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EDITED BY

DANIELE MALFITANA, JEROEN POBLOME,

JOHN LUND

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E-mail: accademiaeditoriale@accademiaeditoriale.it

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Tel. + 39 06 70493456 · Fax + 39 06 70476605
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THE DYNAMICS OF STONE TRANSPORT BETWEEN THE ROMAN MEDITERRANEAN AND ITS HINTERLAND

BEN RUSSELL

IN his twelfth-century description of the North African coastline, the Arab geographer El-Edrisi notes that ‘nobody leaves Carthage without loading considerable quantities’ of stone, often columns, onto their ships.¹ Much of this material was destined for nearby Tunis, where Al-Makkari later observed that, just as at Alexandria, ‘all the houses are built of stone...owing to the great quantity of ancient material.’² At the other end of the Mediterranean, accounts of the building of the tenth-century Medinet Al-Zahra, near Cordoba, refer to columns being brought, via sea and river, from Rome, North Africa, and Asia Minor.³ On the carousel of re-use many of these same structures were stripped of their marble in turn to supply other needs, notably the large Ottoman projects at Constantinople and elsewhere. The demands of the Ottoman state are illustrated neatly by a series of projects aimed at recovering large pieces of marble from both ancient and medieval structures all along the eastern Mediterranean coastline.⁴ The bulk of this movement was seaborne. The reasons for this are explained in more detail in a seventeenth-century essay assigned, tentatively, to the hand of the English poet John Milton (1608-1674).⁵ Part guide, part directive, this short treatise, intended for the discerning gentleman collector and entitled *On Statues & Antiquities*, details those sites of the Ottoman Aegean most bountiful in artefacts suitable for export. Two regions are highlighted. First, the Peloponnese:

... round about near the sea coast, where any ancient city hath bin, which will appear by the ruines, & neare a port where ships may come (p. 259, ll. 2-5).

Second, the coastline of Asia Minor:

... near the sea, from Cnidus standing of the point of Doris even as far as Ilium, must needs yield abundance of Antiquities there remaining the ruines of many famous grecian cities,

¹ El-Edrisi III.2 (JAUBERT 1836, p. 264); cf. GREENHALGH 2006 on stone-use in the Arab world generally. Paul Russell, Susan Walker and Andrew Wilson kindly read earlier drafts of this paper. I am grateful for their suggestions and those of Facta’s anonymous reader. Much of this material was put together during the tenure of a Rome Award at the British School at Rome for presentation at a colloquium organized by Nicholas Purcell and Jean-Marie Pailler at the Université de Toulouse - Le Mirail in March 2008. The research on which this work is based is undertaken at the University of Oxford under the auspices of the Oxford Roman Economy Project and is funded by the Arts and Humanities Research Council.

² Al-Makkari I.7 (DE GAYANGOS 1840, p. 86).

³ Al-Makkari III.3 (DE GAYANGOS 1840, pp. 232-236).

⁴ ROGERS 1982.

⁵ MABBOTT-FRENCH 1938, pp. 259-61. This is the first essay in the Columbia Manuscript and even if it was not written by Milton it was certainly in his possession. Milton was associated with the Arundel family whose agents John Markham and William Petty were active in the purchasing of antiquities from the Aegean (cf. MABBOTT-FRENCH 1938, pp. 519-20). A photocopy of this text (now in the BSR archive) was in Ward-Perkins’ possession, though he never referred to it in his publications.

such as Halycarnassus, Heraclea, Ephesus, Colophon, Smyrna, Trajanopolis, &c. & further into the land Pergamus, where many excellent things may be had, only the charge will be more, by carryeing them to the sea (p. 260, ll. 4-10).

The suitability of these sites is determined both by the likely quality of their resources and their accessibility. For although finer statues merit special effort – and ‘the naked ones are of greatest value’, it is noted – profitability is reliant on the practicability and cost of export, itself explicitly related to distance from the coast. Hence, on Olympia:

... here must needs be an infinite number & all good, nothing being dedicated in that place but the works of the most excellent Masters, within the land may many things of these kinde be had, but the conducting of them by carts & drags will be more chargeable (p. 259, ll. 18-22).

Coastal sites are always favoured, especially those close to usable ports (‘coastal’ and ‘accessible’ are not always equivalent). Only by sawing desired objects into manageable portions could the exorbitant costs of land transport be mitigated.

This paper concentrates on the Roman period – the first three centuries AD in particular. Nevertheless, the long-distance transport of stone of all varieties did not end with the fall of Rome and these later documents offer a literal reflection of distributive practices in antiquity. They demonstrate most notably the continuing importance, in a better-documented era, of maritime transport dynamics for the distribution of stone objects, albeit second-hand ones. At both ends of the process, however, inland sites were part of quite a different pattern: spoliation remained local and small-scale and the supply of material for new projects similarly restricted. The latter is true even at major sites. The 290 columns of the Tomb of the Prophet at Medina, for example, were carved from local stone covered in polished stucco so as to appear marble, in much the same way as the columns of the Temple of Claudius at Colchester in Britain, were built of stucco-coated brick.¹

This paper explores what an examination of the long-distance distribution of artefacts carved in stone can reveal about the interconnectedness of the Roman Mediterranean – that ‘irregular lake, and all its ancient promontories’, as Ruskin puts it – and the lands beyond its coastline.² In so doing, it will attempt to contextualize the role of the imperially orchestrated redistributive system in this process and explore what the analysis of stone objects can add to attempts to model distribution patterns of material goods in the Roman world.³

MARITIME DYNAMISM IN ANTIQUITY

Numerous well-documented cases can be highlighted to document the long-distance seaborne distribution of stone around the Mediterranean in the first three centuries AD. Indeed, the majority of the most intensively exploited ancient quarries were located on the seaside or in close proximity to it. The white marble quarries of Thasos and those of Proconnesus are cases in point.⁴ At the former, material could be loaded directly onto waiting ships, as it could also at the granite quarries of northern

¹ DONALDSON 1930, p. 36; BLAGG 1990.

