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MARBLE TRADING IN THE ROMAN PERIOD: PUNTA SCIFO D, AND CAPO GRANITOLA A

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Abstract

The Roman marble trade was a diverse and multifaceted economic niche of the Mediterranean world, connecting many regions and peoples of the Roman world. The eastern Mediterranean supplied the majority of marble to the empire, between the reigns of emperors Augustus and Constantine. The regions of Greece and Asia Minor produced by far the best-known types of white marbles. The archaeological study of maritime sites, in this case shipwrecks, and the material evidence and landscapes of Roman quarries and ports, is vital to fully understand the long-range ramifications of the trade.

This investigation focuses on these cornerstones of the trade: routes, quarries, and shipwrecks. Another unifying element amongst these aspects were the many ports of the region. A short analysis of how this trade evolved and grew, and how marble became a symbol of imperial power, provides a better understanding of the importance of the marble trade to Roman history.

The two case studies of Roman Period shipwrecks which were chosen for the purpose of this thesis are Punta Scifo D, and Capo Granitola A. These two ships were active during one of the most prolific periods of the Roman marble trade and were transporting a well-documented and popular type of marble, Proconnesian. The majority of the cargo surveyed on both ships is unworked marble blocks and slabs, with some pieces that have been altered prior to arrival. The effect that such a popular and affordable form of marble had on the Roman Empire, and its citizens, can be studied and observed through the cargoes of these shipwrecks.

The goal of my research was to create an understanding of how the trade networks, seasons, technology, the sea, and people all played parts in this expansive transportation of marble. What much of the findings tell researchers is that there were multiple peaks within the marble trade, including the types of white marble being shipped to Italy. For example, *marmor proconnesium* from the Island of Marmara, would reach the peak of demand during the second century AD.

The trade of white marble was by far one of the most influential during the Roman Period. It rapidly became a symbol of Rome, adorning the many monuments, civic structures, palaces, temples, and homes throughout the empire. The investigation of the Roman marble trade provides archaeologists a window into the development and evolution of one of the most significant feats of trade in the Roman Period. Marble was the perfect stone for Roman elites to demonstrate great wealth, prosperity, and imperial power. The Roman Empire, and its entrepreneurial citizens would successfully create a thriving marble trade, that even to this modern day is alive and can be seen throughout Italy, and the Mediterranean as a whole.

Introduction

Roman maritime trade was incredibly expansive for its time, spreading the wealth of the empire far and wide, culminating in its capital, Rome, where all roads led. The list of goods that were traded was just as expansive, from massive shipments of grain from Egypt, precious stones from India, and marble from famous deposits throughout the Mediterranean. Merchants operating under the umbrella of the Roman empire would have transported a variety of goods at once, optimizing what could be sold along their routes. The focus of this paper will be on those cargoes discovered which include marble and other types of stone. The early empire controlled a large number of marble and stone quarries, hiring merchants to transport this stone to and from, often for monumental public projects, or for the elite. There were plenty of wealthy clientele that fueled this trade of stone, both locally and internationally. In this manuscript, I will examine the extraction and trade of marble, selected shipwrecks and their cargoes, Roman-era ports, and the state of maritime archaeology and how it can reveal the story of stone-trade.

The manuscript will focus on the period between the reigns of Augustus and Constantine. Within this span we will witness the decline of imperially operated and owned quarries, shifting to privately run merchant operations. This would not mark the end of the stone trade, but quantity was certainly reduced, which coincided with the large state-funded infrastructure projects, and monuments in the west declining. Localized trade would continue to provide stone to wealthy citizens, cities, and towns. A catalog of relevant shipwrecks will be made, along with an examination of trade routes used during the period. This will allow for a deeper understanding of which sea routes were preferred for safety, and which were used in spite of any maritime hazards they may have encountered.

Additionally, the relationship between the quarries and naval merchants must be understood. The less distance between the quarry and the ships would have saved precious time and resources.

To support and enhance the depth of this manuscript there will also be an exploration of maritime archaeology and how its development over the past one-hundred years has impacted our knowledge. A brief overview of the state of the field, techniques, technology, preservation, and the underwater landscape will be made. These are all essential to understanding the process of collecting physical evidence and data for the Graeco-Roman stone trade, both localized and throughout the eastern Mediterranean. Deep-water shipwrecks constitute a vast relatively unexplored resource, in terms of excavation, as they are difficult to safely dive on for long periods. In some cases, modern submersibles, both manned and unmanned, become indispensable. Fortunately, cargoes of marble are normally quite recognizable and apparent once discovered. They are also easily documented through photogrammetry, as their shapes are regular. The environment, preservation level, and surrounding landscapes are all key to our understanding as well. If a wreck lies near the shoreline, or a reef, the cause of disaster can be plausibly theorized.

The goal of this research is to construct a picture of both macro- and micro-Graeco-Roman stone trade, beginning with where and how the marble was quarried, and its journey to its new home. In this research the majority of the marble will be resting on the seabed, or beneath it. Occasionally examples of stone which reached its destination will be cited, such as the obelisks in Rome. In the grand scheme of things, both large and small cargoes of stone are important as they all have a valuable niche within the trade. Archaeological research such as this is an attempt to share with the world events of our past, and how the

people within these events lived. Just as much as this study is scientific, it is also an exploration of the humanity of the period and region. The cultural and economic implications of the Graeco-Roman stone trade may further our knowledge of the wider world of the time, which is invaluable. This study aims to provide more context for this rich part of the Graeco-Roman world.

Chapter One: Where did Roman era merchants sail, and how?

Section 1.1- Classical Routes

Just like any body of water, the Mediterranean is filled with treacherous locations which plagued both the novice and adept sailors. So naturally merchant sailors would chart routes all throughout the sea which provided them with safe and reliable journeys, moving from port to port to trade their wares. However, at times less desirable trade routes were necessary based upon their origins and destination, or because of the season. The shortest distance between the merchant and their payday would obviously have been tempting. Unfortunately, no matter how safe the passage was chosen, Roman sailors could not have accounted for the weather, pirates, or perhaps a reef exposed by a storm. In many cases, sailing in deep water was much safer than "coasting" as it is referred to by many scholars. Many ships were claimed by rough water along the coastline, where they could be dashed against rocks.

Deep water trade routes were very popular during the Roman period. The Greek polymath Eratosthenes from the third century BC, also the chief librarian of the Library of Alexandria, wrote about this preference. Long before the Imperial Romans sailed the Mediterranean, merchants sailed for multiple days and nights through deep water without complication. Coasting was used to exit and enter ports, but otherwise held no advantages over deep-sea sailing. In the months without favorable winds, ships would tack along the coastlines out of necessity. The author Pascal Arnaud[1] wrote that journeys of four days to a week were very common, which included routes between Rhodes and Alexandria, North Africa and Gaul, and from the Straits of Messina to Alexandria. However, in this manuscript the focus will be upon marble and stone being traded from the eastern Mediterranean, primarily from Greece, and

[1] Cesar Ducruet, ed., *Advances in Shipping Data Analysis and Modeling: Tracking and Mapping Maritime Flows in the Age of Big Data*, (Oxfordshire, U.K, Routledge, 2018), 21–25.

Turkey, which both produced a great quantity of the marble used during the Roman Period.

Greece, or Hellas, was incredibly important to Roman trade as through it flowed much of the products from the east. Hellenic marble sparked the Roman obsession with the "luminous stone," as they called it, with so many forms of marble to adorn their growing empire. The most prioritized cargo was grain, as it sustained the empire and its capital, Rome.[2] One of the most intriguing aspects of the Roman Empire and its own cultural fabric, was their tendency to adopt and implement many of the traits from the regions they conquered and their respective traditions. Greece had an enormous influence on the Roman peoples, their culture, religion, and government. The sea-routes of the Greeks were also adopted and sometimes shifted by the Romans. For example, Corinth would become the primary port in Greece under Roman rule, returning some of the lost influence over maritime trade in the Mediterranean.

The revitalization of key infrastructure, in this case the port of Corinth, would greatly aid in the rejuvenation of many of the regions which had seen economic and structural decline. Greece had fallen upon hard times due largely in part to extended agricultural collapse which had followed a trend of skilled workers leaving the countryside for better work elsewhere in the rapidly changing Mediterranean world.[3] This followed the shift in power from the Hellenistic states to Rome. The money and workers followed the Roman trends. Three of the major port cities through which much of the trade flowed were Corinth and Patrae in the Peloponnese, and Nicopolis in the Epirus region to the north.

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[2] Dorothea Marh Freed, "Trade routes of the Roman Empire," PhD diss., (University of British Columbia, 1941), 4.

[3] Freed, "Trade Routes of the Roman Empire", 5.

Corinth acted as a primary bridge between western and eastern Roman sea trade. The state of Corinth had an isthmus where both the ship and goods were hauled across the Diolkos.[4] This allowed merchants to avoid a two-hundred-mile trip, which also had to round Cape Malea near to Patrae (Patras). Much of this western coast of the Peloponnese, which had previously been a backwater of Greece, had now found itself along many of the most important Roman sea-routes. Among these cities which saw rejuvenation, were Dyme, Cyllene[5], and the aforementioned Patrae (Patras). These ports saw an influx of trade from nearby Italy, as they were advantageously positioned.[6] Some of the other marble quarries in the Peloponnese were located near Mt. Taygetus, as well as from Croceae, and the regions of Laconia, and Sicyon, which lie to the west of Corinth. An example from the works of Pausanias while describing Corinthian baths, "…who beautified it with various kinds of stone, especially the one quarried at Croceae in Laconia."[7] Pausanias is a rich source of information about ancient Greece, and fortunately, he decided to speak about marble and its quarries on occasion.

The complex net of sea-routes used by merchants during the Roman period connected the multitude of communities across the Mediterranean Sea, Europe, Asia, and Africa; this was truly a marvel of exchange and communication. These merchants and their stout vessels made it possible for such high levels of trade and commerce, both in the material and cultural sense. The Roman Empire understood the great importance of their waterways, and how it kept their economy alive and thriving.

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[4] Nicos Papahatzis, *Ancient Corinth: The Museums of Corinth, Isthmia, and Sicyon*, (Athens, Greece: Ekdotike Athenon S.A., 1996), 28.

[5] Ancient Dyme is most likely the modern Kato Achaia, and Cyllene is now known as Kyllini, where a port is still in operation. It lies on the westernmost tip of the peninsula.

[6] Freed, "Trade routes of the Roman Empire," 6-7.

[7] Pausanias, *Description of Greece*, 1.1.1. Digital version in Perseus Digital Library online: F. Spiro (ed.), *Pausaniae Graeciae descriptio*, Bibliotheca Teubneriana, Lipsiae, 1903, 2.3.5.

Through this exchange they were able to create a diaspora, both sharing and absorbing various aspects of culture, religion, technology, and of course, goods. The impression the empire made was so strong in fact that many versions of their culture have survived to our modern day. One such value which lives on is the fascination with polychrome and white marbles. White marble can be seen adorning the streets, homes, religious institutions, monuments, businesses, universities, and of course governmental structures, of many countries across the globe. This is a unifying element which was used by the Romans, which continues in their stead. The Romans celebrated this great interconnection of regions and peoples through the marble trade, especially from the east. The eastern Mediterranean in many ways helped birth and foster the Roman empire, and Republic before.[8]

1.2 - Evidence for These Routes Along with Their Risks and Rewards

The aforementioned Cape Malea was infamous in the Peloponnese and was feared by any sailor who passed near it. It is located very near to ancient Patrae, on the southern coast of the Peloponnesian peninsula.[9] Ships and their crews had to err on the side of caution whenever they rounded it, as it boasted dangerous winds and water. This was further verified by the author Pliny. “I feel sure, Sir, that you will be interested to hear that I have rounded Cape Malea and arrived at Ephesus with my complete staff, after being delayed by contrary winds.”[10] In addition to this written source, hundreds of sailors who successfully sailed through these dangerous waters left offertory inscriptions to the twin protectors of sailors, the Dioscuri.[11] So, the safest option to skirt around the cape, was to pass through Corinth instead. Corinth was not

[8] Justin Leidwanger, Roman Seas: A Maritime Archaeology of Eastern Mediterranean Economies, 2020, 78.
[9] Freed, "Trade routes of the Roman Empire,” 8-9.

[10] Pliny the Younger, *The Letters of Pliny the Younger,* (New York, N.Y.: G. E. Stechert, 1936), Book X, XV.

[11] Castor and Pollux, the twin brothers of myth who protected sailors and their vessels. They are also spoken about in *The Odyssey* (11.298–304).

only geographically situated for success, but it was also improved and revitalized by Julius Caesar, and ensuing rulers. The ports of Corinth which were given improvement were Lechaeum and Cenchreae. Before Caesar and the Roman economy revitalized Corinth it had slowly become a veritable ghost town. Its rebirth as a crossroads of trade made it powerful and wealthy.

The merchants of Syria, Egypt, and Asia Minor, with their many lucrative goods, including exotic marble, now sought passage through Corinth under Roman rule. The trade that they brought to Greece and Rome greatly stimulated the economy, especially in Greece which had seen a decline in the years before Roman intervention. Other ports which Roman ships frequented in the region were Dyrrhachium and Apollonia. The marble which came from Asia Minor, Egypt, and Greece was highly coveted for its luster, wide range of color, and strength. There were a number of favorable marbles which came from Greece and Turkey that were of a higher quality yet still affordably priced. This made them ideal choices, as it put less strain on the Imperial coffers, and delivered a beautiful final product.

Athens, a city which once boasted an affluent and busy trio of harbors at its peak, served as a critical center of Mediterranean trade. During this period, and the previous era, the activity had dwindled significantly. It had become a safe port for primarily localized trade. Though Athen's ports had diminished, one of their main exports remained Greek marble, the majority of which came from the quarries at Hymettus and Pentelicus. Some of this marble was used in the production of their popular copies of statues.[12] Pentelic marble was very popular in Rome and was utilized in many ways.

The Roman province of Asia Minor was vast and produced many quality exports, including marble. The great city of Ephesus was one of the largest ports of Asia Minor, giving it great affluence and influence. However, Ephesus struggled with

[12] Freed, "Trade routes of the Roman Empire," 11.

an issue of silting, which slowly grew around the mole which had been built to afford the harbor more safety and calmer waters for anchored vessels. Strabo even remarked that Ephesus was "…the largest mart in Asia within the Taurus."[13] One of the famous locations for marble in Asia Minor was Synnada, located in ancient Phrygia. It was commonly called Synnadic marble, but more aptly named *Docimites lapis*. This marble is quite distinctive due to the presence of purple inclusions.[14] These quarries in Synnada quickly became imperially owned and operated, leading to the production of even larger blocks and also pillars. The pillars were quarried and shipped whole to Rome from the aforementioned Ephesus.

The great city of Byzantium, later known as Constantinople, was also a key port of the region and of the Mediterranean. From north of Byzantium came timber which was desired for its use in sturdy ships; this region had extensive forests. Sturdier ships were required for the transport of stone cargoes, especially for longer journeys. Much of the trade entering and leaving Asia Minor passed along the western and southern coastlines, favoring the west coast. The west coast saw much heavier travel, due largely in part to its numerous, well-equipped harbors. The northern coast of Asia Minor had only one major port which was called Amisus. Among all the harbors of Asia Minor, the following were well-renowned: Tarsus, Cyzicus, Mytilene, Chios, Smyrna, Ephesus, Miletus, Rhodes, and Byzantium.[15] Very near to the city of Byzantium was the Marmara Island which produced one of the most prolific marbles at the peak of this trade: *marmor proconnesium*. This marble from Asia Minor will be a major focus of this thesis, as it was the bulk of the cargo found on key shipwrecks such as Punta Scifo D, and Capo Granitola A.

