Shipments Great and Small: Moving Building Materials by Sea

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Introduction

Demand for prestige materials, primarily from major imperially-funded projects but also from locally-funded schemes all around the Roman world, put enormous pressure on the producers of raw materials and, especially, transporters. Big buildings demanded big materials and this had an impact on the infrastructure through which these materials were used and the means of transport employed. But the fashion for stone construction more generally also meant that vast quantities of this material were moved overseas throughout the Roman period. As Knoop and Jones have remarked, in a study on stone working in the Middle Ages: 'apart from the selection of suitable stone, probably the most important problem in connection with the supply of building materials was that of carriage.'[1] In this short paper I will consider what the shipwreck evidence reveals about the dynamics of this traffic, focusing on cargoes both big and small, and what they reveal about the commercial mechanisms behind them.

The Shipwrecks: Dataset and Chronology

Our shipwreck record is ever expanding. New wrecks are continually being discovered and old ones re-examined; important recent initiatives, like the publication of Strauss' dataset of wrecks on the Oxford Roman Economy Project's website and McCormick's mapping of sites on the *Digital Atlas of Roman and Medieval Civilisations*, show how our knowledge of the underwater record has increased since Parker's seminal *Ancient Shipwrecks of the Mediterranean and the Roman Provinces*.[2] Although several new stone wrecks have been found in recent years, most of these are yet to be fully published and so for the purposes of this contribution the dataset that I published in 2013, which constitutes 95 wrecks with stone cargoes, will be used.[3] As the distribution map in fig. 1 shows, the known wrecks are spread all around the Mediterranean, though with significant concentrations in French and Italian waters. There are good reasons to think that the density of wrecks in both these areas reflects the original intensity of maritime traffic but it should also be noted that wrecks are primarily found in areas where diving is popular and visibility good; 66% of the wrecks documented by Parker are located in water less than 30 m deep.[4] The empty areas on this distribution map need to be treated with caution, therefore; absence of evidence is not evidence of absence, and there are certainly more unpublished wrecks containing stone cargoes in the Aegean, for instance.

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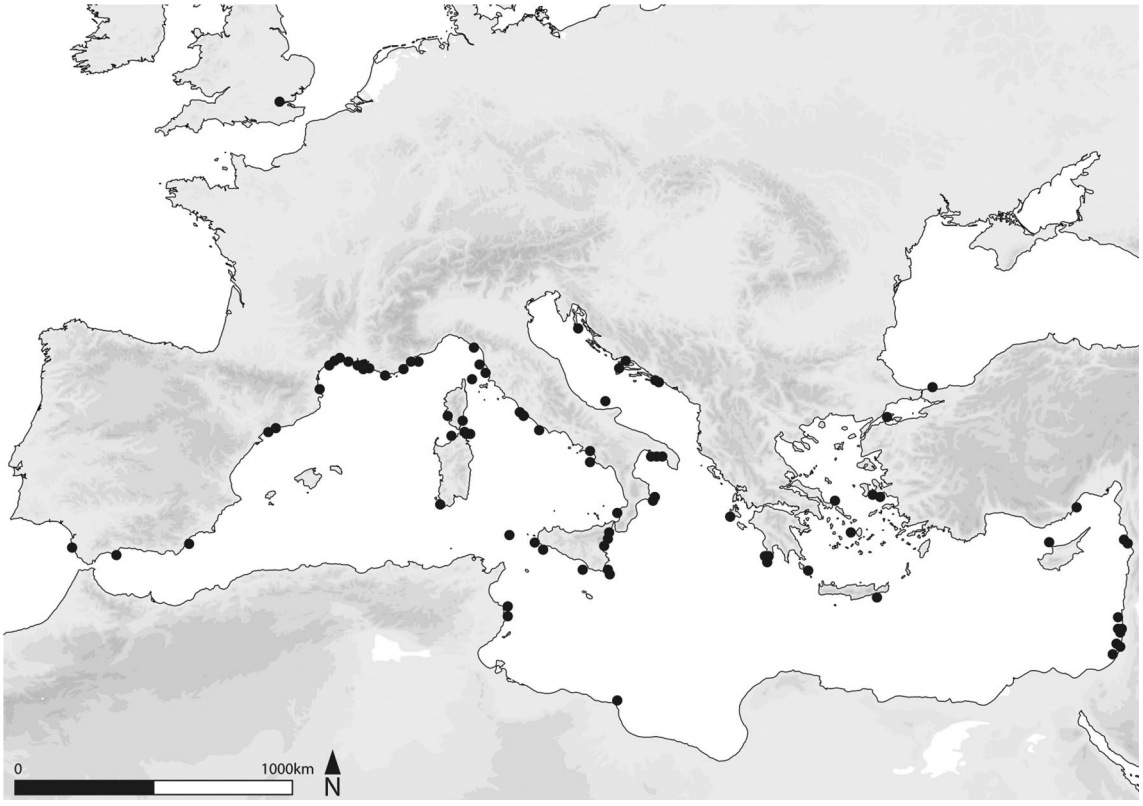

Fig. 1: Distribution of shipwrecks with stone cargoes.

