rulers depended on importing food by sea in order to retain political stability. There is plenty of anecdotal evidence that Romans were willing to take to the sea whenever they felt it necessary or desirable, but documents are lacking that would provide firm information about the frequency of sailings or the routes followed. Even the Price Edict, the basis of figure 1, gives only an illustrative example of the sort of activities that went on across the Mediterranean in late Imperial times. Hence, to study the “connectivity” that underpins a recent study of Mediterranean history, 1 or to establish the importance of “maritimity” or “maritime consciousness” in ancient societies, one has to bring in archaeology, with all its problems of incomplete, skewed, or irrelevant information. In the case of the Roman world, the sheer quantity of material and the enormous number of movements and contacts that occurred, these in themselves make archaeological inference difficult.

The analysis of archaeological finds is structured upon the concept of assemblages. 2 The most informative assemblages are unselfconscious collections formed in an unplanned instant of time, such as the contents of a house overwhelmed by a volcanic eruption or, indeed, a ship and its cargo wrecked without warning. The least reliable are scatters of possibly unassociated finds, such as there appear to be on the seabed; 3 there is no certainty that “single” objects were lost accidentally from a passing ship, were jettisoned in distress, or are all that survives the erosion, fishing, or looting of a coherent shipwreck, even in deep water. 4 With increased understanding of the undersea environment, and improved technology for exploration, one can now see that many supposed “isolated finds” may in fact be all that remains of a shipwreck; 5 on the other hand, not only can there be no certainty about the status of underwater assemblages; it is still difficult to search extensively for artifacts, and clearly identify them, in the wide spaces of the sea. By contrast, on land archaeologists are on a firmer basis in assuming that artifacts were deposited like a paper chase along routes traveled in the past and that they have been found and reported in a broadly random fashion; to this end they draw up distribution maps.

The use of artifact distribution maps is a long-established feature of archaeology. There is, in fact, a range of types of such maps: the spots on the map may represent single finds, groups of finds, or find spots (i.e., sites); they may be emphasized, distinguished, or grouped in a variety of ways.

1 Horden and Purcell 2000.
2 Conveniently summarized by Murphy 1997.
3 For an early attempt to make sense of “single finds,” see Barag 1963.
4 For deep-water exploration and interpretation, see Ballard 2009.
5 A cautious reappraisal of “isolated finds” on the Mediterranean coast of France leads to this conclusion: Long 2002.
Fig. 1. Map of sea links by Rougé 1966, 88-89, captioned: “The principal ports of the Roman Mediterranean and the currents of trade, according to the Aphrodisias fragments . . . (these are not shipping lines in the normal sense).”

Fig. 2. African kitchen ware, second–third centuries A.D. (after Hayes 1972, map 5, with some changes and additions).

Some archaeologists are not averse to drawing on their map emphases, such as arrows or “snail-tracks” delineating routes, which are their own interpretation. The advantage of the distribution map is that, when it is appropriately assembled with relevant physical and historical (political) underlay, viewers can form their own interpretation on the basis of the evidence before them, even to the extent of recognizing that gaps in the distribution could be the result of an absence of settlement in antiquity or of archaeological activity in the present. Now from the map of Red Slip casseroles and
plain cooking wares shown here (fig. 2), it is an entirely reasonable inference that the generally wide distribution of African kitchen ware was the result of transport by sea; this was, indeed, proposed by the author of the map, John Hayes. It is worth pointing out, however, that this is not a quantified or weighted map, which would directly reflect the movement and the loss of the casseroles, but a map of find spots, so it shows the distribution of people (or settlements) who used casseroles, a map of cultural assemblages. This should draw attention to the way in which distributions may be interpreted through a prior vision of the period concerned rather than themselves demonstrate an interpretable pattern.