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[13] Strabo, *Geography* 5.3. 6. Digital version in Perseus Digital Library online: A. Meineke (ed.), *Strabonis Geographica*: *Recognovit Augustus Meineke*, (Lipsiae, 1877), 14.1.24.

[14] Freed, "Trade routes of the Roman Empire," 27.

[15] Freed, "Trade routes of the Roman Empire," 27.

Mytilene was famous for its two harbors, and for being the largest city of Lesbos, which is an island off the coast of Turkey. Both harbors had been reinforced and made safe with stone-moles, which encircle portions of the harbor to reduce the danger of rough waters. The northern harbor of Mytilene was deep, and quite large. While the southern harbor of Mytilene was considered a 'closed' port, which meant the moles encircled it and left a much smaller entrance. It was able to accommodate around fifty triremes at once.[16] Rhodes and Chios, in addition were quite stout harbors, which were theoretically both closed harbors through the use of moles. It is said that Chios could hold eighty ships at once, and they were given ease of access with a roadstead which is a sheltered offshore area for the vessels.[17] Lastly, there was Smyrna, which constantly competed with Ephesus, for naval trade. Smyrna was in possession of a good harbor which could be closed. It was also a producer of marble, but most of the marble was used during the construction of the city center.

Ships leaving the ports of Egypt, namely Alexandria, would generally take well-traveled routes unless they were heading directly for Rome, or any other city, with specifically requested cargoes. A famous route which was taken by many merchants followed the southern coast of Asia Minor, which in the summer months meant northwesterly winds, and a port tack as the wind blew from the left.[18] As the route then took them to the port of Rhodes, the wind was now coming from the right which meant a starboard tack. Tacking is very common in the Mediterranean for ships equipped with sails. Following Rhodes the route would generally take them to Crete, then Malta, and finally Syracuse in Sicily. The Strait of Messina was one of the final legs of the journey and would take up to three months due to the prevailing winds

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[16] Freed, "Trade routes of the Roman Empire," 29-30.

[17] A roadstead is generally a sheltered stretch of water adjacent to the shore where ships can ride at anchor.

[18] Lionel Casson, *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times*, (Princeton University Press, New Jersey, 1991), 208.

from the northwest.[19] Validity of such routes can be supported by shipwrecks, but only to a certain degree since a sea-route exists in an ephemeral realm, or in charts and maps.

The task of verifying naval routes from the time of the Roman empire is challenging without concrete evidence or ancient references. Even with these supporting elements, it is not exact. To piece together additional information through archaeological research of shipwrecks and their concentrations is much like assembling a puzzle with only a handful of the pieces. To quote A.J. Parker, "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."[20] The sinking of a ship, and its subsequent existence underwater for hundreds of years, leaves a challenging stratigraphy to interpret, often shaped and affected by outside influences. A ship may disintegrate, its cargo may be plundered from the seafloor, or perhaps the ship and its cargo could be scattered. Even a single block of marble may offer us valuable information, our puzzle piece.

An excellent method of tracking and reconstructing Graeco-Roman stone trade routes involves the broad category of white marble. This tracking method can assist in gauging relationships between distant communities, who commissioned the shipment of marble. One such famous type of marble is *marmor lunense*, which comes from Italy. *Marmaros* means "shining stone," which can be attributed to its high quality and ability to hold polish.[21] The concept of trade is explained very succinctly by Professor Lord Colin Renfrew, as the relationship between organization and

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[19] Casson, 208.

[20] A. J. Parker, "Artifact Distributions and Wreck Locations: The Archaeology of Roman Commerce" *Memoirs of the American Academy in Rome*, Supplementary Volumes 6, (2008), 177.

[21] The marble's translation was taken from the website, Rome and Art.

commodities, which allows for trade. Otherwise, there would be no need for merchants to haul marble from Greece to Rome. His theories were focused on land-based trade, but the concept still applies. Renfrew also uses the Law of Monotonic Decrement, which is related to the ebb and flow of trade, supply and demand. Another form of sea-trade is referred to as 'nautical tramping' explained by Dr. Richard A. Gould in *Archaeology and the Social History of Ships.*[22]

Nautical tramping voyages were estimated to have taken between three weeks and three months,[23] and consisted of selling, buying, and exchanging goods. Ships carrying cargoes of stone perhaps would not have taken such long voyages with their bulky cargo. It is far more likely that they would have traveled from their origin to their destination without tramping. But it is not impossible that they were carrying smaller wares that would fit within the sumptuary category of cargo. What is very clear is that the Roman artisanal trade required a steady supply of quality marble for both architectural and artistic purposes. An archaeologist by the name of Pietro Ercole Visconti investigated the wharves of Marmorata in 1868. However, he did not leave any records of this investigation. Some of the more prolific marbles supplied to Rome were: *chemtou* from Africa, *docimium* and *marmor proconessium* from Asia Minor, alabaster and porphyry from Egypt, chios from Euboea, and *paros* from Aegean Greece, *pentelikon* from Attica, and *luna* from Carrara.

The sea allowed merchants to transport their wares in bulk, especially stone, which was one of the most cumbersome cargoes. For example, the author Charlesworth discusses trade overland in Greece versus over sea, "Yet there was little heavy traffic passing upon them and transport by sea was often easier and more

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[22] Richard A. Gould, *Archaeology and the Social History of Ships*, (Cambridge, UK: Cambridge University Press, 2000), 152-53.

[23] Gould, 153.

convenient".[24] However, ships were not sailing at random amidst the Mediterranean; they possessed commissions, and directives. They each had their destination, and it was their goal to reach port with relative speed. Preferably their route would be the shortest, but this did not stop merchants from taking their wares across the sea.[25] Archaeologists and researchers of maritime studies employ the distribution of inscribed items, such as bricks, tiles, ceramics, and of course, stone to track sea routes. For example, if a piece of quarried marble was found off the coast of Tunisia and was inscribed with the mark of a quarry in Carrara, then this would become a data point in mapping a route.[26] Without the use of waterways these bulky cargoes could not have traveled such great distances. Many of these marble sources, unless local, had to be transported through means of ship.

Merchantmen, their crews, and any passengers were always painfully aware of how vulnerable they were to the changing of seasons and winds. These rules of nature ruled their comings and goings throughout the Mediterranean, especially if they were going long distances. The famous grain-ships of Egypt could just barely manage two trips each season if they were fortunate, before winter winds swept across the sea. During these periods, the merchants were oftentimes forced to remain in port where their vessels were sheltered from the rough waters and winter storms. Those merchants which passed through Pozzuoli,[27] the port of Naples, then later Ostia/Portus, faced many layers of bureaucracy and were at the mercy of the harbor officials. This lengthy process was no doubt limited to specific ports; otherwise, merchants would lose a great deal of time and money languishing at anchor. The

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[24] M.P. Charlesworth, *Trade-Routes and Commerce of the Roman Empire*, (New York: Cooper Square Publishers, Inc.,1970), 116.

[25] Parker, "Artifact Distributions and Wreck Locations," 183.

[26] Parker, 184.

[27] Lionel Casson, *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times* (Princeton, N.J.: Princeton University Press, 1991), 199.

summer months were normally on the side of the merchants traveling to and from the ports of Rome, as the winds blew strongly from the northwest, or northwesterly. These conditions allowed sailors from Rome to reach Alexandria in an efficient manner, usually in one to two weeks' time.[28]

1.3 - Frequented Sea-Routes

The number of shipwrecks increased dramatically between the years 500 BC and 500 AD, with peaks in both the Republican and Imperial periods of Rome. The number of shipwrecks implies a far greater number of vessels traversing the sea which reached their destinations safely. This indicates a high volume of movement along the sea routes of the Mediterranean during this era.[29] Merchants trading in stone would have carried it over both short and long distances. Local stone exchange likely constituted a very large portion of the stone trade, especially with its reduced risks. Local quarries providing for nearby cities were and still is a norm today. But the international marble trade was nonetheless vibrant, especially during the height of Roman infrastructure expansion and influence amongst their provinces. Marble would become a form of celebration and a way to exhibit the empire's reach and affluence.

Within a triangulated area between the islands of Sardinia and Ostia, a great number of ancient shipwrecks have been documented. The islands of Sardinia are home to many ports, some of the major ones include Olbia, Neapolis, and Cagliari. To navigate the waters surrounding Sardinia would appear to be challenging, as it is home to one-hundred and forty-seven islands in total. If a ship were to have been blown off course it could have meant catastrophe for the crew, vessel, and cargo. One such area of danger is the Strait of Bonifacio, where strong currents flow between Sardinia and Corsica. A strong current is both a positive and negative for ancient

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[28] Casson, 207.

[29] Parker, "Artifact Distributions and Wreck Locations," 187.

sailors, who could have used them to gain momentum, but perhaps also to lose control. According to some reports, there are at least thirty distinct ancient shipwrecks along the Strait of Bonifacio.[30]

Other hotspots for trade and related shipwrecks include the Tuscan Islands, the coast off of southwestern Turkey, Sicily, Malta, and south-central France. A high number of these wreck sites have been dated to the Republic-Principate period, and then the Imperial period.[31] "Ancient ships met their end in a wide variety of circumstances, but shipwreck sites are, for the most part, unselfconscious formations…".[32] This means that though no two shipwrecks are alike, they can each provide researchers with valuable data as they are normally only disturbed by the elements.

Their misfortune has given us a peek into the ancient world of Roman maritime trade and history, the lives of the crew, and the citizens of the empire. There is much to be learned from the lives of the non-elite, who are always the majority. The goods which were being transported and bought through the centuries; and how sailors from different time periods navigated the same sea, all of these are niches within the study. No single shipwreck can be used to paint an accurate route, especially as ships were often blown off course by any number of miles, take, for example, an object which was buried along a river, and over time, it erodes, and is carried away from its original deposition. Now any data that would have existed alongside the item is lost. Thus, the object cannot be connected to its original depositional site, leaving inconclusive information.

To comprehend the movements of ancient vessels, there must be an understanding of the underwater landscape. Terrestrial and underwater landscapes are

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[30] Parker, "Artifact Distributions and Wreck Locations," 188.

[31] Parker, 188.

[32] Parker, "Artifact Distributions and Wreck Locations, 188.

not so different, aside from the obvious. The many scattered finds and features of each shipwreck must be plotted on a map, which then leads to the search for any sort of pattern amongst all this data. Archaeologists from across the Mediterranean can compare their findings, thus understanding the distribution. Finally, researchers interpret the combination of these two steps. This is essentially landscape archaeology.[33]

Merchants could source their stone directly from the quarries, which would often be linked easily to the coastline or were in fact on the waterfront. A perfect example is the famous city of Carrara, in northern Tuscany, Italy. Marble produced here was and still is highly sought after for its high quality, and ability to hold a beautiful polish. However, the routes which were taken most often from Carrara traveled north and south. The southern route was more significant as it led directly to Rome, which both consumed and distributed this marble. Rome was the beating heart of the empire's trade, and the buyers had extravagant taste. It is said that all roads lead to Rome, by sea or land. Rome is connected to the sea by its port, Ostia Antica, which lies 26.7 kilometers (16.6 miles) from Rome. There is a network of canals which supported the trade to and from Rome, alongside the mighty River Tiber (Tevere). Sea routes depend upon the ports, which just like everything else are subject to change over time.

Ports which lie upon the delta of a river require the intervention of humans, if they are to be continuously used over many centuries. This is due to the silting effect of rivers, depositing slowly but surely layers and layers of mud, sand, and debris. Harbors also faced the problem of shipwrecks, as they created obstacles and hazards for other ships.

Returning to trade routes, merchants carrying stone would undoubtedly have carried other goods as well. Depending upon the weight of these other items, they

[33] Parker, 192.

could act as ballast if stored in the hold, or vice versa, if the marble was organized below-decks. This was an art learned by dependable traders, as they had to balance the calculated weight of cumbersome stone to not upset their vessel. Once underway, ships carrying stone would follow their routes by day and night, guided by the sun, and stars. It is a fallacy, that has been perpetuated greatly, that Roman era sailors were afraid of the seas which they sailed on. While superstitious, they were talented and skilled sailors who were experts in their trade. To be leery of the seas and their master, Neptune, was natural.

Most merchant vessels were smart enough to steer clear of coastlines for as much of the journey as was possible. Less proximity to the rocky coast was preferred, staying well away from the rogue waves and currents that could carry them onto the boulders. Shipwrecks were likely not as common as we would believe, as these routes, if followed correctly, could take merchants safely into harbor. Factors such as an ill-repaired ship, violent weather systems, or risk-taking captains, could account for many wrecks. Other causes could include miscalculated ballast, shipworms, or rot. An example of an unlucky vessel which sank off the coast of Calabria near to Crotone, is the shipwreck named Punta Scifo D. This wreck lies very near to an infamous reef, which plausibly was the cause of its untimely demise.

Large, established ports represent only a fraction of where ships would receive stone shipments. Many times, ships would dock themselves on makeship slipways where they would directly take onboard the stone blocks from the quarry. This was definitely the case in Attica, Greece. A rock-cut slipway was made at Drakonera, where a white-marble quarry was discovered.[34] This slipway allowed ships to safely dock and launch back into the sea with their cargo. It is situated directly on the coastline, making it extremely convenient for transferring the cut marble onboard.

[34] Georgia Kokkorou-Alevras, Eirene Poupaki, Alexis Eustathopoulos, Efstathia Rigatou, and Achilleas Chatziconstantinou, "An Overview on Ancient Quarries of Southeastern Attica: The Ancient Quarries of Hymettus Revisited1," *Athens University Review of Archaeology 2* (November, 2019), 120.

Nearby this quarry there was supposedly another, which extracted sandstone, or *poros* near Marathon, and Dikastika. The researchers who investigated the site at Drakonera supposed that the material was used locally due to its high quality, which made it a desirable stone for producing architectural elements and sculpture. Georgia Kokkorou-Alevras and her colleagues also distinguished that this sort of theory could be pursued using archaeometric data through the sampling of marble.

There were likely many well-traveled local sea routes near the coastline of Greece due to a high quantity of seaside quarries. South of the aforementioned quarry, on the Lavrion peninsula, is the famous Cape of Sounion where the Temple of Poseidon is located. This same temple was constructed of a bluish-gray marble extracted from the quarry of Agrileza. An example of a non-coastal quarry from the Roman period is located in Stefani, where a grayish-white marble is present. An extensively used, and well-documented quarry lies in the ancient city of Thorikos, now known as Velatouri. It produces a gray-bluish marble similar to that of Agrileza. However, unlike Agrileza, Velatouri has been in continual use since the Geometric period.[35] This makes it one of the most prominent quarries of Greece, due to its longevity alone.

Some ancient authors, including the prolific Strabo, made it clear that the quarries of Hymettus were widely known and produced quality stone desired by many. One of the stones produced here was a yellowish limestone, specifically at *Kareas*. This is outside of the city of Athens. Amongst these quarries there is a substantial amount of evidence for the use of the fish-bone pattern of extraction which was used often during the Roman period.[36] The quarry of "Karavi " dates to the late-Roman period. To support the aforementioned writing of ancient authors, the Mahdia shipwreck off the coast of Tunisia contained fully carved marble columns from

[35] Kokkorou-Alevras, et al, "An Overview on Ancient Quarries of Southeastern Attica," 120.