The chronology of these wrecks shows some interesting trends, especially when considered against the background of the overall peak in shipwrecks, located by Parker in the 1st century BC and by Wilson in the 1st century AD.[5] Both those wrecks datable on archaeological, epigraphic, numismatic or other grounds to a specific 100-year period and those dated more generally show a peak in the 3rd century AD (fig. 2). This is particularly striking when one considers the evidence from land-based sites, which would indicate a zenith in the long-distance stone trade somewhere between the late 1st century AD and the late 2nd century AD.

The first thing that should be noted about this dataset, however, is that the wrecks that contribute to this third-century column on the histogram primarily belong in the first half of that century. Equally, this total is inflated by wrecks dated more broadly to either the end of the 2nd or the early 3rd century AD; in other words, much of this activity is Severan in date, an era in which large-scale construction at Rome but also a range of provincial centres boomed.

The second thing to note about the wrecks dated to this period is that a substantial number were carrying sarcophagi rather than architectural elements (fig. 3). In fact, the number of third-century ships carrying stone for building is roughly the same as in the 1st century AD. These sarcophagus wrecks are indicative of demand for imported marble for

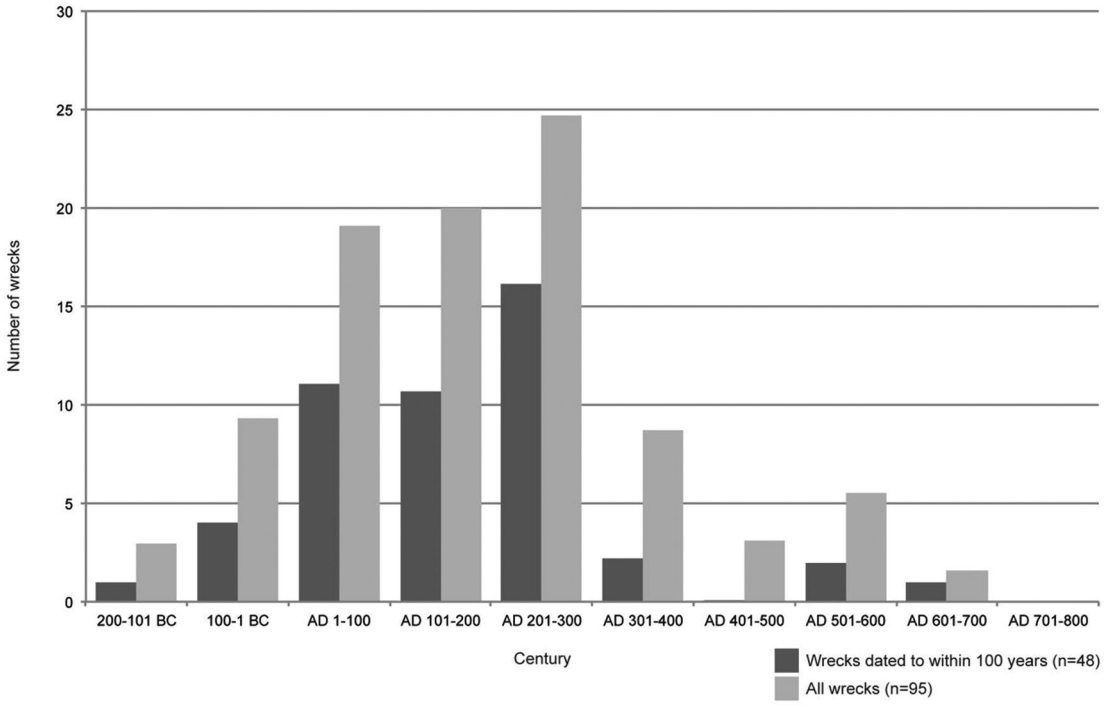

Fig. 2: Histogram of shipwrecks with stone cargoes.

funerary monuments, which in fact continued right through the 3rd and into the 4th century AD, as evidence from the various Adriatic centres, like Aquileia and Ravenna, shows.[6]

The third point to note about the chronology of these shipwrecks is that these later examples are primarily from southern Italian waters. The number of wrecks elsewhere in the western Mediterranean drops off after the 2nd century AD (fig. 4). In contrast, the totals from the eastern Mediterranean stay relatively low throughout the period and are only higher than the western Mediterranean numbers in the 5th to 7th centuries.