² RUSKIN 1906, vol. 2, pp. 153-154.

³ On the need to contextualize imperial activity, HARRIS 1993a.

⁴ KOŽELJ-MULLER-SODINI 1981; ASGARI 1979; ATTANASIO 2003, pp. 194-199.

Sardinia.¹ Changes in accessibility could have far-reaching implications. The silting up of the harbour at Luna during the 3rd century AD, for example, is seen as a crucial contributing factor to the diminished importance in this period of Carrara marble in the face of competition from the eastern quarries, above all the better-placed Proconnesian and Thasian ones.²

Of course, the relative efficiency of maritime transport affected access not only to these major quarries. The twenty-five sandstone quarries identified along the Tunisian littoral in a recent survey project are indicative of a preference for coastal extractive sites, even though little of this material was travelling far.³ Finds of Carthaginian limestone sarcophagi at Tarragona, however, show that maritime connections allowed well-located consumers to interact with more distant markets.⁴ In addition, it should be remembered, this peculiar dynamic of maritime connectivity was not a distinctly Mediterranean phenomenon.⁵ In this short paper, a single example – that of the palatial villa at Fishbourne, on the southern coast of England – will have to suffice. Here, Blagg has identified limestone from the local quarries along the coast of West Sussex (Selsey Bill, Church Rocks, and the Isle of Wight), from Purbeck in Dorset, as well as from several sites on the French coast, probably Soissons and Caen, pre-dating the extensive use of the latter in medieval England by some thousand years.⁶

The connective potential of the Mediterranean basin has been discussed in detail elsewhere.⁷ As the few above examples show, it was as instrumental to the distribution of stone objects as it was for artefacts in other media. So much is demonstrable, at least superficially, through recourse to the kind of distribution maps formulated most comprehensively, and most recently, by Lazzarini.⁸ Despite this, it could be argued quite legitimately that economic studies of the Roman world have tended to over-privilege the Mediterranean, an unsurprising observation when one considers the role played by the city of Rome, the largest market of antiquity.⁹ As Casson, elegantly but somewhat simplistically, puts it, ‘the Mediterranean in a very real sense made one world of the Roman Empire. The sea was the heart and around it the provinces stretched in a wide arc. The arteries were the shipping lanes, the largest leading from points on the perimeter to the huge capital at Rome, and later Constantinople.’¹⁰ However, Roman rule encompassed more land than sea. Rome and the Mediterranean were not synonymous. Indeed, it is questionable whether large areas of the Roman Empire ever had *normal* access to Mediterranean-centred distributive systems, be they commercial or redistributive.

Focusing solely on the pattern of connectivity stimulated by maritime transport it is easy to get carried away with the picture provided by stone objects. Hence, Dodge: ‘The golden age of the provincial municipalities, in which public munificence was one of the accepted responsibilities of the wealthy citizen, had arrived. This large consumer market caused marble to *flood* the provincial markets as it had the Rome mar-

¹ WILSON 1988.

³ PASKOFF-TROUSSET 2004, pp. 255-263.

⁵ ABULAFIA 2005, pp. 76-80.

⁷ HORDEN-PURCELL 2000; BRESSON 2005.

⁹ Cf., for example, Map 1 in SCHEIDEL *et al.* 2007; MATTINGLY 2007.

² WALKER 1988; DEL MEDICO 2002.

⁴ RODÀ 1990.

⁶ BLAGG 1990.

⁸ Cf. LAZZARINI 2004.

¹⁰ CASSON 1954.

kets a century before' (my italics).¹ The reality appears somewhat different. Certain provincial towns were well-placed to profit from the long-distance movement of decorative stones; the majority were not. For the movement of bulky commodities at least, the division between coast and hinterland was rarely easily bridged. Indeed concern with providing a link between the sea and the lands beyond it, particularly via canals or rivers, is a recurring trope in ancient literature: pertinent examples include the mooted Moselle-Saône canal, referred to by Tacitus, and the proposed canal linking the modern Sapanca Göl in the hinterland of Nicomedia with the Sea of Marmara, pitched by Pliny the Younger to the somewhat under-whelmed Trajan.² Over this 'most extensive lake,' the former writes, 'marbles, produce, timber and commodities are easily and cheaply brought to the road; but from thence, are conveyed in carriages to the coast at great charge and labour. Accordingly, they desire to connect this lake with the sea.'

CONTEXTUALIZING REDISTRIBUTION

The long-distance movement of stone between the Mediterranean and its hinterland, while not unknown, was exceptional, the result in most instances of imperially-orchestrated redistribution. This is true for movement in both directions. As Fant has eloquently put it, 'long distance trade in stone is an improbable phenomenon.'³ The level of demand for high-quality or uniquely patterned stone from imperial building projects, primarily at Rome, distorts the picture of small-scale, localized quarrying and the typically limited pattern of distribution that was the norm. Most quarries, as far as we can tell, were municipally or privately owned.⁴ The handful of enormous marble and granite quarries at which there is evidence of imperial involvement are spectacular anomalies.⁵ Intimately linked to supplying the needs of local urban centres most quarrying has been accurately described by Goodman as a 'periurban' industry; the distribution of quarries closely mirrors that of urbanization – few cities were located more than 30km from a primary source of building stone.⁶ The transportation of stone was a difficult, expensive, and time-consuming process and, wherever possible, was avoided. Stone was often extracted within the confines of a city, as at Rome, Sabratha, Nîmes, and Vienne, for example.⁷

In many ways this reflects practices in the sixth- to fifth-century BC Aegean, where stone-supply was closely linked to the autarchic ideal of the *polis*. In this earlier period, material was generally only imported from far away to compensate for local deficiencies. This was the case for the temple at Engyum in Sicily where Diodorus tells us the need to import stone greatly increased its cost.⁸ At Ephesus, so Vitruvius says, Proconnesian marble was imported for the building of the archaic temple of Artemis only up until the shepherd Pixodarus' discovery of a local marble source.⁹ Nevertheless, the long-distance transport of stone did have symbolic value in this period and

¹ DODGE 1988, pp. 215-217.