In the 1970s, Ian Hodder (together with Clive Orton, later followed by Michael Fulford and echoed by Colin Renfrew) noticed that there was a subjective element in the study of archaeological distribution maps and determined to make it more systematic. The assumed normal distribution of archaeological finds is in the form of a halo, radiating out in all directions from the point of origin (i.e., of manufacture or sale), with the density of finds decreasing steadily with increasing distance from the center. By plotting the number of items at each site against the distance of the sites from the origin, a “fall-off” or “regression” chart is created. A straightforward “halo” distribution would result in a steep, straight regression line; a distribution that was in some way “abnormal” would be shallow and could even be curved or wavy. An obvious example of an “abnormal” distribution would be where goods are loaded at the port of origin on to a ship, which then sails a considerable distance before unloading and distributing its cargo: this would produce a shallow regression line, like that labeled 13 in figure 3, representing prehistoric stone axes made in Cornwall and generally accepted by prehistorians as having been shipped along the south coast of Britain before being distributed by land to sites in central southern Britain and beyond. In fact there could be other explanations for

6 Hayes 1972, 414.
a shallow regression line, but Hodder drew attention to the way in which distributions could be interpreted more systematically. The subjective element, however, cannot be entirely removed: for example, in his overviews of Romano-British trade Fulford suggested that London was the chief port for imports from overseas but that goods were sent on not by water but by radial land routes.8

The British distribution of mortaria made at Soller in Germany (fig. 4) might be thought to illustrate this idea: the finds are concentrated on London and then fan out in a halolike “normal” distribution across most of the Roman province.9 On the other hand, it is interesting to compare a distribution map also of mortaria but in this case made at Bavai and Noyon in Gallia Belgica, compiled by Kay Hartley (fig. 5).10 The distribution is broadly similar to the previous example, but the author (with the benefit of many years’ study of this pottery) comments:

the main concentrations are in the coastal areas approaching the Thames estuary, in the London area and in south-west England and south Wales, which they no doubt reached by coastal traffic . . . [S]maller clusters in north-east England and Scotland suggest delivery at the Humber, Tyne and Forth . . . a normal distribution pattern for imports from northern France, notably different from the distribution patterns of British [inland] workshops.

From this example it can be seen that the extent to which water transport is invoked to interpret a particular distribution may depend on the attitude of the archaeologist in question rather than on

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8 Fulford 1989.
9 Tyers 1996, fig. 135.
10 Hartley 1998, fig. 2. Of mortaria from Soller, Hartley writes: “The distribution of Rhineland mortaria is generally similar to that of the mortaria from northern France. London is known to have been a delivery point for Rhineland mortaria . . .”
Fig. 5. Mortaria made at Noyon and Bavai (Gallia Belgica): weighted find spot map of finds in Britain (from Hartley 1998, fig. 2, by courtesy of K. F. Hartley).
straightforward analysis of the plotted find spots. Regression does not in itself identify the route or the means of transport by which goods were distributed, even if it helps to highlight differences.

In the study already referred to, Hodder and Orton studied theoretical models for archaeological distributions, using the idea of a "random walk." They found that a straight, shallow regression line, such as no. 13 in figure 3 above, resulted from a small number of "steps," each relatively long—just as would be the case where goods were moved by sea. However, when they further refined the model by incorporating constraints—such as "gateways" like mountain passes or straits—through which the traffic had to pass, they found that this made little difference to the regression. The implication for archaeological distribution maps is important: it means that the distribution map does not in itself plot the route followed by goods that are deposited in a haphazard manner. The "nodal points" or "transhipment places" that must certainly have existed in any trading network are not necessarily indicated by the plot of archaeological finds. This point will be taken up again shortly.