[36] Kokkorou-Alevras, et al, 123.

Hymettus. This also sheds light on the trade of stone from Greece during the Roman period, and how marble was transported aboard ships. The quarry which produced said columns was in continuous use during the Roman period.[37]

During the surveying of Roman Period quarries in Greece, written evidence was discovered which supported a direct connection to the Roman trade of marble. The inscription is connected to the Cethegus family, which held both senatorial and consulary positions in the Roman Empire. The inscriptions discovered within the quarry attested their ownership, and operation of the said quarry(s). These inscriptions can be dated to around the reign of emperor Tiberius (AD 14-37), but the researchers believe the operation of the quarry(s) would have begun before the reign of Emperor Augustus. Finding evidence that would support this theory is unlikely, as in many cases earlier extraction traces and materials from the workers have more than likely been lost. In the case of archaeological sites situated on bedrock or an area which is exposed to continuous factors of erosion, dateable materials such as pottery, tools, bones, etc., are often lost. Even in the cases in which these items are found, it does not offer definitive evidence for the beginning of habitation. Inscriptions such as these are incredibly diagnostic and provide a firm foundation for theorization and further investigation if deemed necessary.

[37] Kokkorou-Alevras, et al, 125.

Chapter 2: A brief study of ports, and how maritime landscapes are studied

2.1 - Roman ports

The Roman empire controlled and traded through a vast network of ports and small harbors. The importance of Alexandria's port never diminished as long as there was a need for grain in the empire. The province of Egypt also provided Rome with quality granite, alabaster, and porphyry from its private and imperial quarries, but also with relics from long before the inception of Rome as a great power; some of the most prominent of these stone monuments were the obelisks. This trend of relocating and repurposing monuments or stone objects was started by Augustus in 10 BC. These obelisks were carried across the Mediterranean on vessels reported to be of great size, normally used for carrying cargoes of grain. These vessels were of a class of massive wooden barges, some of which were towed by multiple ships. Barges of this sort were also utilized for the transportation of marble from the eastern provinces, more specifically Asia Minor. Such large vessels also required a harbor which could accommodate them properly, which meant more time at sea until a port of such size could be reached.

In many meaningful ways these coastal communities of the eastern Mediterranean were more connected with one another than villages sequestered in the mountains. This was partially due to the amount of time overland travel took, particularly if there were not well-established roads. But these coastal ports and communities were tied intrinsically to the sea itself, as was the majority of marble trade. In addition, it was very possible that many of these major ports would have had an established network of debit amongst the banks and lenders within each city, removing the necessity for carrying large amounts of gold and silver.

Another key port city of the eastern Mediterranean was Corinth, situated on the northern edge of the Peloponnese which borders mainland Greece. This harbor offered two valuable benefits to those who passed through it: reducing the time of travel by means of a unique passage overland, and the avoidance of the dangerous waters around Cape Malea on the southern tip of the Peloponnesian peninsula. Corinth was of vast importance to the people of Greece, and to the broader Roman economy. With the revitalization of this port came growth and renewed life in a region which had been hemorrhaging manpower and had encountered economic stagnation. This growth and prosperity were also fueled by the sudden Roman interest in Hellenic marble in the construction of architecture and creation of art.

The originally Greek city of Dicaearchia, later Puteoli, and finally Napoli, was graced with an advantageous natural port which is now referred to as the Bay of Naples. It would become the primary Roman port for a time, until Ostia to the north was expanded and improved over time. The Bay of Naples, while naturally situated to be utilized as a port, like many other ancient harbors had the recurring issue of siltation. The Sarnus river flows directly into the bay, which also would have allowed river travel. Puteoli maintained its importance as the primary port of Rome, until emperor Claudius built the harbor of Portus adjacent to Ostia to the north and closer to Rome.[38] Puteoli would remain a viable harbor with a good capacity, though it was now in the shadow of Portus.

The Bay of Naples has provided important archaeological information about the ancient landscape of ports. A large portion of the historic harbor was slowly covered with layers of sediment, only recently excavated during the construction of new railway tunnels in Naples. This situation is perfect for the archaeological

[38] Jean Rougé, *Ships and Fleets of the Ancient Mediterranean*, edited and translated by Susan Frazer, (N.Y.: Columbia University Press, 1981), 170-171.

preservation of many elements of the harbor, especially when the silt has preserved wooden elements of shipwrecks. On the rare occasions that the hulls of Roman ships are partially or even completely preserved, they can provide rich data on Roman cargo, trade, and the lives of seafarers.

The author Jean Rougé, who wrote *La Marine dans l'antiquité*, or *Ships and Fleets of the Ancient Mediterranean* in the English translation, has offered many insights. One such example that she gave was of the coast of Istria,[39] which was host to many small ports, sometimes referred to as marinas. Usually, these marinas are too small for high numbers of vessels, but they are often nestled in protected coves with some sort of beach. These smaller local ports acted as the connecting fibers between regions which normally would be incredibly isolated. This allowed for a broad web of trade routes ranging from the minuscule local economies to the enormous economic powerhouses of Rome, Alexandria, and Ephesus. From their small marinas, local merchants could easily take their goods to larger ports, and vice versa. These large ports, such as Portus and Alexandria, were the hubs of the trade-network. During the summer months, and the debated shoulder seasons, these local marinas and ports bustled with merchants from across the Roman Empire and beyond. The winter brought much of this maritime activity to a complete standstill, while overland routes would have become the focus.

[39] Rougé, *Ships and Fleets of the Ancient Mediterranean*, 169-170.

Chapter 3: How do we analyze shipwrecks to inform upon Roman stone trade?

3.1 - Tools for analysis

Landscape archaeology and the array of techniques and tools which have been used, especially in more recent times, can be applied to a degree to underwater landscapes. Two of the tenants of this field of research as defined by Justin Leidwanger, are how the artifacts were distributed by human hands or nature, and spatial analysis.[40] Artifact and shipwreck distribution along the seafloor, when used in conjunction with one another, could certainly be applied in the research of ancient seafaring routes or areas of semi-habitation and work. When specific filters are used within this framework of study, for example, time period or cargo type, then theoretically a map could be created of frequented routes.

This same framework could be utilized while examining jettisoned material to understand hotspots for dangerous portions along these same routes. There would need to be an extensive study to reveal if there is any correlation or not. In essence, the patterns created by the Roman marble trade can be examined and simplified, for not only scholars and students, but also the general public. Additionally, as it can be applied to nearly any sort of analysis, the usage of land for quarries, marinas, ports, machinery, living quarters, and so much more, can all be studied.

Geographic information systems, more commonly known as GIS, is an incredible tool for the bulk of spatial analysis. For artifact distribution and site spatial analysis, GIS offers a multi-layered map of the sites. It assists greatly in managing all of the data points, within their specific contexts. There is often too much information spread across too large of an area to convey the data in a simple manner, especially

[40] Justin Leidwanger, *Roman Seas: A Maritime Archaeology of Eastern Mediterranean Economies*, (Oxford, U.K., Oxford University Press, 2020), 77.

on conventional maps. This is where GIS performs at its best, by creating an interactive experience which allows for nuance, and simplifies the oftentimes overwhelming amount of archaeological data. The different forms of GIS modeling called "raster" and "vector," present the data in unique ways both helpful for simplifying these complex landscapes. Vector modeling is perfect for representing spatial data, and nonlinear data, while raster modeling uses square cells, and is commonly used by archaeologists to represent and convey artifact distribution and frequency. This sort of modeling is incredibly useful when visualizing how the artifacts and cargo are distributed over the seafloor. Alternatively, it should be possible to also represent the distribution of specified shipwrecks throughout the Mediterranean.

In its short life GIS has managed to change how archaeologists process and think about data, and even how we think about space. GIS may be utilized in both survey and analysis, the two major categories of archaeology. Surveying land while using GIS can even be used to predict the possible locations of unknown archaeological sites, which could be applied to the discovery of lost shipwrecks or similar maritime sites. During maritime archaeology projects, the immediate access that GIS can provide to the data is invaluable, as it can then inform on how to proceed next. This also interfaces with micro-analysis, which in archaeology is the examination of small-scale features or traces left behind on artifacts or remains.[41]

Mapping maritime landscapes, shipwrecks, the cargo, and so on, can all be done through GIS, allowing for multi-layered, data rich displays of the project area(s). The shipwreck can be surveyed alongside its cargo, and the spread of artifacts along the seafloor, with their frequency and typology all packed together. This can also be used to differentiate between separate shipwrecks, any jettisoned materials, or

[41] Leidwanger, *Roman Seas*, 77.

artifacts which were carried by currents and then settled.[42] Surveying these maritime sites using GIS also means that the geographical, geological, and hydrological (including tidal, and vegetation data) can all be implemented. This process is important when assembling a better understanding of the landscape. Spatial interaction is key to the development of maritime studies.

GIS, along with the other sciences outlined above, can illustrate how shipwrecks and their cargo interact with their environments, becoming a landmark for humans, a part of the landscape, and a home for marine life. GIS has an incredibly wide application in maritime studies, allowing researchers who cannot dive on these sites, whether due to environmental conditions or restrictions, to continue their studies and surveying. But also, for those researchers who are diving and excavating, it is invaluable as it gives a top-down view of their project area, with multi-faceted and complex data becoming easily accessible.[43]

Both the material and non-material evidence of maritime culture should be considered and implemented during these studies as much as possible, especially as it is a nuanced landscape and history. Leidwanger discusses the fluidity between terrestrial sites or landscapes, and the marine, which relates directly to the focuses of this manuscript.[44] It is important to account for the fluid nature of the Roman marble trade, as it heavily depended on this relationship between the terrestrial and maritime. The trade of quality marble was not operating under the same everyday needs as many other goods which were exchanged across the Roman Empire and beyond. Marble was not a trade good which was used by the common man, for daily needs, like olive oil and grain. So, the incredible growth of the marble trade was completely due to its

[42] Leidwanger, *Roman Seas*, 77.

[43] Leidwanger, 77.

[44] Leidwanger, 78.

beauty and popularity as a building material. Marble was also a symbol of power and wealth when used. How we perceive this trade now should be attempted in a fluid and organic fashion, as the shipments would have been made upon specific orders, rather than regular ones.

The scholar A.J. Parker had a great deal of influence on modern landscape archaeology theory and methodologies, especially for maritime culture and communications.[45] Additionally, the archaeologist Paul Rainbird has contributed substantially to the archaeological study of islands, referred to as "islandscapes." Essentially the discourse of this topic revolves around a conceptual framework of the archaeology of islands and coastlines. This depends upon a blend of both terrestrial and marine landscapes, as it is the core of this type of study.[46] Another archaeologist involved in this discourse, Cyprian Broodbank, holds the position that this field should be approached from a platform firmly in the holistic. Broodbank's idea according to Leidwanger is to discover the sea paths through which these ancient Mediterranean peoples interacted. This form of study of the landscape and coastlines uses the concept of nodes or spheres of the Mediterranean Sea, and even more specifically for this thesis, the Aegean. The coastlines in this approach are interconnected through multiple threads of commerce, culture, and during the Roman period, government.[47]

Now, according to Leidwanger, maritime landscape analysis is the perfect tool for expanding the studies about the economic communities, and their multi-layered interaction across the Roman Eastern Mediterranean.[48] Maritime landscape archaeology is a perfect approach to better understanding what role the Roman marble

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[45] Leidwanger, *Roman Seas*, 78-79.

[46] Leidwanger, 79.

[47] Leidwanger, 79.

[48] Leidwanger, "Roman Seas," 80.

trade played in the grander scheme of things, as well as how the frequency, provenance, and location of its numerous shipwrecks and cargoes, fit into this framework, the economy, and the coastal communities. The sentiments which all of these scholars share, as illustrated by Leidwanger, is that the Mediterranean Sea is the key to the history, archaeology, and landscape. The Aegean connected the many islands and communities which called it home. The sea was the greatest road of all for the Roman Empire culturally, politically, and economically as it connected the vast number of coastal nodes. Within this web there were smaller spheres which supported the locals and were their own micro-economies.[49]

Studying the coastal marble quarries spread throughout the eastern Mediterranean can lead to a better understanding of the cultural landscape of this trade, and the broader economy. While these quarries were primarily local in nature, they still held an important place in the Roman trade network, supplying the heart of empire with a plethora of white and polychrome marbles. The Romans, like so many before them, utilized the power of the sea, and the great potential it held to expand their reach to many relegated coastal communities to form a web of marble exchange. A primary example of this would be the Greek city of Corinth, which saw a remarkable era of renewal. This is one example amongst many similar, though not all as grand, incorporations into the greater Roman economic machine. Understanding these conduits through which the marble trade flowed is vital to studying the blend of maritime and terrestrial landscapes.[50]

Once again drawing on the wisdom of Parker, he believed that to truly conceptualize and understand the marine landscape and its connection to the terrestrial one, we as archaeologists and scholars must adopt a mariner's perspective. The

[49] Leidwanger, 80.

[50] Leidwanger, "Roman Seas," 80.

extension of an agricultural economy, of which much of the world once operated within, to one of primarily seaborne redistribution might entail an overlap of roles. Leidwanger explained that there is likely nuance within the many roles of the individuals within the Roman economy, where professions and skills may overlap with one another. This could mean that in some cases quarry laborers and craftsmen could have filled another role in the marble economy, perhaps also operating as mariners and merchants. They would have participated in the transportation of the marble which they had quarried or worked upon. It would make sense in theory, as these workers would have had an intimate knowledge of the stone, and how to move and transport it safely to and from the vessels.[51]

The comprehensive landscape of terrestrial and maritime, unlike other fields of study, must include the numerous forms of material evidence which are often placed within their own niches of archaeology. These types of evidence include but are not limited to: shipwrecks, the remains of ancient ports, the many scattered maritime debris, shoreline distributions of artifacts (which can be understood through GIS mapping), and finally the spatial patterns of seaside sites, also achievable through GIS. In many cases these complex relationships, sea-routes, and maritime sites are documented and examined in too narrow parameters. Rigidity within archaeological studies can be at times incredibly helpful, but in many other cases, the introduction of dynamic approaches may be implemented to fully comprehend the complex histories of human interactions.

The scholar Braudel makes the argument that we as archaeologists must understand the human-environment dynamics in maritime archaeology. These elements of human interaction are key to understanding the sites which we

[51] Leidwanger, 80.

investigate.[52] Viewing these landscapes, long influenced by the passage of mariners as a dynamic and incredible road highway, allowed the Romans to bring marble and stone from all over the eastern Mediterranean, especially the Aegean, to their markets. For there to be a greater understanding of how this highly prized stone impacted the Mediterranean and the Roman empire, there must be studies which go beyond the distillation of the trade into small-scale and large scale, as well as the application of long versus short distance. These approaches are far too limiting for these archaeological and historical studies. The landscapes do not end at the edge of the water or land; they are interconnected. Removing limitations of language upon maritime archaeology can bring about a greater understanding of Roman marble trade.[53]

Diversifying the terms with which we describe patterns of trade in the economy of marble shipping, and the many other forms of trade, would potentially pave the way to a better understanding on a wider spectrum. Studies which intend to quantify and display the breadth of Roman marble trade must consider the fluidity of sea-routes throughout time, and the space of the Mediterranean. This stone was known for its many distinctive colors, though white is the most recognizable, firmly established itself in the cultural fabric of Roman society and commerce. To bedeck the lands and capital of the mighty Roman Empire in marble from the east, their spiritual birthplace in many ways, was to display their technical and political prowess.[54] Frankly, the Roman marble trade was an unlikely phenomenon, but with enough backing from the wealthy, the temples, and imperial projects, it became a widespread exchange that

[52] Leidwanger, "Roman Seas," 83.