² TACITUS, *Annals* XIII.53; PLINY THE YOUNGER, *Letters* X.41.

³ FANT 1988, p. 147.

⁴ MARC 1995.

⁵ PATON-SCHNEIDER 1999.

⁶ GOODMAN 2007, p. 111; ADAM 2001, pp. 20-21.

⁷ JACKSON-MARRA 2006; CHIESA 1949; WARD 1970; BEDON 1984, pp. 30-33.

⁸ DIODORUS IV.53.5-6.

⁹ VITRUVIUS X.2.15.

both Pliny the Elder and Vitruvius note that Proconnesian marble was used on the Mausoleum at Halicarnassus in the 4th century BC.¹ Of course, imported stone never lost its symbolism: one is reminded of Cicero's famous retort to the boasting Chians and their marble walls that he would be more impressed were they built of the travertine of Latium.² The identifiable coloured marbles so popular in the Roman world served precisely such symbolic ends, in imperial building projects reflecting Roman majesty overseas.³

The logistics that enabled this incredible movement of stone to imperial building projects are well illustrated by the Egyptian evidence.⁴ Three papyri record the requisitioning of animals for the movement of stone from quarries in the Eastern Desert to the Nile.⁵ While this 120km overland route caused difficulties, transport downriver could be equally problematic, as a papyrus now in Dublin makes clear.⁶ The main content of this letter, dated to February AD 300 and the first of a pair from a procurator of the Lower Thebaid (Aurelius Isidorus) to the *strategoi* downriver, is worth quoting in detail:

Since the ten state ships being sent to Syene for the transport down river of the columns are insufficient to carry all of them, and since their transportation is most urgent, it has become necessary that other ships should be sent to take the remaining columns on board and bring them down to Alexandria. If these ships do not receive sufficient assistance from the winds [...] they will exceed the time limit by which the columns must be brought to Alexandria, especially as the fall in the level of the water is increasing daily. Let every one of you, therefore, considering the absolute necessity of this task, display his own zeal, and while the ships are going up river, whenever they are not propelled by the winds, give his personal attention to seeing that they are towed by their crews and the inhabitants of the villages of the river ports, and hand them over to the next *strategos* (ll. 44-48).

The use of state-owned ships for the movement of columns on the Nile is unsurprising.⁷ What is more striking is the logistical investment by the state in the movement of empty ships upriver, an investment well beyond the means of anyone unconnected to the imperial administration. The symbolic value of this material, of course, relied on this fact. It was precisely the remoteness of source and scale of exploitation that is remarked upon by Strabo with regard to the quarries at Dokimeion: 'on account of the present extravagance of the Romans, great monolithic pillars are taken from [the quarries]...so that, although the transportation of such heavy burdens to the sea is difficult, still, both pillars and slabs, remarkable for their size and beauty, are conveyed to Rome.'⁸ It is in this context that the famous gifts of columns given by Hadrian to Athens and Smyrna need to be considered: rather than necessarily indicating monopolistic ownership of the sources of these materials (the quarries at Chemtou and Dokimeion), these acts were probably intended to reflect the generos-

¹ VITRUVIUS II.8.10; PLINY THE ELDER XXXVI.47; WALKER-MATTHEWS 1997, pp. 49-59, note that imports on the Mausoleum came from Attica, Paros and Proconnesus, and were used for visible parts of the structure with local materials being employed for its core.

³ FANT 1993.

⁵ *P.Lond.* II 328, *BGV* III 762 and *P.Giss.* 69; PEÑA 1989.

⁷ Though in passing it is worth noting that the ownership of the ships of the relief convoy is not commented on; later in the same papyrus (ll. 100-101) ship-captains and sailors 'in the service of the military' are mentioned, indicating the requisitioning of vessels.

² PLINY THE ELDER XXXVI.46.

⁴ ADAMS 2007.

⁶ *P.Panop.* 2.

⁸ STRABO XII.8.14.

ity of the emperor, his access to exotic materials and unbounded wealth.¹ In the case of Athens such gifts also reflect this particular emperor's desire to furnish appropriately the renewed capital of the Greek world.²

For these established and repeated redistributive processes – from the quarries at which imperial control is attested to imperial building projects – a specifically designed infrastructure developed. This was engineered principally to supply Rome but was also equipped to deal with the exceptional transportation of large objects in the opposite direction – that is, from the Mediterranean inland. At inland Palmyra, for example, columns of red granite from Aswan and grey granite from the Troad were used in the Tetracylon and the portico of the Baths of Diocletian, both high-profile, imperially-sponsored projects. These imports were intended, through their scarcity, to contrast with the local stones that formed the primary urban building materials, and, through their scale, to contrast with the typical imports, most of which arrived in panel-form suitable for wall veneer or floor tiles.³ In no sense was the import of monolithic columns normalised: as abandoned columns at the rock-face demonstrate, local granite and limestone quarries, 5km and 10km from the city respectively, supplied the majority of the monumental architectural elements.⁴

THE LOGISTICS OF STONE TRANSPORT

The exceptional movement of large pieces of worked stone by the imperial administration or its associates needs to be understood in this broader context. A quite different rationale underpinned the normal movement of stone.⁵ The size of quarried blocks that could be transported, in particular, was dictated by a range of factors: the available means of transport, particularly for overland routes; the physical geography of the region through which transport was required; and the infrastructure in place to support such activity. For all but the imperial administration these were very real limiting factors.