What was, notwithstanding, clear from the theoretical study of Hodder and Orton was that one could expect to find gaps in a seaborne distribution map. One can see that it is these gaps that characterize the map of mortaria from Belgica (fig. 5) and explain the interpretation placed on it by Kay Hartley. In fact, this aspect of distributions had already been recognized intuitively by John Hayes, who spotted it in his map of "Late Roman C" Ware (fig. 6). There is no disagreement that imports of Roman goods from the Mediterranean region to post-Roman Britain, where they tend to be found in the west, must have been by sea, not overland through Gaul. Late Roman C Ware was made in the northeast Aegean and presumably came to post-Roman Britain and Ireland along with oil, wine, and other supplies for Christian ritual. The distribution shown in figure 6 is indeed "gapped," with a long space between the "halo" area close to the manufacturing center and the relatively numerous finds in Britain; the regression line of this distribution would

11 Hodder and Orton 1976, 130. 
12 Tyers 1996, 82.
be shallow, appropriate to sea transport—but the inference might not be readily made without some knowledge of the political background at the period. This inference was, in fact, made by Hayes (see fig. 7), who, in an interpretative or emphasized map, showed the sea route to Britain by arrows; however, he relies for justification of his interpretation on historical information, noting that the period of this export to Britain coincides with Byzantine control of Ceuta and the Strait of Gibraltar from ca. 544 to 629. At all events, the conclusion of this discussion must be that distribution maps of general archaeological finds may well suggest sea transport but do not in themselves indicate the route followed.

In his study of African Red Slip pottery as a whole, Hayes was certain of the importance of sea transport: of Late Roman C, for example, he wrote, "its site distribution . . . indicates a seaborne distribution of the ware." African Red Slip in general had "an extremely wide distribution around the Mediterranean," as did Arretine and Attic pottery in previous periods—"the same factor applies in all cases: the sea provided a cheap route for the transportation of those wares in bulk, and they were therefore competitive in all markets." One might nowadays qualify the modernistic language of this economic scenario, and one must also recognize that "bulk" cargoes of table ware are rare among Mediterranean wreck finds, but in general terms one can see that the use of water transport can be inferred from patterns of distribution of Roman pottery, both in the northwest provinces and in the Mediterranean core of the empire. Furthermore, one has to recognize that ships did not sail haphazardly, scattering trade goods like chaff across the map; they were commissioned to sail to a destination and normally did their best to follow the quickest or shortest route there. The

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13 Hayes 1972, 426.
14 Hayes 1972, 368.
15 Hayes 1972, 414.
16 Parker 1996, 99: "distributions of traded goods were maritime . . . but neither peripheral nor radial, but articulated by the invisible tracks of commercially determined voyages."
Fig. 8. Finds of tiles stamped L-HER-OPT and related marks.

problem for Graeco-Roman antiquity is how to find out what these destinations and routes were, given the loss of practically all documentation.

Finds of Roman table pottery are numerous, and so argument based on distribution maps of pottery is statistically sound: inference is less certain where fewer objects are found, even if, as in the case of stamped tiles, they are readily identified and (in principle) assigned to a place of production. One might reasonably assume that, wherever possible, Roman tiles would be distributed by water, in view of their bulk and weight and, indeed, the probability that a roof-load at a time, rather than one or two pieces, would be ordered or delivered. Thus, for example, Margareta Steinby, noting the location of the tile factories of the Atii at Aricia and of the Egrilii at Ostia, comments:

Roman stamps are found in a radius of 50 km or more from Rome, but along the rivers and the seacoast the distribution area extends much more widely, e.g., . . . commonly in the Sabine country. Also, the villas on the islands (Giglio, Giannutri, Capri, Ischia, Ponza) are often built with Roman tiles. . . . From the distribution of the stamps it follows that the figlinae outside Rome itself should be sought principally along the Tiber and its tributaries, especially the Anio, and on the seacoast, viz. where there existed the access needed to the raw materials for the tile industry and the practicability of transport by ship, instead of the high costs on land.17

However, when one looks further afield, according to Steinby, finds of tiles made near Rome are too meager to constitute evidence of trade: even the substantial numbers of stamped tiles found at Carthage and in the villa and baths at Tripoli, as well as the handful of finds from eight other sites in Africa, represent only return cargoes (and perhaps a special order, in the case of Tripoli), “a secondary trade.”18 Two points arise from this analysis: one, that a “gapped” distribution, as I have termed it, indicates water transport and, two, that there was a certain distance from origin beyond which it was not economic to transport goods by way of trade. The second point, if it could

17 Steinby 1978, 1493, 1508.
18 Steinby 1981.
be justified, would give us an archaeological statistic of transport costs. Does a wider look at tile transport in the Roman world justify this?