[53] Leidwanger, 83.

[54] Leidwanger, "Roman Seas," 84-85.

continues today. Marble was and still is a luxury item, but in many ways it became a staple of Roman society.

It is quite evident that through the many efforts of dedicated scholars, that this niche within maritime archaeology will see continual attention. More specifically, Ben Russell has quantified the mobilization of quarries in the eastern Mediterranean which rose to meet the demands of the empire.[55] This was achieved through the many varied local markets contributing to a larger market, though it is difficult to say whether or not there was a typical cargo size. The raw tonnage of marble would have varied significantly, especially since every quarry produced at different rates. There was surely a smaller simultaneous exchange of marble in this economy, an economy which tailored itself to the fluctuating tastes of the Roman elite. The shipwrecks which have been surveyed in the south of Italy are but one example of this trade but may help in the understanding of local transport in the Aegean.

3.2 - Marble as a means of identification, for routes, and origin

The cargo of any vessel represents a treasure trove of information to the right researchers. If the stacked cargo of marble has shifted from its original location, the way it sank, and how the wood gave way to time can be surmised. The amount of marble found on wrecks is of great importance as well. A smaller cargo of marble components and blocks, somewhere in the realm of 50-100 tons, could mean a smaller vessel, or the rare case of marble being a secondary cargo item. A much larger cargo, of around 350 tons for example, could suggest the vessel was a barge, designed to be hauled behind ships equipped with sails.[56]

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[55] Leidwanger, 85.

[56] Carlo Beltrame and Valeria Vittorio, "Roman Ships Carrying Marble: Were These Vessels in Some Way Special?," *Between Continents: Proceedings of the Twelfth Symposium on Boat and Ship Archaeology, Istanbul 2009*, edited by Nergis Günsenin, (Istanbul, Turkey: Ege Yayınları, 2012), 142.

These intricate sea routes, which in general followed the advantageous and prevailing winds, must be analyzed and displayed in such a way that is spatially dynamic, rather than flat and linear.[57] Leidwanger writes about how this is a common issue in the field, especially as the subjects being portrayed are anything but flat and linear. The Roman marble traders and mariners usually would have followed the more conventional, 'safer' routes. But this viewpoint is not the absolute truth, and is too rigid, as Roman sailors would have taken more diverse paths, often fluid in nature. To be successful in sailing any body of water the sailors needed to be able to adapt, and alter their course when necessary, as the sea is always changing. The season, the day and night cycles, and the actual area of sea itself, were all taken into account while transporting goods like marble across the Mediterranean.

To fully understand the flow of the Roman marble trade at its peak, the model of study must remain flexible enough to accommodate future findings that shift our perspectives. Properly visualizing and describing the varied winds of each season, the tidal patterns and currents of the sea, shifts in sea levels, and of course, and the organic patterns of trade, are all examples of factors to enrich our models of future research.[58] Leidwanger also speaks on the topic of the popular methods of ship construction during the Roman period and distinguishes that there was additional shipbuilding techniques employed regionally and was not limited to the tried-and-true method of mortise-and-tenon. For the purposes of this study, mortise-and-tenon construction will remain the focus, as it was perfectly suited for the transportation of marble due to the blend of flexibility and rigidity it provided. Material evidence in the form of fragmented pieces of the wooden hulls, which are in some cases preserved between or beneath the marble cargoes, directly supports this claim.

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[57] Leidwanger, "Roman Seas," 81.

[58] Leidwanger, "Roman Seas," 81-82.

The shipwrecks referenced in the study of Carlo Beltrame[59] have been well-surveyed; Punta Scifo D in particular was meticulously sampled to identify the cargo of marble. This gave the researchers a positive identification on where the merchant sailors picked up their marble, and where they were probably shipping it. It seems that either they had picked up a smaller cargo of Verde Antico marble from the Peloponnese or loaded both while docked at the Island of Marmara where the majority of their cargo originated, the cargo being Proconnesian marble. It is impossible to tell at this juncture whether they were loaded at different times and locations. The only possible indicator from the wreck itself would perhaps be how the marble was oriented in the cargo. This study group of four shipwrecks located around southern Italy and Sicily represent a common trend in the shipping of marble during this period, the period being between the second and third centuries AD.[60]

Many cargoes of this time consisted of a mix between finished and unfinished marble, much of which was Proconnesian marble, extensively used in the Roman Period. This is a significant trend in how marble was shipped in these centuries, demonstrating an important methodology in the trade itself, and expectations held by clients. Another form of material evidence which further supports that this was commonplace in the business, are the array of example pieces found at quarries. These example pieces sent from the clients, are a fantastic example of physical evidence that connects the quarry to another region(s).[61]

The examples are generally a single architectural element, such as a capital or base. An example of this in the trade of Proconnesian marble, was discovered in one

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[59] Carlo Beltrame, "The Contribution of Four Shipwrecks to the Reconstruction of the Trade Dynamics of Proconnesian Marble in the Roman Period," *Archeologia Classica*, vol.72, n.s. II, 11 (L'Erma di Bretschneider, 2021), 439.

[60] Beltrame, "The Four Shipwrecks," 439.

[61] Beltrame, 439.

of the Marmara quarries.[62] This piece was an example of a capital which would be followed by the quarry workers who would have been highly skilled in multiple aspects of the process. The stone itself supplied enough diagnostic evidence to be sourced from the region of Aquileia, Italy.[63] This Roman colony lies in the far northeastern corner of Italy, on the Adriatic Sea. Finding this connection is important because it demonstrates a tangible material exchange between two regions in the eastern Mediterranean. It was very likely that the architectural elements were being commissioned for the construction of a monument or another form of civic structure, like a forum. The findings of Beltrame suggest that the majority of this classification of marble cargo was transported to the Black Sea, and towards the Italian peninsula, the biggest suppliers being from the Saraylar and Marmara quarries in Asia Minor.[64]

By far the most prevalent form of marble cargo was of unworked material, further specified by Beltrame as devoid of any molding. This was the easiest as it meant the quarried marble could be gathered and shipped to its destination, foregoing the previous process of carving the marble into components. Some relevant examples found off the coast of southern Italy and Sicily are the shipwrecks named Punta Scifo D, Marzememi I, Correnti Island, and Capo Granitola A.[65] Each of these vessels were transporting cargoes of unworked marble in the forms of blocks and slabs. There was a project in 2011 and 2013 which the scholar Dante Bartoli was heavily involved in, alongside Simone Parizzi who is a specialist in naval engineering, and Lorenzo Lazzarini from the University of Venice Ca'Foscari, who is an expert geologist and often consults on marble archaeometry. This project was called "The Routes of

[62] Beltrame, 439.

[63] Beltrame, 439.

[64] Beltrame, "The Four Shipwrecks," 439.

[65] Beltrame, 440.

Antique Marble," and its main goals were to reconstruct Roman Period routes, analyze the shipwrecks, and distill the unique characteristics of the cargoes.[66] By doing this, in a very detailed and orderly fashion, they were able to glean new and insightful data on this type of trade.

3.3 - Valuable information about Roman stone trade

One of the primary goals which Beltrame and Vittorio were working towards was to determine whether or not these merchant vessels were in any way constructed differently from the vast majority of Roman period vessels, specifically to transport marble. They point out that when the marble was loaded, the sailors may have placed it upon the backings. It seems that the backings of a ship refers to structural elements, and that placing the marble on the backings, a rigid part, allowed the ship to remain flexible and stable in the water. If the marble had been placed poorly, or shifted in transit, the ship could become unbalanced, raising the risk of taking on water.[67]

Since there is a definitive lack of specified Latin terms for ships which carried marble, Beltrame and Vittorio are aligning with the consensus about the vessels. They suggest that in general these ships were constructed in the same fashion as other Mediterranean ships.[68] It should be noted that many objects did not have special names, as they might today. For example, in the Medieval period, swords were simply called swords, and many of the fanciful names and classifications we ascribe to them today would not have existed. So, it is very possible that ships with specifications made for carrying marble existed, but they would not have had a special name or label. It was very common for every captain to have their own preferences and needs and would have their shipwright (naval carpenter) make any modifications. Most wooden

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[66] Beltrame, 440.

[67] Beltrame and Vittorio, "Roman Ships Carrying Marble, 142.

[68] Beltrame and Vittorio, 141.

vessels could be modified to a certain degree, within their capabilities, whether they were changed internally or externally. From the research data, it appears that they were modified and repaired frequently to maintain a comfortable, safe, and efficient sailing machine. Ships could be modified for tactical (color of paint on the hull, color of identification, and so on), cosmetic (paint, and ornamentation), and for practical purposes.

The authors state that the ships must have sailed with a mast and rudders. Otherwise, they moved by means of small prow-sail or were towed.[69] Towing was a valid option for the transportation of stone. The technique would likely have been for the extremely large and cumbersome cargoes (350 tons), such as the obelisks. The men on these vessels were not guaranteed to be actual sailors, but could have also been artisans, guards, travelers, and so on. Traveling specialized artisans may have been hired to work the marble upon its arrival at the port. The hypothesized dimensions of these vessels would be no larger than the specifications of a vessel commonly called the *onerariae*.[70]

These *onerariae* very likely came in various forms, both flat hulls and curved. Most vessels would have a cabin or shelter for the crew. The vessels needed to be flexible and strong enough to withstand the shifting cargo, as well as the wave action. Through a study of the available examples of surviving Roman era hulls, the ships were almost certainly constructed with a double order of mortises, and double planking. This added an extra level of strength which was a blend of flexibility and rigidity. The conclusion of Beltrame and Vittorio, which follows the general consensus, is that there is yet to be substantial evidence of a distinctive class of ships called *naves lapidariae*.[71] Until there is explicit evidence that these were a special

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[69] Beltrame and Vittorio, "Roman Ships Carrying Marble," 145.

[70] Beltrame and Vittorio, 146.

[71] Beltrame and Vittorio, 146.

class of ships, they will remain simple trading vessels, carrying one of the most expensive materials of the Roman world across the treacherous seas. These were skilled sailors, engineers, craftsmen, and laborers, who brought pieces of the Roman east, to the center of the empire, and beyond.

The Roman stone trade expanded upon the already existing technique of transporting stone and marble over waterways. Stone was moved primarily locally and regionally but was made exponentially more common throughout the Mediterranean. Quarried stone, specifically marble, was a luxury building material, reserved for special projects. As marble became a symbol of status for the Romans, the trade would see a boom. The amount of quarried marble would not be surpassed until our modern era. Every Roman era marble quarry that can be surveyed is another data set which can be added to the research and our knowledge of the marble trade from a local perspective. Local depots, slipways, inscriptions, shipwrecks, and so on, are all pieces to both the local and wider puzzle that is Roman marble trade.

The scholar Justin Leidwanger cites the existence of surviving epigraphic material which reports a whole series of details about local trade practice. Leidwanger also speaks of the substantial collection of Roman textual and visual sources which we still possess.[72] This local information included papyri documents listing details such as levies based on tonnage, type, and origin, as well as the cargo itself. These documents were not related to the import and export of marble, but these documents can still tell us a great deal about how it would have worked in the case of marble.[73] These snippets of local Roman era trade reveal that the combined tonnage of marble, the specific type of marble, and where it was quarried, would all have impacted the levies placed upon the cargo. So, this would likely mean that every time the merchants entered a new port or city, they would have a new levy of tariffs to handle. This could

[72] Leidwanger, Justin, *Roman Seas*, 41.

[73] Leidwanger, 41.

reasonably lead some merchants to avoid anchoring in the safety of a port, if they were being frugal, meaning that they would be anchoring themselves in possibly unsafe conditions.

The trade junction which exists between the island of Sicily and Calabria in southern Italy is of considerable significance to our understanding of the western Roman empire's marble trade. This body of water which separates the two landmasses holds both safe harbors and dangers to the vessels which passed through. The corridor between would have been traveled frequently by many types of vessels, whether for trade, fishing, or even naval ships. Numerous ancient authors speak of the importance of seasonal traveling, and respecting the seas, rather than braving the journey and risking lives, the cargo, and the vessel. Two of these authors, though writing in vastly different times, were Hesiod and Vegitius. Hesiod was an ancient Greek scholar, while Vegetius lived in the later Roman Period.[74] Both ancient scholars followed roughly the same principles of seasonal travel, although Vegetius outlined a much broader season of seafaring, though still tempered by the winter months. Vegetius lived in a time period outside of the scope of this manuscript, but his words are valuable, nonetheless.

The few months of the year in which marble traders could safely and effectively operate within serves as a framework for study. Within these periods of safety for a Roman merchant sailor lies another dimension of the trade itself. Quarrying was done within a broader period of time but was still often limited by the seasons. Foul weather and conditions affected most aspects of the marble trade, though the artisans would have likely been working under shelter in some capacity. Another aspect that needs to be considered is that even during these "safe" months merchants would encounter dangerous weather and environments. This illustrates just how difficult it would have been to work in this trade. These same conditions also

[74] Leidwanger, "Roman Seas," 63.

affect our study of these ancient shipwrecks, the seafloor around them, and even the seaside quarries, some of which have been submerged.

The winter season was commonly referred to as *mare clausum*, which literally means closed sea.[75] This was a practice to prevent the deaths of sailors, merchants, and passengers, as the winter months were unfit for safe travel overseas. They did not use a system of dry docks during this period, though they would have pulled them ashore, and conducted any necessary maintenance. This would have been common practice as the hulls of their ships would be assaulted by, not only the elements, but also wood eating mollusks. Re-applying pine tar to the wood would have extended the lifespan of a vessel. This was the time to make any repairs or alterations that could not be done while at sea.

The quarry workers were experts in their trade, able to maximize their cargo space with expert stacking and compartmentalizing, such as when transporting sarcophagi. They also were proficient in utilizing as much of the stone as possible, reducing waste and cost. This reinforces the idea that we cannot oversimplify the import and export of marble, and the cargoes themselves, as being homogenous. To state that there were only shipments of over 200 tons of marble would be false and misleading. There were as many variations to cargo as there were customers and their projects, with smaller exchanges of marble being just as present in the marketplace as massive ones ferried by barges and their towing vessels. This smaller, yet substantial marble trade, with its own nuances, served a market which demanded luxury marble variations.[76]

The transportation of quarried marble by sea, even over short distances, was completely valid, and would have been done extensively. In fact, during the less favorable or dangerous months of the year, these shorter hauls would have been, in all

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[75] Leidwanger, “Roman Seas” 63.

[76] Leidwanger, 85.

likelihood, a much safer endeavor. This meant that quarries could still turn a profit even in the off-season. Maritime trade was conducted with relative ease, especially when the sailors observed caution in their route and season. The sea and waterways provided incredible accessibility across the many regions of the Mediterranean, or in the words of Leidwanger, "goods to market."[77] The shorter voyages carrying marble to market or to buyer, would have filled these gap seasons where maritime trade was almost entirely suspended. This form of exchange served a greater purpose outside of the broader market, meeting the needs of the locals.