Shipwreck evidence shows that sea-going vessels existed capable of carrying stone cargoes weighing as much as 350 tonnes.⁶ While the 'Blackfriars Ship' from the Thames at London was also engaged in the movement of stone, it seems clear that even the largest river-going vessels could have matched in tonnage only small- to medium-sized sea-going vessels.⁷ The barge from Lipe on the Ljubljana Moor, for example, could have carried around 40 tonnes, not significantly less than the cargo of eleven blocks and one column of the relatively small Meloria C ship, wrecked off Livorno.⁸

On land, vehicle or labour limitations played an even greater role in determining transport potential. Blocks had to be tailored in both size and shape to the available transport means. The second-century AD contract from Oxyrhynchus between Antonia Asclepias and a group of stone-cutters, for example, specifies the supply of a se-

¹ *IGR* IV 1431; Pausanias I.18.8-9; also FANT 1993, pp. 155-157.

² SPAWFORTH-WALKER 1985.

³ DODGE 1988.

⁴ SCHMIDT-COLINET 1990; for parallels from Palestine, cf. FISCHER 1998, pp. 231-232.

⁵ DELAINE 1997, p. 101; WESTERMANN 1928, pp. 386-387.

⁶ Cf. ROYAL 2008, p. 62.

⁷ MARSDEN 1994.

⁸ MEES-PFERDEHIRT 2002; BARGAGLIOTTI 2002.

ries of 'squared building-stones transportable by camel.'¹ A record of building materials from the same city distinguishes between four sizes of stone blocks: two sizes of 'portable stones', perhaps human and animal, and two of 'wagon stones'.² Of course, when an object was too heavy for either man, animal or wagon to carry haulage had to be relied on. This was both slow and expensive. Nineteenth-century records of granite quarrying in Virginia note that it could take up to a five days to haul a 50-tonne block as little as a kilometre using a mixed team of horses and oxen.³ The shape as well as the weight of a load would also have played a role in determining portage capacities. Since donkeys or mules, using panniers, could only carry loads that could be divided into equal halves for reasons of balance, the maximum weight of each single object would be reduced. Specially devised supports across the middle of the back could have helped with the portage of large blocks, as depicted on the camels engaged in stone transport on Vasari's depiction of the rebuilding of St. Peter's on the walls of the Sala dei Cento Giorni in the Palazzo della Cancelleria, Rome.⁴ Despite this, columns presented clear and understood difficulties: at least one law existed that allowed shippers to be penalized for damage to columns during transit and protective bundles of columns, in sets of two and four, have been preserved at Portus and at the Mons Claudianus quarries.⁵

The difficulties associated with the long-distance movements of goods away from the sea are especially pertinent in the case of the north-western provinces. Here, the extent of penetration of goods from the Mediterranean inland was determinant, as Strabo observes, on the successful integration of overland and fluvial transport networks.⁶ The bulk of inland movement, it is often assumed, was achieved along rivers: corporations of *nautae* on many Gallic rivers are testimony to lively fluvial activity.⁷ However, though the Aphrodisian fragments of the Price Edict do distinguish between upstream and downstream travel, the effect of adverse currents on the efficiency of fluvial travel should not be underestimated.⁸ This much is clear from Strabo's description of the Rhône. For although, as he notes 'the voyage which the Rhodanus affords inland is a considerable one, even for vessels of great burden, and reaches numerous parts of the country,' upstream from Lyon in particular, the river 'is swift and difficult to sail up [and] some of the traffic from here preferably goes by land on wagons.'⁹ Even on the Nile, as we have seen above, where wind and current usually opposed each other facilitating travel in either direction, upstream haulage of river vessels was necessary at times.¹⁰

This affected both the timescale and the cost of transport. In his discussion of the journey of Augustine of England (who died in AD 604) from Rome to Richborough, for example, Cook estimates that a flatboat manned by three to five boatmen being towed up the Rhône might advance as few as seven or eight miles a day.¹¹ By these estimates a craft that could make the trip downstream from Lyon to Avignon in two to

¹ *P.Oxy.* III 498, the adjective used is *καμηλικός* (also attested at Palmyra in *OGI* 629).

² *P.Oxy.* XXXI 2581.

³ WOOD 2008.

⁴ SCHIAVO 1964, pp. 151-166 (Pl. XVIII).

⁵ *Digest* 19.2.25.7; BACCINI LEOTARDI 1989, nos. 46 (= PENSABENE 1994, no. 19) and 129; PEACOCK-MAXFIELD 1997, p. 201 (Fig. 6.26).

⁶ Strabo IV.1.2.

⁷ GRENIER 1934, pp. 546-555.

⁸ ROUÉCHE 1989, p. 307.

⁹ Strabo IV.1.14.

¹⁰ CASSON 1994, p. 131.