Some tile cargoes were local, and just part of a short-haul delivery system: such were the 300 roof-tiles, probably from the nearby factory at Fréjus, that sank at Les Roches d'Aurelle, near Saint-Raphaël, in the late first century A.D.\textsuperscript{19} One cannot be sure whether the tiles and the wine amphoras that were on board were a private order for a wealthy villa owner or whether, like the handmade cooking pots that made up the cargo, they were being carried wholesale for onward sale; however, the circumstances resemble the likely scenario of tile transport near Rome, as reconstructed above. Most Roman tiles found in southern Gaul were made locally, even when they were stamped, like the quite well-known marks MARI and L-HER-OPT, and traveled less than 200 km; the firm of L. Herennius Optatus also had a kiln at Torre Llauder on the coast of northeast Tarraconensis, and it was probably from the latter that the stamped tiles were exported to Majorca, as also to a destination not reached by the ship bearing these tiles that was wrecked near Agde and perhaps to other sites westward along the coast of Spain (though these might have been served by road): figure 8. Depending on how one interprets these rather imprecise data, tiles from Torre Llauder traveled 200 to 300 km or perhaps somewhat farther by sea, giving one an idea of what might be a baseline figure for economy and convenience in sea transport. The same could be proposed for other stamped tiles, such as those from Campania marked STAB-APPNI or Q-MVCIASCLEPI, found around the Bay of Naples and on Ponza and Ischia but also at Lipari;\textsuperscript{20} this represents a range of 300 km or so (fig. 9).

The situation was different where the terrain or the road system made land transport impracticable: such was the situation in Dalmatia, where tiles made in Emilia or near Aquileia are found as much as 600 km along the coast (fig. 10). It was obviously sensible to supply coastal settlements by sea, but sites inland, cut off by the Dalmatian mountains, did not import Aquileian tiles but used locally made tiles.\textsuperscript{21} This should alert us to the possibility that special circumstances, very possibly not discernible archaeologically, could render a general theory of transport economics unreliable.


\textsuperscript{20} The fact that other Campanian tile-stamps, namely Q-MVCIASCLEPI, DAMAE LIVIAE, and ABDAE LIVIAE, are also found on Lipari shows that this was a proper traffic, albeit of unknown quantity and duration.

\textsuperscript{21} Parker 1996, 100; Wilkes 1969, 499–502; 1979.
This is, indeed, the case when one looks at, for example, Sardinia and Carthage. Although Steinby (cited above) considered quantities of Roman tiles found in Sardinia negligible, Wilson remarks on “the large numbers of Urban brickstamps” and the likelihood that many of the unstamped tiles are also from the mainland. The chief find spots are coastal cities, but these are at very varied distances by sea from Ostia—Olbia 275 km, Neapolis 525 km, Cagliari 1,000 km. When one looks at other destinations, it becomes clear that distinctive tile-stamps provide firm evidence for long-distance transport but that reliable quantification is impossible: stamped tiles from Rome and Campania

22 Wilson 1982, 228.

23 Thus Q-MVICASCLEP is found in Sicily and Majorca, DAMAE LIVIAE and ABDAE LIVIAE at Carthage.
certainly traveled to Sicily and to Carthage (ca. 600 km) and to Majorca (ca. 900 km), but one has no idea whether the numbers were just handfuls, as in “ballast,” or whole shiploads on a regular basis. It is merely suggestion, but one has to note that the wreck of Punta Scario A, in western Sicily, was a very large cargo of stamped tiles (probably Campanian), comprising floor-tiles, tegulae, and imbrices—certainly not “ballast” but a real consignment:24 although ships can be blown off course and wrecked almost anywhere, it is not fanciful to suppose that this ship was sailing to Carthage when she was driven ashore near Marsala.