Big Ships

Why this concentration of shipwrecks in this relatively late period off southern Italy? These wrecks are focused along the southern coasts of Puglia and Calabria, and along eastern Sicily. All of these vessels were carrying eastern materials – in fact by the 3rd century AD our dataset is heavily dominated by vessels carrying stones from eastern quarries. There is a clear correlation here between the scale and direction of this traffic and the evidence for marble use on land: Luna marble, the main western material identified in shipwreck cargoes (primarily in the Tyrrhenian and off southern France), drops off in use in the mid 2nd century AD and is increasingly replaced by eastern materials (especially Prokonnesian marble), notably at Rome.[7]

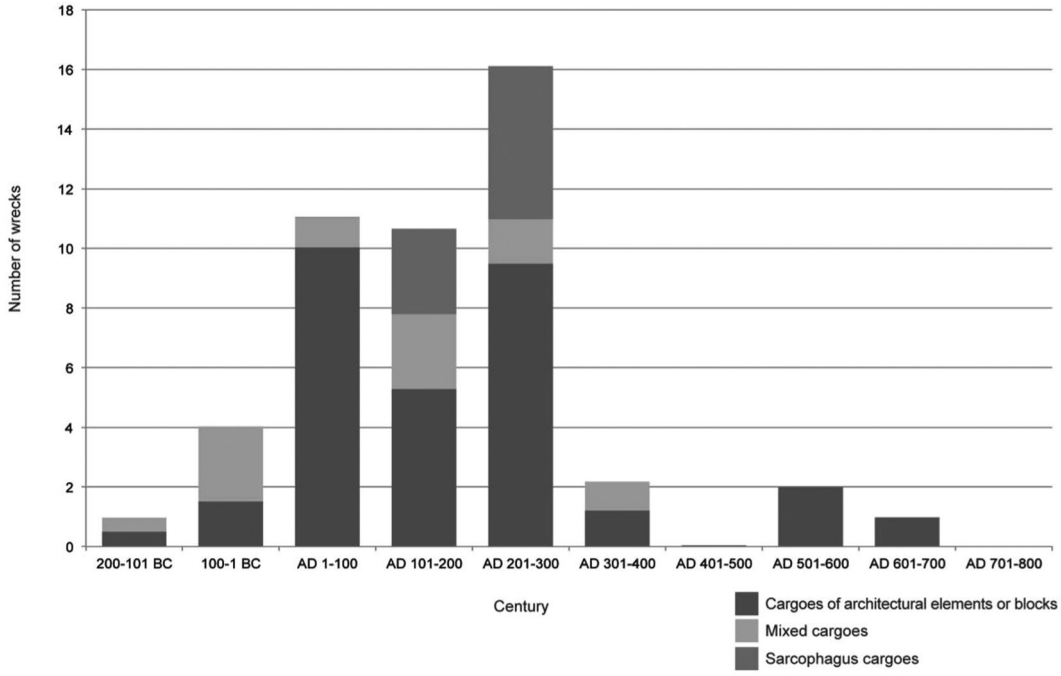

Fig. 3: Histogram of cargo types on shipwrecks datable to a specific 100-year period.

These southern Italian vessels are found on the sea route from the Aegean to Rome and the distance that these ships had to have travelled might explain the number we find wrecked. The trajectories of this traffic can be seen if we map these wrecks based on the likely origin of their cargoes, using the methodology suggested by Parker, which takes account of the divisions of the Mediterranean sailed through rather than the distance traversed (fig. 5).[8] As this map shows, almost all the wrecks in the *Ionium* sea were carrying materials from extremely far away. In the graph form of these data (fig. 6), we can see that western materials were not being moved far – or at least the shipwreck evidence does not give us any insight into those materials that were moved further – while the bulk of the eastern materials that we find in wrecks were being distributed substantial distances. The ships traversing the Ionian sea and rounding southern Italy were travelling considerably further and through far more dangerous seas than those plying the Tyrrhenian and Ligurian seas, for instance. However, the long-distance maritime trade in eastern marbles did not begin in the Severan period; it had, in fact, been going on to varying degrees since the 2nd century BC and highly intensively since the mid to late 1st century AD. Considering this, one might expect more second- rather than third-century wrecks in this area. Distance travelled cannot be the only factor explaining the number of third-century Italian wrecks.