¹¹ COOK 1926.

five days might take a month to complete the return journey. These figures compare well with the 28 to 30 days in summer and up to two months in winter recorded by nineteenth-century authors for un-motorized upriver travel from Arles to Lyon.¹ These same sources give some indication of the logistical requirements of upriver haulage, suggesting that six boats with a combined cargo of 300-400 tonnes being towed together required a haulage team of 30-40 horses. These figures, 10 tonnes per animal, are in the same order of magnitude as those given by Pensuti for haulage by water buffalo on the Tiber (an average of 20 tonnes per pair), when one considers differences in current on each river.²

On any construction project, transport of material would represent a serious expense. Contracts for the supply of material often included quarrying, transport and construction. The accounts from Epidaurus suggest this was certainly the case in the 4th century BC.³ The Oxyrhynchus contract discussed above covers both the quarrying and transportation of blocks from the 'northern quarry' on the edge of town, but not their ornamentation. Some information on the relative cost of the movement of stone overland can be extrapolated from later sources. Sixteenth-century figures for the price of marble loads and the freight of marble from Carrara to various locations collected by Klapisch-Zuber allow some comparative analysis of the cost of land and sea transport.⁴ These show that, on the one hand, the cost of transporting a load of marble from the quarries to Marina di Carrara, the closest port, only 10km distant, was fractionally more than the cost of the original block at the quarries. On the other hand, the total cost of freight for the 525km voyage from Marina di Carrara to Naples in the same period was only 1.5 times more expensive than for this 10km overland trip. This suggests a cost ratio of sea to overland transport in this period of roughly 1:35, which compares well with 1:42 figure given in the Price Edict when one considers that this trip was downhill. Since earlier figures identified by Salzman for medieval England suggest that the cost of transport exceeded that of the stone itself for distances over 19km, these prices seem plausible.⁵ Building accounts from this period additionally allow for a comparison of the cost of land and river transport. The stone used for the building of the porch of Corpus Christi College, Cambridge, in 1583-1584, for example, cost 75% of its original value to be moved 16km overland, the same as moving it as far as 130km via water (in this case down the river Nene and up the Great Ouse); this suggests a cost ratio of river to overland transport of approximately 1:8, almost identical to that detailed in the Price Edict.⁶ Changes in transport technologies over time have done little to affect the basic divergence in cost between maritime, river and overland stone transport. As recently as 1962, Clifton-Taylor notes that limestone from Portland in Dorset was cheaper to purchase in Dublin (c.625km distant), to where it could be transported by sea, than inland Birmingham (c.210km distant).⁷

Of course, what these costs, like those detailed in the Price Edict, appear to fail to account for is the cost of trans-shipment, that is the movement of stone between one means of transport and another. Regardless of the capabilities of individual vessels or vehicles the successful combination of different means of transport, across differing

¹ LENTHÉRIC 1892, pp. 512-513.

² PENSUTI 1925.

³ BURFORD 1969.

⁴ KLAPISCH-ZUBER 1969, p. 209.

⁵ SALZMAN 1967, p. 119.

⁶ ALEXANDER 1995, p. 127.

⁷ CLIFTON-TAYLOR 1962, p. 22; cf. PEARSON 2006, pp. 91-102.

media, must have presented substantial difficulties. Difficulties that needed to be overcome since, in practice, most medium- to long-distance movement of stone would have to have been accomplished by a combination of transportation means. This is well-illustrated by the eleventh-century account by Leo of Ostia of the construction of the church of the Benedictine monastery on Monte Cassino by the abbot Desiderius in 1066:

All these [columns, bases, epistyles, and marble of different colours] he brought from Rome to the port, from the Portus Romanus thence by sea to the tower at the Gargliano River, and from there with great confidence on boats to Suium. But from Suium to this place he had them transported with great efforts on wagons.

Assuming that different vessels were used on each leg of this trip, the cargo would have been trans-shipped three times between initial loading and final unloading.¹ Trans-shipment of a material as heavy as stone must have been expensive: once a cargo was loaded the distance that it was to travel was, in cost terms, much less significant, a fact as true for the short- to medium-distance movement of material overland as it is for the long-distance movement of material overseas. Since in most cases trans-shipment costs appear to be built into general transport costs, analyzing their scale precisely can be difficult. Occasionally, however, general costs can be broken down to reveal the impact of trans-shipment costs. In 1500, stone brought from the quarries near Ancaster to Louth, in Lincolnshire, for the building of the church spire cost 40*d.* (old English pence) per load to transport.² This price covered an initial 24km overland trip costing 12*d.* from the quarries to the nearest river-port, a 19km trip downriver costing 8*d.*, and a final 56km trip overland costing 20*d.* Since the final overland section of this trip is actually cheaper than the preceding downriver stage (0.35*d.*/km compared to 0.42*d.*/km), it seems likely that the cost of river transport here included the costs of loading and unloading the vessels at either end of the journey. Indeed other records from the period talk of river transport constituting the movement of material from and to 'the wharf', suggesting that responsibility for loading rested with the shippers. If this interpretation is correct then these sixteenth-century figures indicate that trans-shipment costs could elevate the cost of river transport to the same level as overland transport. In order to avoid precisely such costs, the eleventh-century abbot of Saint-Denis, near Paris, planned to bring columns on a single trip from Rome via sea to the mouth of the Seine and then up-river for precisely the same reasons.³ Even in the 19th and early 20th centuries, as Ward-Perkins noted, it was still a 'sound commercial proposition' for limestone from Puglia to be imported into Rotterdam, because only a single loading was required.⁴

The cost of trans-shipment, however, is only part of the problem. When one considers that a 1m³ block of marble weighs around 2700kg, the trans-shipment of indivisible objects like columns or other monolithic architectural elements would also have required a significant logistical outlay. Port infrastructure – especially the pres-

¹ Leo of Ostia, *The Chronicle of Monte Cassino* III.26 (HOLT 1957, pp. 10-11).

² ALEXANDER 1995, p. 128.

³ ABBOT SUGER, *The Other Little Book on the Consecration of the Church of St-Denis* II (HOLT 1957, pp. 36-39).