The conclusion of this discussion thus seems to be that there is no formulaic cut-off point beyond which it was not economic to transport heavy goods by sea, but that circumstances of topography, supply, or demand could all make it on occasion worth sending such goods quite long distances by ship. At least one can see that the infrastructure of maritime trade was in place and sufficiently developed, in the Principate anyway, to respond to commercial needs as they arose. As far as archaeological method is concerned, land-based distribution maps of traded goods do potentially reveal the use of water transport but do not indicate routes followed by ships. To reconstruct ancient maritime routes, one must turn to shipwrecks, that most informative class of assemblage.

In the fifteen years or so since the present writer’s Ancient Shipwrecks of the Mediterranean was compiled, there have been some changes in our knowledge of the marine archaeological resource. The average depth at which newly reported sites lie is increasing, owing not only to mixed-gas diving but especially to advanced technology, using remote sensing and both manned and unmanned submersibles. Several Mediterranean countries have established a national survey of underwater antiquities, and improved archaeological and scientific techniques have been brought to bear on wreck sites first discovered years ago, so the record continues to grow and is also more reliable. The rate of accession of new wrecks to the record, however, has slowed down since the rapid pace of fifteen years ago. Overall, recent additions have tended to fill out and reinforce the former pattern. Thus the general weighted distribution map of ancient shipwrecks has only a few newly populated squares, and the pattern is broadly the same as before (fig. 11). The chart showing the frequency of wrecks by century is also much the same as before (fig. 12); the outer parts of the curve have been

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24 Parker 1992, 360 no. 961.
filled up and the curve smoothed out, but the peak of wrecks in the late Republic-Principate period remains the predominant characteristic. Where it is possible to plot wrecks by period on a regional basis, newly discovered sites (for example, in the eastern Mediterranean "Israel-Lebanon" region) tend to reinforce the old pattern (fig. 13). The inference to be drawn from this is that the former analysis must have been substantially correct, at least in terms of statistics.

Ancient ships met their end in a wide variety of circumstances, but shipwreck sites are, for the most part, unselfconscious formations and thus may be taken as a sample of the ships that actually sailed. The location of each wreck represents a voyage arrested along the way, and so the distribution map of wrecks corresponds to the directions in which ships sailed; one must recognize that they could be blown far from their intended course, and so no individual wreck site is evidence for a route, but as a generalizing trend the map of wrecks points to the routes traveled. The form of a wreck distribution map will be "halo"-like, not "gapped," but the "halo" will be distorted into "fingers" that represent the trends of sailing routes. An example of this is figure 14, the map of late Empire African cargo wrecks: the map suggests that ships radiated out in all directions from African ports, but with a special emphasis toward Rome. When both land finds and marine wrecks can be plotted on a single map, as in the example of Kapitän 2 amphoras, containing wine probably from Cos, the distribution of wrecks is more nuanced and enables some compensation to be made for the bias of records in favor of sea areas that are popular with sports divers (fig. 15). However, this

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method of analysis is rather intuitive, and it is worth considering whether a more rigorous method is possible.

The Dressel 1 form of wine amphora was very widely exported from central Italy during the second and first centuries B.C. (fig. 16). For much of this period there was no convenient road route
through the Maritime Alps, so the many amphoras that were sent to Gaul necessarily traveled by ship.\textsuperscript{26} It is, therefore, no surprise that many cargoes of Dressel 1 amphoras were wrecked on the coast of Liguria and Provence (fig. 17). One can see intuitively that the distribution of wrecked cargoes broadly corresponds to the inferred routes followed by cargoes that reached Gaul or Spain for onward dispersal; however, the Dressel 1 wrecks cluster in a very marked way in southern Gaul, forming the great majority of wrecks known from that region. How does this concentration of wrecks of a particular type compare with the general distribution (the whole population) of ancient shipwrecks?