The size of these ships' cargoes suggests another possibility. Many of these Italian ships were carrying cargoes that are among the largest found anywhere. Table 1 lists the smallest (<40 tonnes) and largest (>150 tonnes) recorded stone cargoes. French wrecks,

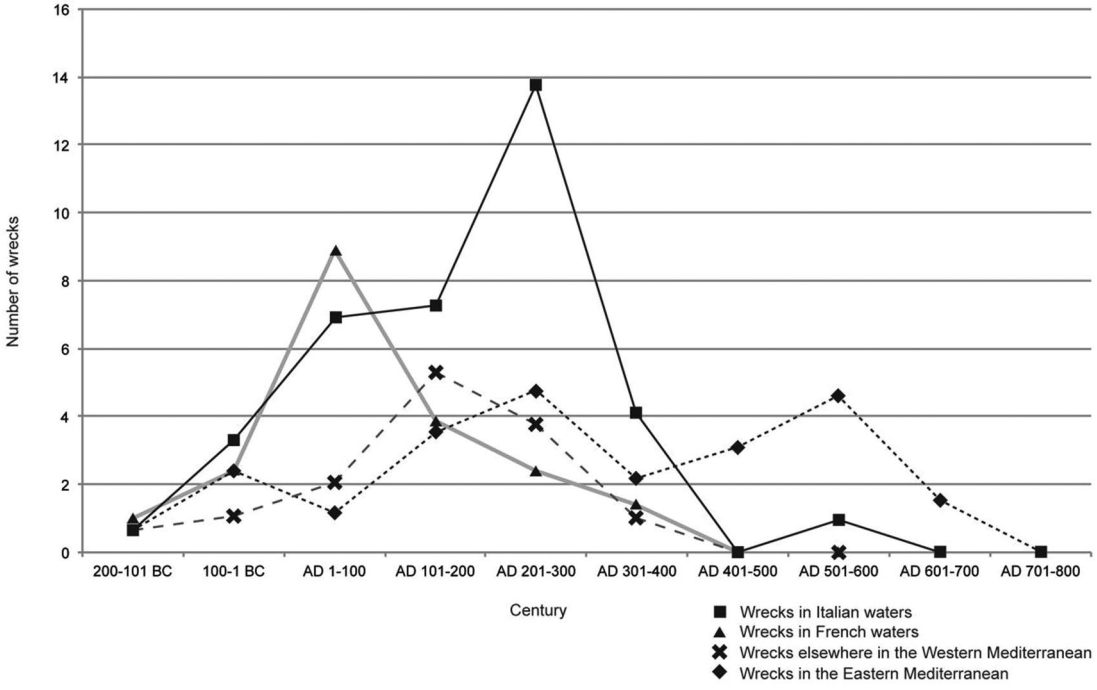

Fig. 4: Graph of the location of shipwrecks by century.

as well as Croatian ones, dominate the list of the smallest ones and southern Italian ones the list of largest ones. The largest three wrecks were all enormous, with stone cargoes in excess of 300 tonnes: Capo Granitola A, Isola delle Correnti, and Punta Scifo B.[9] Individual cargoes did not get larger over time; there is no suggestion of a general trend in cargo or, indeed, ship size. However, there are more large cargoes attested in the 3rd century AD: four are dated securely to that century with another two being dated to the 2nd–3rd and 3rd–4th centuries respectively, compared to one in the 1st century BC and one in the 1st century AD. These cargo weights are not equivalent to the deadweight tonnages of the vessels carrying them, that is the amount of cargo these ships could carry – their capacity. Perishable commodities could have formed an additional component of the cargo and it is also likely that ships carrying cargoes as heavy as stone blocks would have travelled under-capacity: as Throckmorton noted, 'modern practice is never to load a ship with stone beyond about two-thirds of its gross tonnage.'[10] 'Gross tonnage' here refers to the volume of the vessels.