⁴ DODGE-WARD-PERKINS 1992, p. 73.

ence or absence of suitable lifting devices – must have played a pivotal role in determining the viability of stone trans-shipment, and consequently the routes along which stone cargoes were transported. At a well-equipped port – coastal or inland – trans-shipment would have been expensive, at a poorly-equipped one it would have been near-impossible. W. H. Smyth, the naval commander tasked with overseeing the removal of columns from Lepcis Magna in the early 18th century, struggled with just such a problem. In a letter to his superior, dated May 1816, he writes, ‘the beach is shallow; but at the ruins of the westernmost fortress, I imagine these weighty masses might be removed, provided the necessary machinery and tackles were at hand.’ It took over a year for resources to be gathered for this task. Finally, in November 1817, he reports the task complete, at the same time noting, ‘I had the satisfaction to perceive these weighty masses embarked and stowed, at the rate of at least sixty tonnes a day; which, when you consider the open roadstead, the distance the ships necessarily were from the beach, and our limited crews, I trust will meet your approval.’¹ Gervase of Canterbury, writing in the 12th century, observes that the shipment of limestone from France to Canterbury for the rebuilding of the cathedral would have been utterly impractical were it not for the ‘ingenious machines for the loading and unloading ships’ designed by the project’s head architect.²

The larger the block, of course, the more difficult it was to move. In his report on the transport of material from Didyma in the late 19th century, O. Rayet describes in detail the difficulties posed by a large capital, now in the Louvre.³ Twice the devices used to lift this piece broke, dumping it into the sea and resulting in the unfortunate death of one workman. This capital weighed only four tonnes; in comparison, an 11m long granite column, like those used in the portico of the Pantheon, could weigh as much as 55 tonnes. With this in mind, it seems likely that there was an inverse equation between the number of ports capable of dealing with a given object and the size and weight of that object. Few ports, particularly inland ones, received the level of investment attested at somewhere like Ephesus, where both local bigwigs and emperors were directly involved in the maintenance of its harbour.⁴ Interestingly, imperial activity in the harbour of Ephesus reached its zenith in the early 2nd century, at precisely the point when exploitation at the central Phrygian quarries was being reorganized to meet the massive upturn in demand resulting from Domitianic, Trajanic and Hadrianic building projects at Rome and elsewhere.⁵

STONE AND DISTRIBUTION MODELS

The logistical requirements of stone trans-shipment and its disproportionate cost in the medium- to long-distance movement of stone is especially significant when it comes to attempting to integrate the evidence furnished by stone objects with that issuing from other classes of artefact, notably ceramics.

Numerous examples of the long-distance inland movement of ceramics of Mediterranean origin can be pointed to. In their separate studies of the distribution of am-

¹ SMYTHE 1854, pp. 475-476 & 488-489.

² For Gervase of Canterbury, cf. HOLT 1957, p. 56.

⁴ ZABEHLICKY 1995, pp. 205-206.

³ RAYET 1888, pp. 140-141.

⁵ FANT 1989, pp. 29-31.

phorae in the north-western provinces, for example, both Peacock and Fulford have pointed to the importance of the eastern axis of the Rhône and the Rhine and their respective tributaries, the Saône and the Moselle, over and above that of the Atlantic coast, as the primary route along which material reached the Rhineland and Britain beyond; the stimulus for this distribution, it is argued in both cases, is the market represented by the army along the Rhine.¹ This suggests that full amphorae routinely crossed the watershed between Rhône and the Rhine or the Saône and the Moselle.

In contrast, the distribution of stone artefacts of Mediterranean origin shows a quite different picture. Imported marbles reach certain sites on the Rhône in significant quantities: Arles, Orange and Vienne are prominent examples.² At each site, imported marbles are represented by most object types, from veneer panels to monolithic columns. Moving upriver, however, the quantities of imports tail off rapidly. Imports did cross the watershed between Rhône and Rhine but there is a noticeable pattern in both the form and scale of this material: ignoring imperial projects, all of the largest pieces are sarcophagi or statues; columns or large blocks are extremely scarce, perhaps even altogether absent, while the bulk of imported material was in the form of thin panels for wall veneer or floor tiling. This is the case even at important urban centres like Cologne, Xanten, London, Colchester and York.³

The exorbitant cost of moving stone played a vital role in the process. Indeed, it seems that the logistical requirements of trans-shipment played a far greater role in dictating the general pattern of distribution of stone objects than it did ceramic objects, for example. It was the difficulty and cost of transport, rather than the cost of the materials themselves, or any restrictions on their use, that is also most likely to explain the deliberate exploitation of what have come to be called 'substitution' marbles. The ideology associated with particular stone types travelled even where the materials themselves did not. Thus the yellow Pène Saint-Martin, quarried in the Pyrenees, was used instead of the more famous Numidian marble (*giallo antico*) in the Gallic provinces, while in Spain a variety of coloured marbles similar to the more famous stones used in metropolitan contexts were intensively exploited.⁴ Although imported marble appears as veneer at several suburban villas around Cologne, much more common are coloured marbles from local Belgian quarries.⁵ These local stones fed the demand that could not be adequately satisfied by imports.

What this brief examination of the picture in the north-western provinces shows is that different types of stone object, like different types of pottery, were exposed to very different distributive mechanisms. In order to accurately model the distribution of these objects our analysis needs to be capable of differentiating between detailed divergences in the evidence. For this reason, distribution maps of the kind so common to studies of the ancient 'marble trade' need to be used with caution.⁶ In recording instances of retrieval of particular stone types they are liable to over-simplify the complexities of the evidence, failing in most cases to provide sufficient information

¹ PEACOCK 1978; FULFORD 2007.

² PENSABENE 1972, pp. 322-323; ANTONELLI-LAZZARINI 2004.

³ FISCHER 1999; PRITCHARD 1986; PEACOCK-WILLIAMS 1999.

⁴ BRAEMER 1982; GRÜNHAGEN 1978.