Many regions of the Roman Empire produced their own unique products which they exchanged on the open market. Greece and Turkey were known for their high quality, abundant deposits of marble. Lucrative marble quarrying and trade grew exponentially from being a local trade item, to one being available to all who could afford the costs of shipping the heavy material. The Hellenic regions produced the majority of the empire's most sought-after forms of marble, especially the white variants which were desired for both their application in sculpture and architecture.[78] Leidwanger refers to these factors of economic propulsion as impetus, which drove an increase in seafaring during the era. Hillsides and coastlines were being quarried and taken aboard waiting vessels, who would oftentimes find themselves passing through the corridor which exists between Calabria and Sicily, on their way to Rome. The early empire was especially famous for its massive civic and imperial projects which demanded high quality and diverse forms of marble for building, the most famous of which was the white, and reflective marble when polished.

The wonderful thing about many of these larger Roman era vessels, especially barges, was the fact that they could be used for transporting many types of goods. It all depended on their clientele, and of course who owned and chartered the vessels.

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[77] Leidwanger, "Roman Seas," 85.

[78] Leidwanger, 86.

Barges which carried wine, oil, and grain could just as easily switch to cargoes of marble. Privately operated ships were the most commonly used, being chartered to transport the majority of goods. This reduced the upkeep costs that the empire would have to pay if they kept a large fleet of imperial vessels for trade. Returning to the transportation of marble cargoes, the number of these vessels which came and went from the east was likely a much smaller number compared to that of eastern cargo ships laden with grain, olive oil, and wine. The wrecks which have survived are, of course, a small percentage compared to the actual number of vessels which would have been operated by marble traders.[79]

The scholars Bass and Steffy have made arguments that there was an observable shift in the Roman trade of marble, based on the differing sizes of vessels, which signified relative change from much larger cargoes of marble to those which were more modest in scope and size.[80] This is a theory which could be plausible. But unless all the shipwrecks after a certain period were significantly smaller, then this theory would be difficult to support. It is far more likely that throughout the history of the marble trade in the Roman Period, there were always projects and corresponding cargoes which were modest compared to the likes of Punta Scifo D. There most definitely would have been distinctive characteristics between private and imperial shipments, an important distinction. Some cargoes of stone would have likely had the mark of the current emperor, the quarry from which it originated, and by whom it was quarried.[81]

According to the research of Parker and Gould, ~407 shipwrecks have been definitively surveyed and positively connected to a period between 300 BC and 300

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[79] Leidwanger, "Roman Seas," 86.

[80] Richard A. Gould, *Archaeology and the Social History of Ships*, (Cambridge, U.K., Cambridge University Press, 2000), 173.

[81] Gould, "Archaeology and the Social History of Ships,"173.

AD. This number does not include wrecks which lack chronological data or have simply not been dated accurately yet. This number is also non-representative of the actual maritime trade during the Roman Period. The vast majority of these sites included in their research are located in the Western Mediterranean.[82] There is a logical explanation for this disproportionate number, with a spike in maritime investigation during World War II and afterwards. Many of these shipwrecks were discovered in and around harbors and rivers. The process of silt build-up oftentimes preserves wrecks in harbors. The central and eastern regions of the Mediterranean still host significant numbers of wrecks from the Roman Period, with many areas still requiring thorough modern surveying.[83]

The geographical distribution of shipwrecks and Roman maritime trade was much more evenly distributed, with the exception being larger port cities. The eastern Mediterranean Sea has an incredibly rich history of maritime traditions, trades, and ports. Much of this history we will likely never recover from the depths of time, as nature has a way of erasing coastal evidence. Much of the eastern Mediterranean is subject to consistent and sometimes violent tectonic activity, while whole coastlines have shifted, lifted and sunk, and crumbled into the sea. The coastline of Alexandria, Egypt, is a distinct example of this process as a great portion of the seaside district was swallowed by the sea, which was home to a large section of the necropolis. But the subduction and movement of coastlines, especially in the Aegean, have significantly shifted our modern perception of these landscapes, compared to that of the Roman Period.

It would seem that a much more substantial number of larger ships and barges sank enroute, than smaller vessels. In the case of barges which were towed, it is entirely possible that this reduction in maneuverability was partially to blame for

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[82] Gould, 143.

[83] Gould, 143.

higher levels of failure; although the cause for sinking was unique to every vessel.[84] Data from wrecks outside of the range of this study may still offer insights to the case studies and research of this thesis, specifically, the San Pietro wreck off the coast of Sardinia. The sarcophagi present reveal important details about the trade, and the skills which both the quarry workers and the sailors possessed. This can likely be applied on a much larger scale throughout the marble trade, as these were highly trained and skilled laborers and craftsmen. The sarcophagi present on this wreck were roughed out in a fashion referred to as "double-cut,"[85] which left space in between for separating the two once they were in the hands of the craftsmen. This may have reduced the work required of the quarrymen, and perhaps gave additional material to the craftsmen who could have used it for a lid.

The quarry workers and merchants were apparently not overly concerned with there being extra weight when using this double unit method.[86] It was most probably a calculated decision, as both types of workers were incredibly skilled in their work. They would have taken great pride in streamlining the process. This would have been even more apt if the quarrymen had dual roles as sailors or participated in the shipping of marble. It is incredibly likely these workers assisted in or helped direct the compartmentalization of the marble in the cargo hold. The goal would have been to maximize cargo space, and the amount of material that could be taken. This cargo discovered at San Pietro displays a method of nesting smaller components or sarcophagi within larger ones. Through preliminary examination of the marble itself, the researchers theorized that it would have originated from the Maeander Valley area of Turkey.

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[84] Gould, "Archaeology and the Social History of Ships," 144.

[85] Gould, 203.

[86] Gould, 205.

Author, Carlo Beltrame, states that currently there are two major schools of thought on the matter of marble circulation throughout the Mediterranean and the Roman world. Russell and Pensabene are the most prominent experts within these two schools, a modern stance being taken by Russell, contrarian to the ideas of Pensabene. The school of thought which Russell endorses believes that all quarried marble was shipped on specific orders made by the clients, and that there were not, therefore, any stockyards of marble which could be purchased. This implies that there were no definitive middlemen in this trade, only private and imperial quarries. The stance held by Pensabene, which is based upon the existence of the famous marble yards of Ostia, is the opposite.[87] He believes that throughout the Roman world there once existed depots of marble from various quarries, perhaps in various stages of completion, including veneer, slabs, blocks, capitals, and rough sarcophagi.

However, I believe this rigidity within the field of marble trade paints a very dull picture of the Roman world, as if both of these systems could not have existed simultaneously. Pensabene's school of thought has much more flexibility, even though it is older. The idea that marble yards did not exist remains a possibility.[88] Regional marble yards may have existed at one time, or still do, yet to be discovered. Many of these theoretical marble yards would have likely been used and cannibalized by local populations for building materials, or resold. Building materials exist in an extremely ephemeral state, as an abandoned yard of marble would have been irresistible. Over the millennia existing structures and ruined buildings were taken apart and were reused in contemporary structures and projects.

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[87] Beltrame, "The Four Shipwrecks," 438.

[88] Beltrame, "The Four Shipwrecks," 438.

Chapter 4: Archaeological evidence and research

4.1 - Shipwrecks & Vessels

To be clear, the archaeological community does not possess a solid database for the hulls of the aforementioned *navis lapidarie*, these vessels for all intents and purposes exist only in the words of scholars. Until there is extensive evidence that *navis lapidarie* were special, then they will remain a theory.[89] What does exist are semi-intact vessels of various designs and purposes scattered throughout the Roman world. These shipwrecks which are sometimes only partially intact, or in the rare case almost entirely as they were prior to sinking, are an incredible resource. Each of these vessels can tell us a story about the maritime history of trade in the Roman Empire, and those who lived in it, and were influenced by it. The mortise and tenon construction of the ships during this period are very distinctive as they are constructed inwards from the outside, though in some of these cases, the technique mentioned above was not used. This construction can at the very least be applied to the idea of a *navis lapidarie*.

Beltrame and Vittorio referenced the important work of the scholar Parizzi, who was calculating the dimensions of ancient ships. This study found that the majority of Roman ships were smaller in proportion. These vessels did not have to be immense in size, as this would not have been practical in most situations. Smaller, moderately sized ships were the commonplace, and their smaller size also afforded them greater speeds and maneuvering capabilities.[90] Accurately sizing these ships is difficult because we do not possess a vast array of preserved hulls. What we can analyze, however, are the remaining cargoes, and if they are relatively undisturbed,

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[89] Carlo Beltrame and Valerie Vittorio, "Roman Ships Carrying Marble," 142.

[90] Beltrame and Vittorio, "Roman Ships Carrying Marble," 143.

then we can more accurately estimate the surrounding hull.[91] It is proposed that some of these cargo ships were not equipped with a larger, raisable mast/sail, which was discussed also in the dissertation of Bartoli. These were barges which were hauled by other ships. Very few remnants of ship riggings have survived the ravages of time, though we do have some very fine examples of the ship's riggings depicted in frescoes and art.[92] These depictions are the best examples we have of Roman period rigging, as even in the best of conditions these components are too biodegradable to remain intact.

Many prominent researchers have previously focused on the subject of larger shipwrecks which carried larger cargoes of marble. These projects were crucial to furthering our knowledge of Roman maritime trade and how marble fit into this niche. However, selectively focusing on these vessels which were carrying much larger cargoes means that we are exploring a small fraction of the ships that plied the marble trade routes. Huge shipments of eastern marble would not have been the norm much of the time, as they would have only been required for monolithic and expensive projects. A small, or medium sized vessel, with a capable and experienced captain, could transport these smaller shipments with relative ease; especially if it was locally produced and distributed. The problem with solely giving attention to the larger, more "important" shipwrecks skews the data. This would apply in the reverse as well. It is more than likely that the majority of marble trade was conducted using smaller, non-specialized vessels which could have been retrofitted.[93]

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[91] Beltrame and Vittorio, "Roman Ships Carrying Marble," 145.

[92] Beltrame and Vittorio, "Roman Ships Carrying Marble," 145.

[93] Ben Russell, "*Lapis Transmarinus*: Stone-Carrying Ships and the Maritime Distribution of Stone in the Roman Empire," *Maritime Archaeology and Ancient Trade in the Mediterranean. Proceedings of the 2008 OCMA Conference, Madrid*," Oxford Centre for Maritime Archaeology Monographs 7," ed. by D. J. Robinson and A. I. Wilson (Oxford, U.K., Oxford University Press, 2011) 146.

Studying preserved hulls of wrecks connected to this trade is an elusive task, as many hulls have not survived into our modern era. If there are shipwrecks found in the future which are definitively connected with the trade of marble, we may have much clearer evidence in support of which vessels were used. But this would only be a single point of data in a much larger sample, if researchers hope to be more accurate in their theories. Sample sizes vary greatly in research, so the greater the pool of data to pull from, the more accurate the conclusions. But even with a smaller collection of samples, our understanding of Roman marble trade would grow in a meaningful way.

Ben Russell discussed briefly the past work completed by maritime archaeologists, Maischberger, Bernard, and Pensabene. Maischberger researched the famous marble yards of Rome. H. Bernard was involved with the Porto Nuovo shipwreck excavation and documentation. The example which Russell references from the works of Pensabene was a general discussion about shipwrecks of the Mediterranean. In these previous studies all of the shipwrecks possessed cargoes of material over 90 tonnes and were medium to large vessels. Russell points out that this was in following the descriptions made by Pliny. Russell is a great advocate of more thorough exploration of these smaller, less explored and documented sites, many of which have only been mentioned in passing. This tendency towards prioritizing larger vessels and their cargoes can create gaps in the data. He discusses the fact that a great deal of mentions and publications on already known shipwreck sites are cursory at best. The examples he provided included the Punta Licosa wreck, and the shipwreck off the Marmara Island which contains columns. But also, during the research for this manuscript, many short mentions of sites have been found, usually only a name or location, and they are accompanied by a void of data.

Russell mentions that two new wrecks and their research are being published by Dante Bartoli, an Italian scholar who has worked extensively with the wrecks

associated with Crotone.[94] These wrecks are the Punta Scifo, Punta Cicala, and Capo Cimiti, which all lay off the coast of Calabria.[95] This area of Italy is a hotspot for shipwrecks, where a large majority of ships would have passed on their route to Rome, for example. There is a distinctively higher number of explored shipwrecks in the western Mediterranean, specifically around Italy and France, as compared to in the Aegean. This is brought up by Russell who says that this is due to differences in national traditions, which is rather vague.[96] He does clarify that this lack of explored and documented wrecks, does not imply the absence of wrecks in the Aegean waters. There are many yet to be fully explored and published. The Aegean no doubt possesses a great deal of information in connection with the marble trade.

There will be many references to the work of Ben Russell, as his work coincides very closely with the subject of this research. The influence of post-depositional factors which affect shipwrecks cannot be understated, and Russell states that his own sample of wrecks is not exempt from these influences.[97] The importance of understanding the ways in which post-depositional factors have shaped the underwater landscape, and what that means for shipwreck exploration is all in our perception.[98] We may be excavating a shipwreck that would appear to have sat undisturbed, but in reality, portions of the cargo could have been recovered, or portions of the hull lost forever.

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[94] Russell, "*Lapis Transmarinus*," 148.

[95] Dante Giuliano Bartoli, "Marble Transport in the Time of the Severans: A New Analysis of the Punta Scifo A Shipwreck at Croton," (PhD diss, Texas A&M University, 2008) 1-3.

[96] Russell, "*Lapis Transmarinus*," 143.

[97] Russell, 143.

[98] Russell, "*Lapis Transmarinus*," 143.

Gathering conclusive data on ancient Roman shipping patterns based on where shipwrecks are found is too restrictive and one-dimensional, specifically because this data can paint an over-emphasized picture of coastal travel.[99] In reality coastal travel was avoided more times than not because of the excessive risk. In fact, many shipwrecks are examples of long-distance trade, and some wrecks which possess huge cargoes of colored marble are a strong indication of this trade.[100] Of course this still does not exclude smaller cargoes. But it may have been less cost-effective to only ship smaller cargoes. Unraveling these routes which the wrecked vessels sailed upon is no easy task and becomes quite complicated. Deducing where a vessel was traveling locally becomes even more specialized, as you would need to accurately trace the movement of cargo to destinations that likely no longer exist. When there are limited samples to draw upon, forming legitimate arguments is challenging. Russell states that this is all relative, as in the past archaeologists have been successful when using smaller samples.

This leads to the next point, that there are many shipwrecks which were previously explored in limited detail or could offer up new information through the usage of modern techniques.[101] Thorough investigations, followed by concise and informative publications, must become the norm. This would provide the wider community of students, researchers, and the public with a robust image of the Roman marble trade. The importance of forming a database of information for students, researchers, and laymen to draw upon should be regarded as an achievable goal. The publishing of basic information should be the first step in the process, as it will keep the wider community informed. An example of a very prominent site, the Academy

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[99] Russell, 143.