The data mapped in figure 11 as a weighted frequency map can be represented schematically as in figure 18, a grouped frequency table; this, in turn, can be re-formed as a cumulative percentage

\textsuperscript{26} Tchernia 1986.
diagram, figure 19. The curve that appears in this diagram is an expression of the normal distribution of ancient shipwrecks, in terms of a simple dimension—that is, their location on a scale west-east along the Mediterranean; however, this curve is very useful because it can be used to compare distributions of particular classes of wreck against the overall, normal pattern. In figure 20, in addition to the general curve, two other curves are shown: one is for Dressel 1 cargoes (corresponding to the map, fig. 17), and the other is for cargoes of Dressel 6 amphoras. Dressel 6 amphoras were made at the head of the Adriatic and are found on land mostly there and in the eastern provinces. The Dressel 1 curve diverges furthest from the normal curve in the zone 3°–9° east—that is, in the area where the clusters of these wrecks appear on the natural map—and with a divergence of 39 percentile points at that position on the curve the difference is significant indeed. That is to say, the loss of so many Dressel 1 amphora cargoes in Liguria and Provence is a real historical phenomenon that has to be explained; it is not due to an illusion of mapping or to some differential bias in the information. The same procedure could be applied to other classes of wrecks, and this would no doubt highlight many more significant variations of patterning.

This sort of analysis, which is really only the defining of patterns, derives from the behavioral analysis of the natural world: although it was typical of archaeological studies in the 1970s, it has more recently been thought not really to advance understanding of human history. The “processual” or behavioral archaeological approach has been widely adopted, owing to an increased concern with

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27 Parker 2002-2003; this discussion of wreck distribution analysis has benefited from being tried out at seminars in Marseilles and Victoria BC at the kind invitation of André Tchernia and John Oleson, to whom I am grateful.

28 The Dressel 6 cargoes sample is very small, but if wreck no. 423 of Parker 1992 is discounted, to leave only two wrecks with these amphoras in the south of France, the pattern of divergence is even more marked. Cf. Parker 1992, fig. 11 for a map of Dressel 6 wreck sites.
studying archaeological finds in their setting, to the development of landscape archaeology, and to the
incorporation of conceptual considerations in archaeological research, often called "post-processual
archaeology." Landscape archaeology can be seen as operating on three levels: the lowest level is
the plot, where a cultural resource manager plots finds and features on a base map; the next level up
is the pattern, where field archaeologists set the plot of their discoveries against others, by analyzing
distributions of artifacts or spacing of settlements; while the highest level is interpretation, in which
the researcher places the pattern in the landscape. By "landscape" here is meant the natural or topo-
graphical environment, but that environment as weighted and distorted by various factors: economic
competition, ease of movement, accessibility of natural resources, the viewpoint of the traveler, or
the symbolic practices of the community—all of which may be expressed as some kind of network,
which is the essential connotation of the term "cultural landscape." The maritime cultural landscape
is harder to recreate than the terrestrial, owing to the continuously changing sea and the out-of-sight
seabed, but can be constructed with the help of structural models. An important element of these is
the transport zone, a stretch of coastal sea, often clearly demarcated by natural features, that shares
a common approach to navigation and ship construction; it is at the boundaries of transport zones
that significant transitions take place and recognizable progress into "foreign" waters is made. In the
case of the Graeco-Roman Mediterranean, the historical or ethnographical clues are lacking that have
enabled Scandinavian scholars to reconstruct such zones and transitions in their historical seafaring;
however, for the purposes of this study, one can use the different seas of the Mediterranean as defined
in ancient literature to form the basis of a maritime landscape structure.