Considering this, two options relating to these vessels present themselves. If the Capo Granitola A, Isola delle Correnti, and Punta Scifo B ships were travelling under-capacity, with just two-thirds of their volume filled by cargo, then their deadweight tonnages – their capacities if full – could have been over 500 tonnes. This would put these three ships among the very largest known from the Roman period: the Madrague de Giens wreck has an estimated deadweight tonnage of ca. 400 tonnes and the Albegna

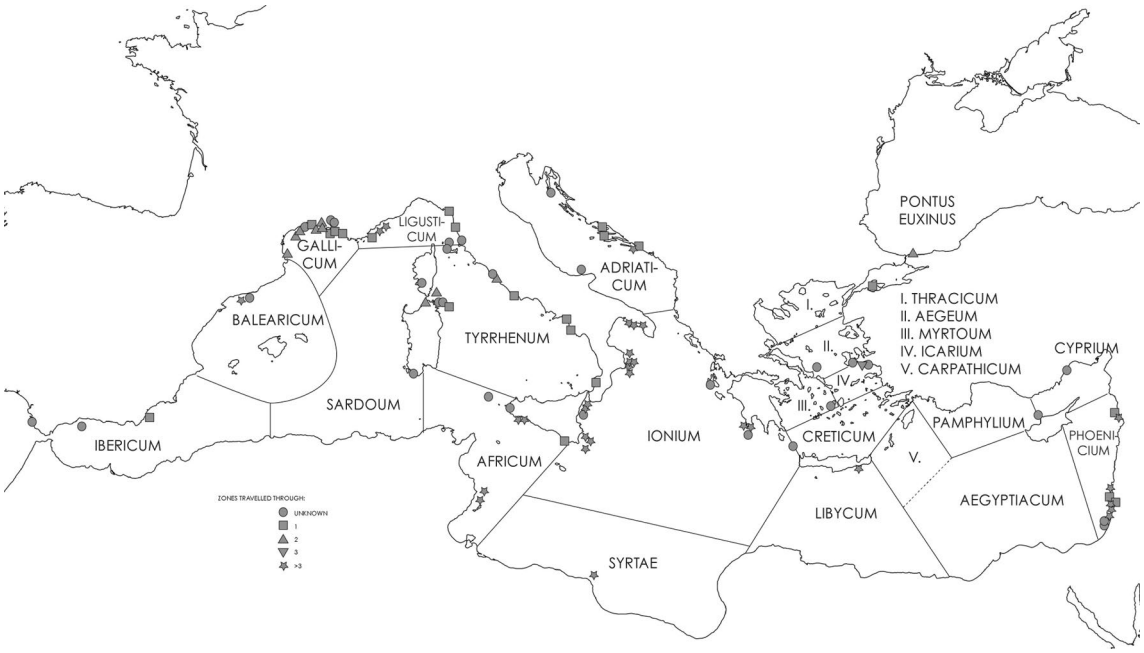

Fig. 5: Map showing the zones through which cargoes have travelled from source.

wreck, the largest known, around 500–600 tonnes; both are dated to the 1st century BC.[11] In the case of the Isola delle Correnti wreck, Kapitän used the hull remains to estimate its length at 40–48 m, its beam at 10–12 m, and its height from keel to deck at 5–6 m.[12] This would make it larger than the Madrague de Giens ship, estimated at 37.5 m in length.[13] In the case of the Capo Granitola A and Punta Scifo B ships not enough remains of the hulls to allow a similar reconstruction. Either they were similarly large or, alternatively, these vessels were not travelling sensibly under-capacity and were in fact dangerously overloaded.

The fact that more large cargoes of stone are attested in the third century than earlier might indicate a certain pressure on transporters. Large building projects were still taking place at Rome but the general number of ships sailing on the Mediterranean, to judge from the shipwreck record, would seem to have dropped in this period. It is possible, therefore, that those large ships that were available were increasingly used for stone transport and, in some cases, even overburdened, in order to cut down the time it took to transport building supplies to major projects. Meijer has also suggested that the imperial system of providing incentives for shippers engaged in the transport of imperial produced might also have a bearing on the later peak in shipwrecks with stone cargoes.[14] As incentives waned in the 2nd century, he argued, the state had fewer ships to pick from. He notes that analysis of the hull remains of the Torre Sgarrata ship, dated to the late 2nd or early 3rd century AD, suggest it was old.[15] More analysis of ships' timbers is required to confirm this overall hypothesis but the limited evidence available at the moment is suggestive.