[100] Russell, 143-144,

[101] Russell, 144.

of Athens, was excavated in the early 20th century, but the findings were never fully published.[102] This leaves a sizable gap in our understanding of the site, even if the excavation itself was questioned by many. The fact is that even a detailed faulty report, which consistently explains findings, will prove sufficient in creating a more accurate timeline. Any information is preferable to a lack of published data, as once an area is excavated there is little to be gleaned from what remains.

Probably one of the most significant ways in which we can begin to understand more about the trajectory of a shipwreck before it sank is what they carried in their cargo. If a vessel contains marble from Luna, and it sank near Ostia, then it could be surmised that it was transporting stone on a semi-local basis to Rome. If a ship's cargo has been found to contain Egyptian granite, then the destination becomes murkier, even regarding the port of origin. However, we can surmise that it would have likely departed from Alexandria. The more detailed data we have on a ship's cargo, and the types of stone, the more precise the ancient routes become for archaeologists to decipher. Unsurprisingly, this type of exact information is rather scarce, when compared to our databases of shipwrecks. Predominantly this is an issue of resources as funding for stone analysis is not particularly common. This process, and that of dendrochronology and carbon dating, are all costly and time consuming. This type of funding is usually reserved for prominent sites, such as Punta Scifo A.

Dr. Russell notes that from his study, only thirty-three of the shipwrecks have conclusive data on their origins, making further research difficult, until the time when there is more field surveying done.[103] It is entirely possible there will never be any further data which lends a conclusive origin or destination for these ships. There can

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[102] Ada Caruso, "A New Athenian Gymnasium from the 4th Century BC, Development of Gymnasia and Graeco-Roman," edited by Ulrich Mania and Monika Trümper, *Cityscapes Berlin Studies of the Ancient World* 58 ISSN (Online) 2366-665X, edition-topoi.org, 2018), 201.

[103] Russell, "*Lapis Transmarinus*," 144.

only be so much information gleaned from these marine sites; and if there is no material evidence that gives researchers a foothold, then there will be no conclusions. This is the reality of archaeological work; there can be countless theories and conjectures made, but they may always lack that foundation of evidence. However, when there is a specific type of marble which is present, this can normally narrow down the point of origin to a smaller region. Archaeologists must then begin the task of determining the destination, and possible routes. As for the many wrecks around Crotone, the ships were most likely carrying marble bound for Rome.[104]

The primary shipwreck and its cargo which will be examined has been named 'Punta Scifo D', which is a Roman vessel dated to roughly the third century AD. The shipwreck itself was first discovered and recorded in 1986 by a man named Luigi Cantafora.[105] The cargo of marble settled objects and remains from the ship allowed for the time period of the vessels operation and disaster to be pinpointed. Among these objects, they were able to collect ceramics and timber which likely gave valuable information to the researchers trying to pinpoint both the origins and time frame.[106] There were also some metal objects found. Not all the artifacts found were from the same wreck, and some had apparently mingled together from another wreck called 'Punta Scifo C'.[107] This is a good example of how important it is to be precise when excavating a site, as many times sites and time periods can intersect or overlap. In this case, Hellenistic and Greek elements overlap or border the Roman ones.

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[104] Russell, 144.

[105] Carlos Beltrame, Lorenzo Lazzarini, and Simone Parizzi, "The Roman Ship 'punta Scifo d' and its Marble Cargo, Crotone, Italy)," *Journal of Archaeology*, 35, Issue 3, (August, 2016), 296.

[106] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 296.

[107] Beltrame, Lazzarini, and Parizzi, 296.

In these cases of site "contamination," the researchers must be very careful when attributing certain characteristics; for example, what was the vessel carrying in addition to the marble? Or if there is ballast present, which vessel did it belong to? In many cases the necessary ballast consisted of a biological material, which would not have survived to the present time unless in an incredibly anoxic, muddy environment. The cargo itself is quite impressive, lying in nearly the same way as it had been stowed onboard. In total the cargo consists of 54 blocks, and a variety of slabs, which could have been utilized for various construction purposes.[108] Documentation of these sites is seldom a simple task, as in the case of "Punta Scifo D," where the entirety of the cargo could not be included in the report. The portion in question was a grouping of four smaller blocks which laid near the shore.[109] In a later season, these blocks could not be located, which was put down to sand covering them, but it is also a possibility they were taken.

To understand the stone trade of this period researchers often compare the cargo's tonnage, number of blocks or elements present, the type of marble, and the proposed route taken. Nearly all the ships wrecked off the southern Peloponnese, Puglia, Calabria, and eastern Sicily, all roughly contain stone from the east.[110] Many wrecks were carrying blocks and slabs of Proconnesian marble, which was a very common and popular type of marble originating from modern day Turkey. The specific island it was quarried from is Marmara Adası,[111] very near to Constantanipole. In a study by Ben Russell, the wreck is part of a larger study group of shipwrecks; he cited another wreck in southern Italy, this one is located near to

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[108] Beltrame, Lazzarini, and Parizzi, 297.

[109] Beltrame, Lazzarini, and Parizzi, 297.

[110] Russell, "*Lapis Transmarinus*," 144.

[111] Which I initially confused with an area in the south east in the region of Mugla which is similarly named, Marmaris, north of Rhodes.

Capo Cimiti, which is just south of Punta Scifo D, in Calabria.[112] This vessel was carrying columns of Cipollino marble which comes from Greece. Other relevant shipwrecks found within this lane of trade between Calabria and Sicily, include Capo Granitola A, and D. These are located off the coast of Sicily and were carrying Proconnesian marble coincidentally. C. Granitola A was carrying a large cargo of around sixty blocks.[113]

Throughout much of this research a common issue has been highlighted quite frequently: the lack of proper descriptions, publications, and other relevant data. However, for the purposes of this study the focus will remain on well documented shipwrecks. The cargo of Punta Scifo D, and Capo Granitola A, which were both a majority Proconnesian marble, demonstrates that there was a thriving market for eastern marble. Though these are only two examples, the volume of their marble cargo speaks for itself. High levels of blocks and slabs which could be turned into marble veneer by trained professionals, and used in the construction of wealthy Roman homes, or state related buildings. The inability to say for certain who had requisitioned these cargoes of Proconnesian marble, is the reality of most shipwrecks. The final destination for these ships can be theorized, especially since they sank along a well-traveled corridor of trade. The cargoes of marble were very likely already paid for, but by whom shall remain a mystery. We would hypothesize the marble was purchased by a wealthy senator who wishes to display his good fortune, or perhaps a donation for the embellishment of a temple; but this is all speculation.

What would cause such vessels to be sunk so close to their theorized port of entry? Foul winds of the winter? A failure of the vessel's engineering if placed under

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[112] Ben Russell, "Roman and Late-antique Shipwrecks with Stone Cargoes: A New Inventory," *Journal of Roman Archaeology* 26, (2013), 333.

[113] Russell, "Roman and Late-antique Shipwrecks," 333.

extreme duress, such as during a storm? If the hull was compromised, then a storm would certainly lead to excess water being taken on, sinking the vessel. As there were only fragments of the vessel found up until this point, there is very little to reveal to researchers what could have caused the ship to sink. Because the marble cargo remained relatively organized, would lead us to suppose it was perhaps not a violent cause. The entire area of which the marble cargo spread over is 22 x 16 m, as the blocks would have shifted when the hull gave way.[114] The roughly forty-meter barge with a cargo of ~344 tons, much of which was marble, in theory was an older ship.[115] If the vessel was old, and had not been serviced for a considerable amount of time, then the wood could have become severely waterlogged, compromising its integrity. Such timbers being placed under the weight of shifting marble could sink the ship. Additionally, the sea around Crotone, Calabria is normally quite calm, reducing the likelihood of a freak storm event.

The conclusions made by the researchers were that at some point the ship struck a rock, which then allowed water to flow into the cargo hold creating an imbalance which sank the vessel.[116] They also surmised that it was bound for the western half of the Mediterranean. This shipwreck is one of the most impressive on record, as it boasts an enormous cargo of marble from the eastern Mediterranean. Though it is not a smaller scale trade vessel, it could perhaps have been interacting with multiple smaller depots along its trajectory. It can be neither confirmed nor denied at this stage without proper documentation from the period, or material evidence to suggest otherwise. There is little remaining of the gear that was once

[114] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 297.

[115] Beltrame, Lazzarini, and Parizzi, 311.

[116] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 315.

aboard this ship, especially nautical equipment.[117] We have very few references to the ships which were chartered for the vast amount of marble trade conducted during the Roman period. So, the most important pieces of data we can gather are those left by the people involved.

During their extensive research and exploration of possible reconstructions of the vessel Punta Scifo D, the team along with Carlo Beltrame, concluded that it must have been a barge.[118] This was after considering every possible variable that could be applied. They also concluded that this ship could not have been self-propelled as there was no leeway for the addition of a sail, its rigging, and the support-system necessary to host a mast. The theory is that one to two ships would have towed the barge from the eastern Mediterranean, along coastlines, as the barge was not built for open water. This endeavor would have been a long one, so perhaps there would have been depots of marble close by. Though they gave very robust reasons for their doubt regarding a sail and mast being present, it remains a small possibility, as there is almost nothing remaining of the actual hull. Admittedly however, their theory is the most logical and sound. Lightly laden ships towing other vessels would have been commonplace practice. Especially in the case of a ship which had lost its mast and rigging, or those which had none in the first place.

Towing barges was also suggested to be the method through which the many famous obelisks from Egypt arrived in Rome.[119] It would appear that amongst the shipbuilders of the ancient Mediterranean, their skills far out-performed the

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[117] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 314.

[118] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 318.

[119] Armin Wirsching, "How the obelisk reached Rome: Evidence of Roman Double-ships, *International Journal of Nautical Archaeology* 29, 2, (August, 2000), 273-83.

expectations of many scholars.[120] This was revealed after a discovery made by George Bass and his team.[121] As mentioned earlier, ship construction was done in the opposite fashion to that of more contemporary European shipbuilders, and more closely resembling eastern methods. The shipwrights of the Roman empire were fastidious in their craft, treating their ships as works of art, as testament to their great skill. These vessels were constructed from the outer hull of planks, inwards, with the supporting skeleton coming after. The ship's outer planking, or hull, was meticulously assembled using mortise-and-tenon joints, often very close together, adding superior strength.[122] This interlacing of the planks, with added dowels in each joint, made the ships extremely durable and flexible. Flexibility was paramount for any vessel venturing out into open water. The barge Punta Scifo D was constructed the same way.

Archaeologists are fortunate to have multiple surviving examples of this aforementioned shipbuilding technique which allows us to further understand the trade of marble across the eastern Mediterranean. Being able to physically examine key structural elements of these ships allows researchers to understand the strengths and weaknesses of this trade. The ships which hauled heavy loads of marble were, in all likelihood barges, which were towed to their destinations. In constrast, smaller, more manageable cargos of marble were stowed in the holds of sturdy, self-propelled vessels. Though it is entirely possible that when in transit across shorter distances, the marble was also placed in smaller barges. A blanket term used to describe barges of

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[120] Researchers have been able to place this method of ship construction as far back as the fourteenth century BC, through the wreck called Ulu Burun. This is described by Lionel Casson.

[121] Lionel Casson. *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times*, (Princeton, N.J.: Princeton University Press, New Jersey, 1991), 27.

[122] Casson, 28.

the Roman period was *schedia*, though it would seem this term was meant for larger barges.[123]

4.2 - Cargo

The cargo of the Punta Scifo D shipwreck is of an impressive ~344 tons, which only accounts for the stone which was being transported.[124] There is so little of the ship itself that it would be impossible to reach an accurate estimation. With so many variables, such as the biodegradable materials aboard, and potentially additional biological cargo, for both trade and consumption by the crew, an accurate estimate of the total weight of the ship is impossible. For these long voyages across the sea, they would have needed ample supplies to keep the crew fed, healthy, and happy. Between the loading and unloading of the cargo, especially in the case of marble, the employment of smaller harbor barges is a possibility if rivers were a part of the equation. When transporting the marble up or down a river, the use of a barge was normal as they were smaller and could be towed. Cargo had to be stowed masterfully to achieve a balanced vessel without listing or overloading the ship which would cause it to sit too low in the water. This is why the arrangement of marble cargoes is so intensively scrutinized, because even something so mundane may reveal information on the sailors and their expertise.

Even when the Roman sailors were taking into account the center of gravity, the Punta Scifo D wreck sank to the floor of the Mediterranean.[125] The cargo was arranged in a series of layers, where the largest blocks were logically placed first,

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[123] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 318.

[124] Beltrame, Lazzarini, and Parizzi, 295.

[125] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 315.

keeping the ship balanced; but perhaps with its heavy cargo, it sat low in the water. The smaller blocks and slabs were placed atop the heaviest, and in between others, like a giant jigsaw puzzle of Proconnesian marble. Unless evidence survives to our present day, we have no way of knowing if these sailors also packed the spaces in between and around the marble with some sort of cushion, as any cushioning would have been made of biodegradable material. The same can be said about the securing of the marble cargo to the vessel with ropes or netting to further prevent movement. Even something as flimsy as a net of thick cord could have added additional security. There was clearly damage to the roughed blocks during travel as evidenced by chips being found aboard other wrecks.[126] An example of this would be the Capo Granitola A shipwreck, which was also carrying Proconnesian marble.

To better categorize and connect these maritime sites and form a greater understanding of the trade, Beltrame divides known cargoes of wrecks into distinct categories: nearly finished architectural elements, raw blocks of marble, columns, and lastly sarcophagi. He has excluded more specific cargoes such as statues and sculptures, as these do not fit within his study.[127] He cites the shipwreck site of Capo Granitola D, as it fits into the first category he describes. Its cargo is composed of three Corinthian, two Ionic capitals, and eight column bases. All of these architectural elements have been dated to the end of the 2nd century AD based upon their style. [128] This cargo was likely only a portion of the marble which had been purchased for a larger project, though what kind of project specifically is more difficult to guess. Perhaps a specialist would be able to theorize based upon the styles and size of the elements. Whether the project was for a civic, private, imperial, or religious building,

[126] Russell, "*Lapis Transmarinus*, 146.

[127] Beltrame, "Four Shipwrecks," 439.

[128] Beltrame, 439.

it is lost to time. However, a comprehensive study could be conducted using the time period and style of the elements, comparing them with structures that have similar capitals and so on.

Cargo could be loaded directly from the quarries onto the awaiting ships with wooden cranes and winches. Alternatively, the vessels could arrive at a depository where large quantities of quarried blocks, slabs, or partially completed elements awaited their pickup. Though the Proconnesian marble which the Punta Scifo D ship carried could have been loaded at a depot, the stone was quarried along the sea. So, it very likely was loaded directly onto the anchored ship using a system of cranes and winches which were driven by a treadwheel through manpower. A hatch in the middle of the deck would have likely allowed for the crew and dock workers to safely load the marble into the cargo hold, stacking it as they went.

On the barge itself there would have likely been a system of winches and pulleys to allow further positioning of the marble onboard. Such a large cargo could have likely been used in some large construction project or sliced into smaller slabs for marble veneer. It has a beautiful patterning in some cases, so perhaps for veneer, or tiling. But this is all speculation, as any written orders which could have shed light on the purpose of the marble did not survive. Not only did each ship transporting stone need to correctly balance the marble horizontally, but also vertically.