⁵ GROESSENS 1991.

⁶ DODGE 1991; DODGE-WARD-PERKINS 1992; LAZZARINI 2004.

on object type or size. The fundamental weakness of this mode of presentation is that it prioritizes the role of the producer over that of the consumer. Choices made by the consumer, not the producer, determined the observable distribution patterns, a point that Pensabene has stressed on numerous occasions.¹

To take an example, the fact that red porphyry, from the quarries at Mons Porphyrites in the Eastern Desert, has been found at Rome, Gamzigrad, Metz and London but not at Jerusalem and Arles could be taken as indicating that the first three were all closely integrated in a distributive system issuing from the quarries from which the last two were excluded; an observation, it might appear, of special significance given the imperial character of these quarries. The same conclusion, however, is difficult to maintain if close examination of the primary data in fact reveals that at Rome this material is represented by an enormous range of artefacts of all types, at Gamzigrad by an imperial portrait, at Metz by only a handful of veneer panel fragments, and at London by a single tile fragment. In this case the factors determining the use of porphyry are likely to have been quite different in each case. By differentiating, in this way, between the various uses to which a stone was put in his distribution maps of Spanish stones, Cisneros Cunchillos has been able to achieve a more fine-grained analytical framework for stone-use in this region than other studies have achieved; Fischer partially adopts a similar approach when mapping the data from Roman Palestine.² Indeed, distribution maps that fail fully to represent the detailed characteristics of the evidence risk compacting into 'a single mould what must often have been a very wide diversity of individual practices,' to adopt Ward-Perkins' well-worded protestation.³ To talk of the distribution of any given stone type without conceptually categorizing it according to object type or sample size is much the same as discussing 'ceramics' of a particular origin without distinguishing between coarse-wares, fine-wares or amphorae, and the various varieties of each.

A brief examination of the distribution of decorative stones in panel format should illustrate this point. The practice of sawing decorative stones into thin panels suitable for wall veneer or flooring was an effective way of engaging in the metropolitan fashion for marble decoration while at the same time limiting the volume of imports and maximizing their potential. This is precisely what the Milton text, discussed above, recommends doing with objects too large to be transported far overland. Panels could be cut from whole imported blocks on site, a practice identified at Cologne and at Fishbourne, or they could be imported ready-cut.⁴ Thinly-cut, relatively light panels would not incur the same trans-shipment costs as the indivisible cargoes, columns most notably, mentioned above. Individual panels could be carried over short distances by a human porter.⁵ Despite their fragility thin stone panels did travel long-distances, both overland and overseas, in many cases as a lucrative secondary cargo. The eighteen sarcophagi that formed the primary cargo of the large transport ship wrecked off Torre Sgarrata, near Taranto, were packed full of ready-cut marble panels from a variety of sources; one report of this excavation notes 'thousands of frag-

¹ PENSABENE 1972; PENSABENE 2002.

² CISNEROS CUNCHILLOS 1988, pp. 88-114; FISCHER 1998, p. 30 (D1).

³ WARD-PERKINS 1980, p. 24.

⁴ FISCHER 1999; CUNLIFFE 1971, pp. 40-41.

⁵ RAEPSAET 2008 gives figures for human portage capacities of up to 150kg.

ments of the half-inch-thick marble sheeting' on the seabed.¹ Marble tiles have been identified at the site of Culip IV shipwreck, off Catalonia, and at a probable wreck-site off the Atlantic coast of Morocco, in both cases secondary to main cargoes of amphorae.² These are some of the only examples of decorative stone objects excavated from a wreck-site which were travelling as an obvious complementary cargo. The fact that in all of these cases the materials represented issued from a range of sources also suggests that decorative marbles in panel form travelled as sample packs, as the result of secondary distribution from intermediate emporia.

DISCUSSION

None of this is intended to argue that stone, and often very large pieces of stone, did not move relatively long distances in inland areas. The limestone of Norroy was used at Bonn (250km along the Moselle), at Mainz (300km away), at Njimegen (400km away), and at Strasbourg (450km by river or 120km by road); a sculpture carved from this limestone was even found at Colchester in England.³ The white marble quarried at Dokimeion alongside the more famous coloured variety (*pavonazetto*) was also distributed long distances overland. However, the primary markets for this material, as Waelkens has shown, were the inland cities of central and southern Asia Minor which had less easy access to the coast and the maritime distributive systems of Proconnesian and marbles from other coastal quarries. Only when transformed into high-quality commodities, like fully-finished sarcophagi or statues, could this material compete in the coastal markets.⁴

What this last example demonstrates is the need to structure any analysis of distribution around the concerns of the consumer. Different products and different types of stone experienced divergent distribution patterns because demand for them varied. While everyday construction was almost always achieved with local materials, at a maximum distance of 30km or so, more prestigious projects might demand more exotic materials. Therefore, while it is true that, as Braemer has noted, the produce of most quarries in the Roman period achieved only 'local' or 'regional' distribution, the extent of this regionalism was determined by consumer demand, itself based ultimately on the quality of the material and the cost of its transport.⁵ Instead of focusing on the discernible patterns of overlapping local, regional and inter-regional distribution of particular object types or materials, it might be profitable to structure our analysis around the use to which these objects were to be put. In this sense, it is useful to think in terms of normality, of how routine a certain activity was or was intended to appear. For day-to-day building local materials would be favoured; for a special decorative effect or a monumental finished stones from more distant locations might be preferred. In this respect, the case of the high-quality limestone from the quarries of the Bois-des-Lens is especially illuminating, as both Bessac and Pearson have noted.⁶ The primary local market for this material was Nîmes (20km to the east overland), where it used for both regular and monumental construction and stat-

¹ THROCKMORTON 1969.