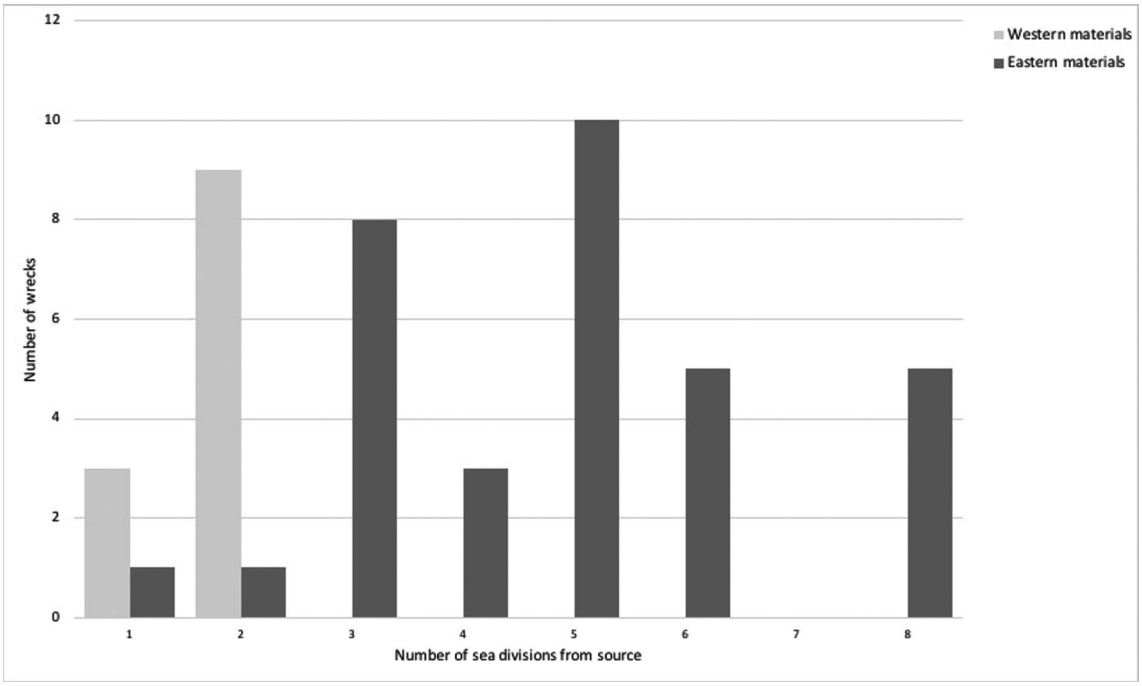

Fig. 6: Graph of the data mapped in fig. 5.

Even if these vessels were sensibly loaded and not travelling at capacity, transporting a material as heavy as stone on a large ship brought with it significant risks. Casson, in fact, when arguing for a specialised variety of ship for stone transport – a *navis lapidaria* – suggested that such a transporter should have been 'shorter and sturdier' than ordinary merchantmen and ideally also reinforced.[16] If a ship the size of the Isola delle Correnti one was fitted out with a reinforced hull this would have added substantially to its displacement (the weight of the cargo and the ship). Considering that the lightweight tonnage (hull and equipment weight) of the shorter Madrague de Giens ship has been estimated as 166 tonnes, the displacement of the full Isola delle Correnti ship would probably have been well over 600 tonnes.[17] This was certainly not a short ship and if it was reinforced it would have been extremely cumbersome; in fact, it is hard to imagine a ship less like Casson's ideal stone carrier.

Small Ships and Local Traffic

Many of the stone-carrying ships wrecked off southern Italy, therefore, were exceptionally large and travelling long distances. Most ships engaged in the movement of building materials were much smaller, typically carrying cargoes of well under 100 tonnes.[18] Some of them, as the distribution map in fig. 5 and graph in fig. 6 show, also moved relatively short distances. Nowhere is this picture of what Parker has called 'low-

Smallest cargoes			Largest cargoes		
Site	**Cargo**	**Weight (tonnes)**	**Site**	**Cargo**	**Weight (tonnes)**
Capo Granitola D	Architectural elements (Prokonnesian)	<10	Capo Granitola A	Architectural elements (Prokonnesian)	c. 350
Jakljan	Sarcophagi	<10	Isola delle Correnti	Blocks (Prokonnesian)	c. 350
La Mirande	Marble slabs	<10	Punta Scifo B	Blocks	c. 350
Les Riches Dunes 5	Block and panels	<10	Sapientza	Blocks	c. 300
Sète	Column drum and block	<10	Punta del Francese	Blocks	c. 265–275
Skerki F	Blocks and columns	c.13	Mahdia	Various	c. 250–300
Les Laurons IX and X	Building stone	c.13 and c.33	Punta Cicala	Architectural elements	c. 250
Dramont I	Blocks	c.23	Saint Tropez A	Architectural elements	c. 200–230
Marseillan	Blocks	c.24	Punta Scifo A	Architectural elements	c. 200
Camarina A	Giallo antico columns	c.20–30	Marzamemi A	Blocks and architectural elements	c. 170–200
Carry-le-Rouet	Building stone	c.25–30	Cavo Doro	Blocks	c. 160
Veli Školj	Sarcophagi	<30	Torre Sgarrata	Sarcophagi	c. 160
Izmetište	Building stone	c.30–40	San Pietro	Sarcophagi	c. 150
Saintes-Maries 18, 21 and 22	Blocks	c.30–40 each	Ekinlik Adasi	Architectural elements (Prokonnesian)	c. 150