Written records of this sort of request for marble are not incredibly numerous, but they do exist in limited forms. There are inscriptions which discuss the trade of marble, and those who were involved. The writings of famous historians also survive. However, these represent a small percentage of the actual trade transactions and records. This is why the investigation and recording of these shipwreck sites in their entirety is of great importance. If these sites are lost, we lose what little there is left of

these trade interactions. Certainly, there will continue to be new discoveries of wrecks which were a part of the marble trade, but there is a finite number which exist.

The scholar Ben Russell makes it clear that many shipwrecks which have larger cargoes of marble were part of the long-distance trade, rather than local.[129] The larger the cargo of eastern marble, the more likely it was being directly transported from the quarry. This is unlike cargoes which held larger varieties of marble, in veneer form. Hypothetically, a lack of shipwrecks carrying local stone would indicate a very high success rate of their transportation. Cargoes of foreign marble which sank in waters which the captains were less familiar with appear more common. However, there is virtually no way to determine where the captains originated, nor which areas they commonly traversed. The only real indicator we have of origins, and the possible destination of the ship, is its cargo.

4.3 - Location

The Mediterranean is host to an incredible number of Roman shipwrecks, many of which have likely never been discovered, and many which have yet to be surveyed. For the purposes of this study, the focus will be on those wrecks which are near to Sicily and Calabria. This stretch of sea was a key route for much of the trade which flowed to and from Rome, and to some extent Neapolis (Naples). Coastal shipwrecks are quite common as the ships could have run afoul during rough waters and storms. These vessels which carried heavy cargoes of marble seemingly encountered many dangers near the Crotone peninsula of Calabria. There are five wrecks which were surveyed by the Institute of Nautical Archaeology around 2005, each named for a particular spot where they sank. It should be mentioned that some of these wrecks had been previously investigated, but to a lesser extent, and a century

[129] Russell, "*Lapis Transmarinus*," 143.

earlier. Punta Scifo does offer a small haven from the rougher waters around its promontory. Its name does suggest possible dangers for sailors who are not paying close attention. The other primary escarpments which leant their names to the shipwrecks are Punta Cicala and Capo Colonna.

A majority of ancient shipwrecks have been found in shallow waters, until recent years with scuba and other technologies, some of which can map the seafloor, revealing abnormalities and shipwrecks.[130] Many of these previously discovered shipwreck sites were found in rivers and the harbors which they flow into, a large percentage of which were in the western Mediterranean as mentioned earlier. Deepwater wrecks represent a much greater range of challenges as their depth often creates additional logistical problems. In these cases, ROVs are invaluable to the surveying work, where it may not be safe or practical for scuba divers.

Many of the shipwrecks which were surveyed in the infancy of nautical archaeology deserve a revisit. Though early investigations paved the way for our modern methods and techniques, they simply lacked modern tools which both simplify surveying and allow for extremely detailed records. A very common problem with older records of archaeological investigation is a lack of publication which can stem from any number of reasons, or even the complete loss of this written research. Disasters occur and archives are lost. The important part of re-surveying sites is taking into account the possible contamination or destruction of a site after 60-100 years. These sites and locations do not exist in a pristine bubble, and archaeologists are well aware that their science is a destructive one. Scholars such as Pensabene and Orsi, and to a lesser extent the laymen who interacted with these sites, are our link to the past. These fishermen and scholars took notice of the significance of these underwater sites.

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[130] Michael L. Brennan, Robert D. Ballard, “Deepwater Ancient Shipwrecks of the Mediterranean, Aegea, and Black Seas: 1988-2012,” *Oceanography*, 26, (2013), 24.

4.4 - Case Studies

Punta Scifo D

The first case study that will be discussed is called Punta Scifo D (also known as #2), as it lies very close to the Bay of Scifo south of Crotone, in Calabria, Italy. This ship, very likely a barge, was transporting raw quarried marble, the vast majority of which is from western Asia Minor. The port from which it departed would have probably been on the Island of Marmara, where it then could have stopped in the ports of Ephesus and Miletus in Turkey, and possibly Piraeus, of Athens.[131] It is in fact one of the largest cargoes of white marble found to date. This specific maritime site and the marble was first discovered in 1908 and studied by the archaeologist Paolo Orsi. Much later, in 1986, the shipwreck itself was documented and reported by the diver Luigi Cantafora. In the following year of 1987, it would be surveyed and partially excavated by a private archaeology company, Aquarius, contracted by the *Soprintendenza Archaeologica della Calabria*.[132]

Unfortunately, the findings and data were never formally published by the company, adding to a commonplace issue in Roman shipwreck archaeology. The director of this project, A. Freschi, had been contracted by the *Soprintendenza* to produce a sketch of the marble, with the intention of dating it, in addition to the test excavation.[133] Information relayed to the *Soprintendenza* about the ceramics studied during the investigation suggested the vessel had been active during the first half of the Third century AD.[134] In addition to the ceramics, the company also recovered a

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[131] Beltrame, Lazzarini, and Parizzi "The Roman Ship," 295.

[132] Beltrame, "Four Shipwrecks," 440.

[133] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 296.

[134] Beltrame, "Four Shipwrecks," 441.

piece of timber, and some metal objects which were between the blocks of marble. There were additionally some pieces of ceramics which were from another shipwreck entirely, dated to the Hellenistic or Late Classical periods. In addition, a wooden anchor was found possessing lead inserts, which the researchers connected to the Greek site nearby.[135] The shipwreck was discovered at a depth of 6.5-7 meters, and 160 meters from the coast itself. The seabed upon which the shipwreck rests is partially covered in sand, meaning that any other archaeological evidence that may have been connected to the landscape is likely lost.[136]

The Ca'Foscari team of Venice oversaw the in-situ investigations of this maritime project and was directed by Carlo Beltrame.[137] The majority of this team conducted detailed photogrammetric 3D documentation, while Lorenzo Lazzarini used archaeometric analysis to document and identify the marble cargo.[138] Simone Parizzi, who is a naval engineer, was put in charge of analyzing the nautical aspects of Punta Scifo D, and its cargo. She was able to reconstruct the arrangement of the cargo before it sank, alongside the theoretical dimensions of the vessel. Finally, Parizzi calculated the weights of the different components, as well as the nautical and hydrostatic characteristics of the ship.[139] Those involved in the founding of the project decided that the methodology followed should be achieved through archaeometric analysis, as it was most appropriate for the range of goals. To properly analyze how the white marble found in the cargo was transported, this was also the best scientific approach.

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[135] Beltrame, Lazzarini, and Parizzi, "The Roman Ship," 296.

[136] Beltrame, Lazzarini, and Parizzi, 296.

[137] Beltrame, "Four Shipwrecks," 440.
[138] Beltrame, "Four Shipwrecks," 440.
[139] Beltrame, "Four Shipwrecks," 440.

More specifically, archaeometric analysis was the most straightforward, as identifying white marble through its visual appearance alone is not accurate. The sampling of the marble blocks had to be extremely systematically precise, allowing for a detailed analytical study of the wrecks cargo, which could then be published.[140] Another incredible detail about the survey of Punta Scifo D, was that the site was one of the first locations to ever be documented through 3D digital photogrammetry, using the Direct Survey Method (DSM).[141] As mentioned previously, Lazzarini is an expert in archaeological analysis of geological artifacts and data. He and his team were able to discover through rigorous archaeometric analysis that 54 of the blocks and slabs recorded originated from the *loci* of the *marmor proconnesium* quarries of the Marmara Island. The most significant part of the origins being pinpointed, is that the cargo was almost entirely from this island in Asia Minor. Only a few others were found to be from Mount Pentelicus, which is near to Athens, and a single piece from the Dokimean quarries close to Synnada, also in Asia Minor.[142]

The calculated weight of the cargo concluded by Parizzi was a massive, combined weight of 344 tons.[143] This is another reason why the vessel was probably a reinforced barge, propelled by a number of ships which would have towed it. Through the combined efforts of the Aquarius Company's investigation and the contemporary 2011-2013 investigations, the preserved piece of the ship's hull was determined to be a wooden wale. The preserved wale exhibits an extremely sturdy method of construction. A wale is a rigid component added to strengthen the hull of the vessel, a logical addition when carrying such a heavy and bulky cargo. The wales

[140] Beltrame, "Four Shipwrecks," 440.

[141] Beltrame, 441.

[142] Beltrame, 441.

[143] Beltrame, 441.

would have been joined to the hull of the ship through two rows of mortise and tenons, which can be seen on the wale. A further theoretical conclusion made was that it was constructed using planks that were twelve centimeters thick.[144]

Parizzi's proposed reconstruction of the Punta Scifo D shipwreck, which was already theorized to be a massive vessel, sheds new light on the transportation of marble, specifically Proconnesian. It would have likely been about 44 meters long,[145] 15 meters wide, and 4.4 meters high.[146] For the time, this would have been an incredibly impressive vessel to witness, and a catastrophic loss of a well-engineered merchant vessel. It should be mentioned that in the area of Punta Scifo there was also a Roman era harbor which was recently discovered, though the site of the harbor itself dates back to the Greek colony of Crotone.[147] Interestingly the harbor was theoretically constructed from necessity, when materials were imported to construct the temple complex which is located on Capo Colonna. This Roman harbor was probably where the Punta Scifo D ship was intending to dock or had been at rest there already. These harbor sites also contribute to the evidence of sea-level changes.

The scholar Dante Bartoli clarifies that the merchant vessel was on its way towards the infamous Strait of Messina, where ships from the east would travel to reach Rome and the rest of the western Mediterranean. He also offers some possible explanations as to why the ship had to be abandoned by its crew in the bay of Punta Scifo. The ship would have likely encountered a storm driven by winds from the east,

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[144] Beltrame, "Four Shipwrecks," 441.

[145] For reference, compared to another shipwreck from a more recent period, the Mary Rose ship is estimated to be around the same length. This ship carrack ship was launched in 1511 AD and was in the navy of King Henry VIII. Nearly 1300 years after Punta Scifo D sank off the coastline of Calabria. A further example of its size, would be to compare its length to the height of the Colosseo in Rome, being about three meters shorter.

[146] Beltrame, "Four Shipwrecks," 453.

[147] Jeffrey G. Royal, "Discovery of Ancient Harbor Structures in Calabria, Italy, and Implications for the Interpretation of Nearby Sites," *The International Journal of Nautical Archaeology*, 37, 1, (March, 2008), 60.

he refers to these storms as either Grecale or Levante. The crew would have sought shelter in the bay, only to have the prevailing wind shift to the south, wrecking their ship in unsheltered waters. [148]

Capo Granitola A

The second case study is a shipwreck named Capo Granitola A, which sank 120 meters from the southwestern coastline of Sicily, with its namesake Capo Granitola being the nearest landmark. Other nearby locations of significance are the commune of Mazara del Vallo, and Torretta Granitola, a small village which takes its name from a tower which dominates the landscape.[149] Mazara is host to a significant regional port, which also lies on the River Mazaro, lending even greater importance to the city as it allowed for access to inland Sicily. The third century shipwreck came to rest on a sandy bottom, which also has aquatic plant life growing in the area. It should be noted that the Ca' Foscari team found that the sand is a new addition to the landscape, and the ship would have hit rocky bottom. Significantly the ship sank in only 2 meters of water, and was first recorded discovered in 1976 by Pietro Compagno, and published initially by G. Purpura.[150] The estimated dating of the shipwreck was based upon the findings of ceramics associated with the vessel, namely the neck of an amphora classified as Kapitaen II. Nearby the wreck there was also found a partially intact Roman sword still in its wooden sheath.[151]

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[148] Bartoli, "Marble Transport in the Time of the Severans," 2009, 2-3.

[149] Beltrame, "Four Shipwrecks," 447.

[150] Beltrame, "Four Shipwrecks," 447.

[151] Sebastian Tusa, "Ancient lithic naval cargos around Sicily," *Interdisciplinary studies on ancient stone: ASMOSIA X: proceedings of the tenth International Conference of ASMOSIA, Association for the Study of Marble & Other Stones in Antiquity, Rome, 21-26 May 2012*, edited by Patrizio Pensabene and Eleonora Gasparini, (Rome, Italy: L'Erma di Bretschneider, 2015), 837.

Nearly twenty years later a second survey was conducted by the Poseidon diving company in the 1990's, where their team created a plan of the area which included measurements of the blocks found on site.[152] There are a total of 54 semi-completed blocks of Proconnesian marble. The team described the cargoes' assembly as being significantly coherent, still laying in a total of eight aligned rows, with some overlapping, presumably from how the ship settled. The total occupied area of the cargo is an impressive 20x15 meters. It appears that the ship's hull impacted something with great force, fracturing the majority of the longer marble blocks. The longest of these fractured blocks is comprised now by four separate pieces, weighing in total 7.6 tons, and measuring 507 cm long, 75 cm wide, and 76 cm high.[153] The heaviest block in this cargo, #10, weighs an impressive 12.6 tons. These calculations were completed using the following system: the sizes were found using centimeters and cubic meters, while weight was calculated using tonnes on the specific weight of 2.62.[154] The final calculations of the cargoes approximate weight is 155 tons, about half that of Punta Scifo D, though still an impressive amount.

The marble samples extracted by means of hammer and chisel by the Ca' Foscari team, were then analyzed by T. Percic and L. Lazzarini. They were working at the Laboratory for the Analysis of Ancient Materials of the University Iuav of Venice.[155] Amongst the cargo of Capo Granitola A there are a number of blocks missing from the site. This type of data often allows the researchers to more accurately place where the marble originated, particularly from which quarries. Another detail

[152] Beltrame, "Four Shipwrecks," 447.

[153] Beltrame, 447.

[154] Beltrame, "Four Shipwrecks," 452-3.

[155] Carlo Beltrame, Thalia Percic, Lorenzo Lazzarini, "The archaeometric identification of the marbles of the Roman shipwrecks of Capo Granitola (TP), Isola delle Correnti and Marzamemi I (SR)," *Journal of Archaeological Science: Reports*, 23, (2019), 953, 955.

which is often missing from Roman Period marble cargoes, are the lead seals which would accompany the blocks in most cases. These seals would have denoted whether they came from private or imperially owned quarries.

An important aspect of these landscapes is the lack of permanent sediments which would have provided the potential for preservation of the shipwrecks themselves, and any items connected to them. The only stone elements that could possibly be removed from the ships by divers would be smaller, thin veneers, if there were any present. Larger marble cargo items would have needed larger operations to loot. There is an unfortunate lack of remaining hull or dateable items, such as ceramics which offer diagnostic evidence allowing researchers to draw further conclusions about the time period of operation. The lack of sand surrounding the shipwrecks prevented the conservation of the site at a diagnostic level.[156] For example, an ancient Roman harbor built on a river's delta often creates the perfect environment for incredible levels of material conservation.

The Ca' Foscari University was also involved in the surveying and excavation as mentioned before. They discovered that amongst the cargo of marble blocks are a scattering of chunks, or 'pebbles' which were interpreted in three different ways, the first being possible remnants from previous shipments of marble, those being Proconnesian and Pentelic, which two samples revealed after analysis. The second possibility for these pebbles is just as interesting, which is the presence of ballast. This would suggest that marble quarry waste was reused for the ballast of ships. Their third idea, which was not favored, is that the fragments came from very thin slabs of marble.[157] There were also two blocks, numbers 50 and 59, which have steps carved into one of the sides. Another few pieces of the marble are molded elements;

[156] Beltrame, "Four Shipwrecks," 457.