In modern times the Mediterranean is generally categorized in terms of three great basins ar-
ranged west-east; however, the ancients did not see the Great Sea this way, but rather devoted much
ingenuity to dividing it into many different sea areas. The divisions—especially in the Aegean, as
too, obviously allow some flexibility of interpretation. It is
29 Briefly explained, with attention to maritime archaeology,
by Parker 2001.

30 The concept introduced by Westerdahl 1992.

31 Well discussed by Rougé 1966, 41–45, from whom this dis-
cussion derives. The different seas as named by the ancients
are of varied connotation, and the list followed here is a com-
promise among different authorities' names; the boundaries,

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we call it—were of very unequal size; however, one can see that in broad terms these maria corresponded to a seafarer’s view of the world. Many of the transition points from one area to another were dangerous, such as Cape Malea in Greece, the Strait of Messina between Sicily and Italy, or the Strait of Bonifacio between Corsica and Sardinia; the ancient sea divisions thus pivoted on transition points just like the transport zones of Scandinavia, and they will serve for similar zonation in the Mediterranean. The Roman seas, termed “the maritime spaces of the ancient Mediterranean,” are mapped by Rougé as in figure 21 here. It is relatively easy to map ancient shipwrecks into these seas, and in doing so one is going beyond the simple patterning of a plain locational distribution into overlaying the distribution onto a cultural landscape.

For the present, this study will stop short of detailed interpretation and concentrate on statistics. As in the previous section, in which the pattern of shipwrecks was considered as a geometrical figure, corresponding to a distorted chart of the Mediterranean, so here the whole register of shipwrecks is shown in the blocks of sea, named and numbered as in figure 21 but in tabular form (table 1).

Table 1 shows where ancient ships are known to have been lost, but in proportion according to which sea, or transport zone, they were lost in. This pattern for all ancient wrecks can be constructed (as in the earlier discussion) as a cumulative percentage graph, which offers the interpreter a “normal” profile of wreck distribution, against which particular classes of wreck can be judged (fig.

### Table 1. Register of shipwrecks in the divisions of the ancient Mediterranean.

<table>
<thead>
<tr>
<th>Sea no.</th>
<th>Ancient name</th>
<th>Wrecks (N)</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mare Ibericum</td>
<td>37</td>
<td>4.8</td>
</tr>
<tr>
<td>2</td>
<td>M. Balearicum</td>
<td>71</td>
<td>10.9</td>
</tr>
<tr>
<td>3</td>
<td>M. Gallicum</td>
<td>148</td>
<td>23.4</td>
</tr>
<tr>
<td>4</td>
<td>M. Ligusticum</td>
<td>117</td>
<td>33.3</td>
</tr>
<tr>
<td>5</td>
<td>M. Sardoum</td>
<td>38</td>
<td>36.6</td>
</tr>
<tr>
<td>6</td>
<td>M. Tyrrenenum/Infernum</td>
<td>231</td>
<td>56.1</td>
</tr>
<tr>
<td>7</td>
<td>M. Africa</td>
<td>65</td>
<td>61.7</td>
</tr>
<tr>
<td>8</td>
<td>M. Adriaticum/Superum</td>
<td>135</td>
<td>73.1</td>
</tr>
<tr>
<td>9</td>
<td>M. Ionium/Adriaticum</td>
<td>105</td>
<td>82.0</td>
</tr>
<tr>
<td>10</td>
<td>Syrte</td>
<td>2</td>
<td>82.2</td>
</tr>
<tr>
<td>11</td>
<td>M. Thracicum</td>
<td>15</td>
<td>83.5</td>
</tr>
<tr>
<td>12</td>
<td>M. Aegaeum</td>
<td>15</td>
<td>84.7</td>
</tr>
<tr>
<td>13</td>
<td>M. Myrtoum</td>
<td>20</td>
<td>86.4</td>
</tr>
<tr>
<td>14</td>
<td>M. Icarnum</td>
<td>2</td>
<td>86.6</td>
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<tr>
<td>15</td>
<td>M. Creticum</td>
<td>39</td>
<td>89.9</td>
</tr>
<tr>
<td>16</td>
<td>M. Carpathicum</td>
<td>17</td>
<td>91.3</td>
</tr>
<tr>
<td>17</td>
<td>M. Libycum</td>
<td>6</td>
<td>91.9</td>
</tr>
<tr>
<td>18</td>
<td>M. Aegyptiacum</td>
<td>9</td>
<td>92.6</td>
</tr>
<tr>
<td>19</td>
<td>M. Phoenicum/Syracum</td>
<td>45</td>
<td>96.4</td>
</tr>
<tr>
<td>20</td>
<td>M. Cyprium</td>
<td>9</td>
<td>97.2</td>
</tr>
<tr>
<td>21</td>
<td>M. Pamphyluum/Lycium</td>
<td>19</td>
<td>98.8</td>
</tr>
<tr>
<td>22</td>
<td>Pontus Euxinus</td>
<td>14</td>
<td>100.0</td>
</tr>
</tbody>
</table>
In further study, this profile will enable generalization about ancient shipwrecks that is linked with Graeco-Roman perceptions of the sea and of movement around the Mediterranean.  
Interpreters who map shipwrecks in zones in this way can avoid the problem of not knowing the intended route or destination of the ancient ships that were lost in mid-voyage. If one takes, for example, the map of Dressel 1 amphora cargoes (fig. 17), one can see that they fall across several zones; this gives an index of the extent to which these amphoras were transported long distances (table 2). Furthermore, since in this case we know the origin of these wrecked cargoes, one can analyze their diffusion in terms of the number of transport zones crossed; this gives one an index of their journeying without having to try to reconstruct linear tracks from nonexistent traces.