Table 1: The smallest and largest attested stone cargoes.

profile local traffic' clearer than off southern France.[19] Here we see what Leidwanger has termed a distinct 'maritime economic neighbourhood'.[20]

Among these French shipwrecks are cargoes of local building stone that were being moved along the coast because land transport was more costly. The Carry-le-Rouet shipwreck, dated to the late 2nd or early 1st century BC, shows that this practice was common in the Hellenistic/Republican period, as well as later.[21] The two ships that sank in the harbour at Anse des Laurons were carrying Ponteau limestone, again for local use.[22]

Not all of these French wrecks were carrying local materials, though. A series of vessels moving Luna marble from northern Italy have been excavated in recent years;

typically their cargoes do not exceed 30–40 tonnes. The three first- or second-century AD ships discovered at Saintes-Maries, each containing six or seven large blocks of Luna marble, are cases in point.[23] Only the Dramont I ship was transporting marble from the eastern Mediterranean and this vessel was probably loaded close to Rome or in some other central Italian harbour.[24] The vessels dealing with imports in this region, therefore, were primarily involved in traffic between the harbour at Luna and the cities of southern France.

Comparable 'maritime neighbourhoods', at least with regard to stone transport, can be recognised in the Adriatic, as well as off the coast of Israel. In the latter case, however, the wrecks identified belong mostly to the late antique period and reflect building activity and the supply of materials to it in a very particular historic context.

Commercial Mechanisms

The distribution and chronology of wrecks carrying stone cargoes reveal a range of patterns and show that there was no single way of transporting this material. What does the composition of their cargoes add to this picture? In an important recent article, Boetto has used a range of shipwrecks containing different types of commodities and cargo compositions to illustrate how different modes of commercial mechanism existed contemporaneously.[25] Her aim is to show how debates about whether Roman maritime trade was primarily either 'direct'/'commissioned' or 'indirect'/'tramping' somewhat miss the point, since within the shipwreck record a whole range of mechanisms can be noted. Boetto highlights five ships in her study: (1) the Madrague de Giens ship, with its homogenous cargo (wine amphorae) loaded simultaneously at a harbour near the place of production and shipped directly to another port; (2) the Cabrera III ship with a heterogenous cargo (various amphorae) loaded simultaneously at a main port (*entrepôt*) and transported directly to another main port; (3) the Culip IV ship with a heterogeneous cargo (various amphorae and finewares) loaded simultaneously at a main port (*entrepôt*) and transported directly to a secondary harbour; (4) the Cavalière ship with a heterogeneous cargo (various amphorae and pork) accumulated and sold via tramping; and (5) the Barthélemy B ship with a homogenous cargo (roof tiles) that is specifically commissioned and transported.

None of the ships that Boetto highlights were carrying stone but some of the same diversity can be noted among the stone shipwrecks. Heterogeneous cargoes existed, for instance, on the Dramont I ship, as already observed, as well as on the Izmetište and Margarina ships; these are comparable in form to the cargoes on the Cabrera III or Culip IV ships in Boetto's typology.[26] On a tiny number of wrecks stone was found in such small quantities that it could have been moved via tramping: on the La Mirande ship, for instance, where five panels of Luna marble