³ BEDON 1984, p. 86; HAYWARD 2006.

⁵ BRAEMER 2004.

² NIETO-PUJOL 1989; BOUBE 1979-1980.

⁴ WAELEKENS 1982; WAELEKENS *et al.* 2002.

⁶ BESSAC 1996; PEARSON 2006.

uary. Away from Nîmes, this limestone is used at the nearby towns of Beaucaire (40km to the east), Arles (15km down the Rhône from Beaucaire), and Murviel-les-Montpellier (40km south-west) for monumental structures and statuary, but not regular construction, and as far away as Nice (250km from the mouth of the Rhône), Fréjus (200km) and Narbonne (150km), to where it was transported along the coast, for monumental structures only. The use to which the material was to be put, therefore, determined the distance from which it was imported. High-quality or uniquely coloured materials travelled long distances when the project on which they were to be used was suitably financed or when they were reduced to manageable proportions, usually in panel form. Similarly, outside of the imperial sphere, material from inland quarries only reached a wider market when it was transformed into high-quality products, so given added value. The sarcophagi issuing from the workshops at Dokimeion are a case in point. Likewise, it was commodities of this kind, valued for their unique craftsmanship, that reached points most distant from their origin. In the north-western provinces, where architecture could be completed in local materials, on occasion faced in exotic imports, high-value imports consisted predominantly of sarcophagi and statues; Pensabene has observed a similar phenomenon in inland North Africa, where marble statuary is more common than marble architectural elements.¹ Statues and sarcophagi could be ordered individually and tailored to the precise demands of the client.

Where suitable stone and craftsmanship were present, local materials were usually preferred. The eleventh-century abbot of Saint-Denis, noted above, in the end found a suitable local quarry for the supply of columns, making his ambitious Rome scheme untenable. Of course, what was considered easily available (local), more expensive to import (regional), and of exceptional value (inter-regional) has to be viewed in relation to various factors.² In the case of stone, as the above discussion indicates, the predominant factor was the cost of transport, itself relative to object type, physical geography, available infrastructure and means of transportation. A combination of these various factors determined connectivity and the normality or otherwise of exchange. At coastal sites with suitable infrastructure, the efficiency of maritime transport dynamics normalised the import of materials from distant sites. At similarly well-equipped inland sites, the transport of building stone 100km downriver might be considered as normal an activity, in terms of effort and/or cost, as the transport overland of similar stone from a quarry 10km distant. Similarly, it is clear that the importation of coloured marble of Mediterranean origin in thin panel form into the north-western provinces was far more normal a process than the import of monolithic columns of the same materials.

Rather than thinking of a series of neatly delineated concentric circles emanating from the urban centres of the Roman world, each marked respectively as 'local', 'regional' and 'inter-regional', we should rather imagine networks of irregularly shaped, interrelated zones of activity, respective to topography, infrastructure and object type, defined by the normality of the pattern of distribution represented by each. In this context, and as the above discussion suggests, the great achievement of the im-

¹ PENSABENE 1972, pp. 327-328.

² REGER 2007.

perial redistribution of decorative stones at its peak, the symbolic masterstroke of this process, was the normalisation of the exceptional.

ABBREVIATIONS

- BGU III = *Aegyptischer Urkunden aus den Koeniglichen Museen zu Berlin. Griechische Urkunden*, Berlin, 1903, Vol. 3.
 Digest = *The Digest of Justinian*, ed. A. Watson, Philadelphia, 1998.
 IGR IV = *Inscriptiones Graecae ad res Romanas pertinentes*, ed. G. Lafaye, Paris, 1927, Vol. 4.
 OGI = *Orientis graeci inscriptiones selectae: supplementum sylloges inscriptionum graecarum*, ed. W. Dittenberger, Leipzig, 1903-1905.
 P.Giss. = *Griechische Papyri im Museum des oberhessischen Geschichtsvereins zu Giessen*, eds. E. Kornemann, P. M. Mayer, Leipzig, 1910-1912.
 P.Lond. II = *Greek Papyri in the British Museum*, ed. F. G. Kenyon, London, 1898, Vol. 2.
 P.Oxy. III = *The Oxyrhynchus Papyri*, eds. B. P. Grenfell, A. S. Hunt, London, 1903, Vol. 3.
 P.Oxy. xxxi = *The Oxyrhynchus Papyri*, eds. J. W. B. Barns, P. Parsons, J. Rea, E. G. Turner, London, 1966, Vol. 31.
 P.Panop. = *Papyri from Panopolis in the Chester Beatty Library, Dublin*, ed. T. C. Skeat, Dublin, 1964.

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ABSTRACT

This paper explores what an examination of the long-distance distribution of artefacts carved in stone can reveal about the interconnectedness of the Roman Mediterranean and the lands beyond its coastline. It discusses evidence for the difficulties associated with the trans-shipment of a material as heavy as stone and how they might have helped to determine the observable distribution of stone objects. In so doing, it attempts to contextualize the role of the imperially orchestrated redistributive system in this process and explore what the analysis of stone objects can add to attempts to model distribution patterns of material goods in the Roman world.

Il contributo prende in esame le dinamiche di distribuzione su lunga distanza di manufatti in pietra con l'obiettivo di indagare le interconnessioni tra il Mediterraneo romano e le regioni costiere che su di esso si affacciano. Vengono poi affrontate anche le difficoltà legate alla diffusione di materiali così pesanti con l'intento anche di riuscire a determinare gli aspetti distributivi degli oggetti in pietra. Lungo questo percorso appare allora necessario contestualizzare il ruolo esercitato dalla macchina imperiale nel processo di redistribuzione di esplorando vie e percorsi per la ricostruzione dei modelli di distribuzione, in generale, di prodotti nel mondo romano.

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