This distribution pattern may be characterized thus: one in five of the known Dressel 1 wrecks are in the Mare Tyrrhenum (within a few hundred kilometers of their likely port of departure), but twice as many wrecks occur in one of the next seas to be reached, and again in the next sea after that. The pattern is certainly different for other classes of wreck, as, for example, cargoes of African cylindrical amphoras (cf. fig. 14).

Table 3 shows that one in three wrecks of African amphora cargoes sank in what we may call home waters, in the Mare Africum, that an even larger proportion sank in the next sea entered, notably the Mare Tyrrhenum en route to Rome and central Italy, while a rather smaller proportion reached farther from home before they were lost. This is, however, rather a coarse analysis: a proper comparison depends on basing the entries on the number of wrecks of each class as a percentage of all wrecks found in each sea zone, and to prepare the data to this standard, as well as to take full account of recent discoveries, is beyond the scope of the present paper. Nonetheless, this preliminary example shows how it is possible to relate the archaeological data to the dangers and costs of longer voyages, and to the different sorts of markets that might be found in more distant journeys.

To return, in conclusion, to a question discussed earlier in this paper: what can one do to work out a formula for the limits beyond which it was worth transporting goods in the Roman world? The discussion of tile cargoes should certainly suggest that most tiles traveled within one component sea zone—that is, the Mare Adriaticum or Superum in the case of tiles from Aquileia or Emilia, or

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32 These diagrams are based partly on data that have not been updated. The original versions of figures 11–15 and 17–21 were drawn by Susan Grice (University of Bristol).
The Mare Tyrrenenum in the case of tiles from Latium or Campania. Only rarely can they be shown to have crossed into a second sea from their sea of origin (as the ship lost at Punta Scario might have been attempting to do). This observation is all the clearer by comparison with the picture of Dressel 1 amphora cargoes, just reviewed. By this means, therefore, one is able to relate finds in shipwrecks to artifact distributions on land and to integrate the patterning of archaeological data with the inferred networks, the cultural landscape, of the ancient Mediterranean and the maritime world of Rome.
Works Cited


Tyers, P., Roman Pottery in Britain (London 1996).