accompanied a cargo of amphorae and on the Chrétienne M(3) wreck, where *africano* panels were recovered.[27] In general, however, the known stone cargoes are extremely homogenous; even acknowledging that many of these sites are patchily published and any perishable elements are now lost, it still seems to be the case that stone usually formed the primary component of these cargoes. Most of these wrecks also contain just a single lithotype. The bulk of ships carrying stone identified to date, therefore, are closest in cargo composition to the Madrague de Giens and Barthélemy B types on Boetto's scheme. Many of the most important marble quarries were located close to the coast and had their own harbours nearby – the quarries on Prokonnesos and Thasos are notable examples – and so it is entirely feasible that some of our ships were loaded directly at the quarry.[28] The small number of cargoes containing two or more lithotypes were probably loaded at main ports. The Punta Scifo A ship, with its cargo of Prokonnesian and *pavonazzetto*, and the Giardini Naxos ship, containing Prokonnesian and *cipollino*, have been argued by others, based on the arrangement of the components of their cargo, to have been loaded in one go at a single location.[29] Ephesos or Nicomedia have been proposed for the former, while the Piraeus might make sense for the latter. In the former case, one overseas shipment (of the Prokonnesian blocks) would have to have preceded the final voyage (with the *pavonazzetto* arriving at the port by land), while in the case of the Giardini Naxos cargo, both the *cipollino* blocks and the Prokonnesian ones would have had to have been shipped to Piraeus before being loaded onto a new ship. The picture suggested by these cargoes fits nicely with Nieto's model of redistribution, as well as Arnaud's observation about so-called 'segmented' sailing.[30]

The majority of ships carrying stone cargoes, in sum, were engaged in 'direct' trade and indeed, like the cargo on the Barthélemy B ship, it is probable that these cargoes represent specific commissions. This argument is clearest in the case of the sarcophagus wrecks, especially the San Pietro ship, which contained chests and lids that still had to be separated and paired up.[31] But it is also probable that all of the vessels containing monolithic columns were transporting commissions.

Conclusions

In his description of Roman engineering, Strabo remarks that 'they [the Romans] have so constructed also roads which run throughout the country, by adding both cuts through hills and embankments across valleys, that their wagons can carry boat-loads…'[32] Overland vehicles and even river vessels, of course, would never have been able to carry the sorts of weight the vessels discussed above routinely shipped. Ordinary wagons would rarely have been able to cope with more than a couple of tonnes.[33] On rivers, where large barges were favoured for stone transport, few capable of carrying more than 100 tonnes have been excavated. Strabo's real point here is that roads opened

up inland areas and that cuttings and embankments, bridges and other infrastructure helped to control the gradient of these roads and so allow the movement of heavy cargoes. Overland and riverine transport was never as efficient as maritime transport in antiquity, however, and for this reason the long-distance movement of stone in the Roman world was primarily carried out by sea. The shipwreck record is the most useful tool available to us for understanding how this maritime traffic in stone was organised and the diversity of cargoes moved around the ancient Mediterranean. While most stone was probably moved through 'direct' trade – and in response to specific orders from architects, workshops or single commissioners – smaller quantities of stone could have been shipped in other ways. Crucially, in no other period, anywhere, do we find as much evidence for the movement of stone by sea as we do in the Roman Mediterranean.

Notes

[1] Knoop – Jones 1967, 45.

[2] Strauss 2013; Digital Atlas of Roman and Medieval Civilisations: https://darmc.harvard.edu/; Parker 1992.

[3] Russell 2013b.

[4] Parker 1992, 5.

[5] Parker 1992, 8 f.; Wilson 2011.

[6] On northern Italian sarcophagi, see Gabelmann 1973.

[7] Russell 2013a, 186.

[8] Parker 2008, 194; the map is based on that produced in Rougé 1966.

[9] Pensabene 2003; Kapitän 1961, 282–288; Bartoli 2008.

[10] Throckmorton 1972, 76.

[11] For the most recent estimate of their tonnages, see Nantet 2016, 343 f. 355–360.

[12] Kapitän 1961, 286–288.

[13] Nantet 2016, 358.

[14] Meijer 2002, 151 f.

[15] Throckmorton 1969, 300.

[16] Casson 1971, 173.

[17] Nantet 2016, 358 f.

[18] Russell 2013b.

[19] Parker 1996, 100.

[20] Leidwanger 2013, 204.

[21] Kainic 1986.

[22] Ximénès – Moerman 1993.

[23] Long 1999.

[24] On this wreck, Joncheray 1998; on its route, Russell 2013a, 136.

[25] Boetto 2012.
[26] Jurišić 2000, 65. 69.
[27] Descamps 1992; Joncheray – Joncheray 2002.
[28] Russell 2013a, 135.
[29] Pensabene 1978, 112–114; Basile 1988, 138 f.
[30] Nieto 1997; Arnaud 2005.
[31] On this point, see Russell 2013a, 271 f.
[32] Strabo 5.3.8.
[33] Russell 2013a, 97 f.

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Figs. 1–2. 4: Russell 2013b. – Figs. 3. 5–6: by the author. – Table 1: by the author.

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