[157] Beltrame, 448.

specifically, they have been shaped into *podia*, or bases for columns.[158] Though these molded pieces of marble create an exception amidst the normally homogenous cargoes, it also speaks to the fact that there will always be nuances that must be observed. Assumptions and standards can provide a useful base from which to proceed, but there will always be unique deviations in archaeology.

The 3D reconstructions of the ships surveyed and excavated by the Ca' Foscari University's team were achieved using naval engineering software, and the expertise of scholars such as Parizzi. Through this process the team was able to create proposals of the minimum sizes for these vessels. The proposed dimensions of the Capo Granitola A shipwreck are: 33 meters long, 10.5 meters wide, and 3 meters high.[159] These reconstructions are an important step in the progress of better understanding the marble trade during the Roman Period, and the ships which made it possible.

The proposed destination of the Capo Granitola A shipwreck was the large harbor of Portus, capable of accepting such a large vessel and its cargo. This hypothesis suggests that the ship's cargo was meant to be temporarily stored there, where it would then be transported by another ship to its final destination(s). Whether the destination was Rome, or any number of cities throughout the south of Italy, cannot be determined.[160]

It was hypothesized that since the cargoes of both Capo Granitola A and Punta Scifo D were positioned in the center mass of the ships, which seems to be common practice when transporting marble, that the excess space would have been filled with other materials. These materials, as they are no longer present, were likely some form

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[158] Beltrame, 448.

[159] Beltrame, "Four Shipwrecks," 450, 453.

[160] Beltrame, 457-9.

of biodegradable goods. Beltrame and the Ca' Foscari teams referenced the writings of Plinius, which speak of lentils filling the ballast space when the Romans transported the obelisk from Egypt.[161] They also made hypotheses about the intended use for certain pieces from the cargoes. The general thought was that these ships were transporting Proconnesian marble destined for large public buildings. A piece from Capo Granitola A was identified as either the base or architrave due to its length and width.[162]

[161] Beltrame, 455.

[162] Beltrame, "Four Shipwrecks," 455.

Chapter 5: Challenges and breakthroughs in shipwreck cargo reassembly

5.1 - Obstacles within maritime archaeology

Some of the most common obstacles within the field of maritime archaeology, are what would be expected: time, money, resources, the environment, and bureaucracy are all factors which must be evaluated and prepared for before every season of excavation and surveying can begin. It is an expensive field of archaeology, as there needs to be a ship or boat chartered for the project normally, which needs an additional crew. Employing a staff of students to assist in the surveying and excavation of maritime sites both saves money and teaches them vital skills within this niche profession. Time is of the essence during all forms of archaeological excavation, whether the site is in danger of being lost, or if the time of year drastically affects the opportunity to survey or excavate. The region could experience extreme heat during the summer months, or heavy snow and freezing temperatures in the winter. The months within which an underwater survey can be conducted are most definitely limited, as the seas can become extremely rough in the winter months.

Many of these same obstacles, especially during the winter months, were factors which barred Roman sailors from transporting goods or passengers overseas. In a great many cases, winter conditions prevent or severely limit archaeological exploration in the Mediterranean Sea. Marine archaeologists must also fully understand the environment which they survey, for example, many of the shipwrecks surveyed by the Routes of Antique Marble project are situated on bedrock.[163] The landscape has been covered by temporary sand and maritime flora, but this would indicate that the majority of items once onboard the vessels are now gone, carried away by the sea.

[163] Beltrame, Lazzarini, and Parizzi, “The Roman Ship,” 296.

5.2 - Theoretical Reassembly and Cargo Analysis

The process of theoretically reassembling a vessel along with the positioning of its cargo is still a developing science. It is greatly furthered by modern technology and new computer programs which have been developed in recent years. During the project, which was called "The Routes of Antique Marble," spearheaded by Carlo Beltrame and the Ca' Foscari University of Venice, a number of shipwrecks were surveyed off the coasts of Sicily and Calabria.[164] These surveys and excavations were a collaborative effort between a number of scholars, institutions, and students. The naval engineer, Simone Parrizzi, utilized the data from the 3D photogrammetry, and the direct survey methods used to create proposed reconstructions of both the vessels and their cargoes. Her method of reconstruction for the vessels utilized a minimum baseline of measurements.[165] This process was limited due to the lack of surviving hull. Her reconstructions of the cargoes prior to the sinking of the vessels are also an incredible step towards the theoretical understanding of the Roman marble trade during its peak.

The Direct Survey Method employed measured the sites using a net of control points.[166] This in turn allowed for a comparative study of the situation on site now versus in previous studies. While they used the automatic photogrammetry, it was important that they remained parallel to the bottom and maintained their depth while surveying. Otherwise, the data could become skewed by any large variations in these measurements. The survey teams also took extremely well documented samples from the marble cargoes, later analyzed by the specialists who collaborated with their project. They utilized a method of X-ray diffraction (XRD) to analyze powdered

[164] Beltrame, "Four Shipwrecks," 440.
[165] Beltrame, "Four Shipwrecks," 440.
[166] Beltrame, "Four Shipwrecks," 441.

samples of the marble.[167] A further method was employed, in which thinly sliced samples of the marble are observed under optical microscopes and assisted by polarizing light. This process of identifying the exact mineral compositions of the white marble is essential to narrowing the possible origins.

[167] Carlo Beltrame, "The marble routes: Capo Taormina shipwreck project – 2017," Honor Frost Foundation, 2017, https://honorfrostfoundation.org/2019/09/24/the-marble-routes-capo-taormina-shipwreck-project/.

Chapter 6: Marble and stone sourcing, and the demand through time

6.1 - Forms of transported stone

Marble was transported in nearly every stage of completion in the time between the first and third centuries. Most commonly it was split into large blocks or slabs; sometimes the faces were dressed, and the edges rounded slightly to reduce chipping. Sharp edges on materials such as stone and wood drastically increase the chances of damage, though in these rough stages it would be less important. The styles of finishing a piece certainly would have had some level of standardization, but every artisan would implement their own signature variations on each. For example, artisans from Corinth would carve their stone differently from those found in Ostia. To circumvent predetermined styles, the clients could ship an example of the elements in the style, and measurements with which they needed to the quarry.

Merchants carried blocks, slabs, thin veneers, capitals, drums, bases, basins, sarcophagi, sculptures, and so on. There was an agreement beforehand on how the marble would be transported and finished or unfinished to the preference. In many cases, the stonemasons of the quarry could have finished the marble to a larger degree to reduce the required time to complete upon arrival. There is such a high level of variability in the tonnage of marble being transported in this period of Roman trade, with barges being able to carry huge quantities of stone, and smaller ships able to carry still quite substantial loads. The blocks of marble were the most common form of transportation, maximizing the cargo space through careful planning.

In a study conducted by Carlo Beltrame and Valeria Vittorio, the two scholars seek to compare a large number of shipwrecks carrying marble to determine whether

there is an underlying uniqueness to these vessels, aside from transporting marble.[168] On average the ships they studied were sunk between the 1st and 4th centuries AD, being well-suited to the aims of this study.

6.2 - Quarries and craftsmanship

As mentioned previously, Corinthia was a relative powerhouse of trade during the Roman Imperial period, possessing both marble quarries and the capability of easily transporting processed marble. Though the data covered in Hayward's article is now twenty years old,[169] the framework is still valid and useful to this research. There have been more recent, comprehensive studies of quarries throughout Greece, which can likely complement the research conducted by Hayward. As the demand for foreign marble increased over the centuries of Roman Imperial rule, the deposits which Corinth possessed became their major commodity. It allowed for the once declining region to find their place in the empire, both as a local, and international port, exporting marble from local quarries to other nearby regions, and to Rome. Hayward discusses the strengths Corinthia possesses geologically, and geographically. It was well suited for stone-extraction, the transportation of said stone, and for wider export to the west.[170]

The stone extracting industry in Corinthia was a major keystone, with large numbers of quarries being documented even twenty years ago as referenced by Hayward. The scale of this quarrying varied over time, with a serious increase in production during the Roman Imperial Period, perhaps with a peak in the second and

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[168] Nergis Günsenin, ed., *Between Continents: Proceedings of the Twelfth Symposium on Boat and Ship Archaeology, Istanbul 2009*, (Istanbul, Turkey: Ege Yayınları, 2012), 141-48.

[169] Chris L. Hayward "Geology of Corinth: Study of a Basic Resource,"*The American School of Classical Studies at Athens*, *Corinth*, Vol. 20, Corinth, The Centenary: 1896-1996 (2003), 15-42.

[170] Hayward, "Geology of Corinth," 15.

third centuries AD. This would be supported by the high numbers of shipwrecks which were enroute to Rome. This data was compiled in a separate study by Ben Russell.[171] Hayward describes Corinthian quarries as being relatively unstudied. But in the twenty years since this article was published, this has undoubtedly been remedied to some degree. However, as it was discussed in this article, the geology of the eastern Mediterranean is quite a challenging subject, with the constant seismic activity throughout.[172] Even the Gulf of Corinth, the very thing that made it important to Roman trade, was created by plate subduction[173] beneath the Peloponnese.

Corinth is a great example for localized quarrying and use of stone for local construction as well as for Rome, later on. The local use and trade was very high, as even twenty years ago they had firmly established 130 ancient quarry sites throughout the region.[174] Their estimation of extracted stone came to three-million cubic meters.[175] This number truly plays into the narrative created by Pliny the Elder, of moving literal mountains of stone, which he lamented as a violation of nature.[176] His lamentations aside, this local production in a single region is incredible. This industry was evidently very well developed and organized. In this region they were extracting the stone in two styles the majority of the time, which were the pit/trench method and by block. Much of the stone being used locally was oolitic limestone, being preferred for construction. Oolitic limestone commonly forms into dunes during its formation,

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[171] Russell, "*Lapis Transmarinus*," 137–52.

[172] Hayward, "Geology of Corinth," 16.

[173] Plate Subduction is the process where two tectonic plates meet, and one plate moves beneath the other due to gravity and density differences. This can cause earthquakes, and tremors, which could no doubt affect ancient quarry sites.

[174] Hayward, "Geology of Corinth," 18.

[175] Hayward, "Geology of Corinth," 18.

[176] Russell, "*Lapis Transmarinus*," 139.

which then usually presents as an easy to follow outcropping of rock.[177] This made it easily accessible and exploitable by quarry workers. There are some well-known Roman quarries located on Temple Hill and in a gully near the Potter's Quarter of Corinth.[178]

A form of stone which this writer mentioned before, called "*poros*" is actually a term up for debate. This stems from the issue that it is a term used to describe different types of stone depending on the region. It is no surprise that this causes confusion and problems when trying to catalog types of stone being quarried or transported, or even used in construction. The term has in fact caused confusion within this writer's research. Hayward prompted that the term be discontinued, and I must agree. But for the sake of the Corinthian stone trade, they commonly referred to the aforementioned oolitic limestone as *poros*, in fact becoming synonymous[179]. The issue is that I have also seen *poros* being used to refer to sandstone, which is completely different from limestone, silicate versus calcitic stone in this case. Even though Pliny the Elder was not entirely for the quarrying of stone on a massive scale, he did record details about the production. Hayward references Pliny in this case, speaking about stone cutting.

Pliny states that quarrying was mostly a seasonal profession, being conducted in the summer months the majority of the time.[180] "When the nature of stone is doubtful, the proper precaution is to quarry it in summer, and not to use it for building before the end of a couple of years, leaving it in the meantime to be well seasoned by

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[177] Russell, "*Lapis Transmarinus*," 139.

[178] Hayward, "Geology of Corinth," 21.

[179] Hayward, "Geology of Corinth," 32.

[180] Pliny the Elder, *The Natural History,* ed. John Bostock and H. T. Riley (Taylor and Francis, 1855), 36.50.

the weather."[181] While some archaeologists and historians support the idea that these so-called "curing yards" once existed, there has yet to be found any physical evidence which would lend credence. This concept remains as ephemeral as the words of Pliny, probably due to the difficult, or perhaps impossible, task of differentiating a 'curing yard' from abandoned blocks of marble. Within these yards the quarry workers would have placed any material which was of questionable integrity, so that they could determine the stones' viability before shipping the product to their customers. Unfortunately, this theory has a distinct lack of ancient supporting sources, specifically from Greece.

In another article by Hayward and a colleague, Robert Pitt, they researched a series of inscriptions left by workers in limestone quarries.[182] These quarries were in Kenchreai, which was another supporting port of Corinth, on the south side of the thin strip of land. This research is important to the exploration of hidden Roman lives, of the workers that enabled this Roman obsession with eastern marble. These were people who left little to no trace in the historical record, so finding their signatures still preserved is phenomenal. Additionally, these inscriptions are local examples of who these workers were, and how they functioned as a part of the stone trade. Historically, miners and quarry workers are voiceless, and marginalized groups of people, in this case being slaves or freedmen.

How do we know these workers were slaves or freedmen? It is not certain, but generally names of slaves can be discerned from others. One of the names inscribed on dressed stone was Nymphas, this name is commonly associated with freedmen.[183]

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[181] Pliny the Elder, *The Natural History*, 36.50.

[182] Chris Hayward and Robert K. Pitt, "Inscriptions from Limestone Quarries at Kenchreai, Greece," *Zeitschrift für Papyrologie und Epigraphik* (2017), 89-96.

[183] Hayward and Pitt, "Inscriptions from Limestone Quarries," 91.

They signed their name and stated that they had completed their work. The roughly seven signatures do not offer enough information to date the work beyond the first or second centuries AD. This would correlate quite well with the peak of Roman obsession with foreign marble, and the use of slave labor during the period checks out as well.[184] The Roman quarry workers would likely have been a majority slaves, but prior to the internationalization of white marble trade, the workers could have been locals instead. Especially in Greece, there was a void left in many of these rural quarry locations, as the localized governments and economies were subverted by the Roman one.

One aspect of coastal quarrying which has not been discussed yet, is how rising sea levels affected the Roman's ability to continue their operations, or if the rising sea levels were even noticed during their time, as this process was very likely a slow one. However, in the Mediterranean, specifically the Aegean, there are to this day extreme levels of tectonic activity. This activity has been linked to the raising or lowering of some of these coastal marble quarry sites, with a specific example being on the island of Crete. These seismic events caused significant movement along the coastlines of Crete.[185] Entire sections of these quarries were both raised or lowered, being significant examples of how the environment plays a huge role in stratigraphy and archaeological investigation as a whole.

The functional height of the Roman quarry's floor which sank likely due to these tectonic shifts, and rising sea levels, was approximately 0.60 meters (nearly 2 feet) above sea level. For accessibility and safety this would have been perfect, especially as this gave ease of access to ships and barges being loaded from the quarry

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[184] Hayward and Pitt. "Inscriptions from Limestone Quarries," 95.

[185] Eleni Tziligkaki, "Quarrying the Coasts of Crete in Antiquity; Some Geoarchaeological Considerations," *Bulletin of the Geological Society of Greece*, vol. 53, 2018 (Proceedings of an International Conference held on Melos Island in 2014) 230-31.

site. Slipways could have been constructed or carved from the stone.[186] These sites which now exist below the water, very likely are stripped of their soil and other archaeological elements such as pottery, with the opposite being the case for the sections which were elevated further during these events. Eleni K. Tziligkaki points out that the accuracy with which these coastal sites can be excavated is difficult and not extremely accurate.[187]

These slipway sites have been exposed to extreme erosion over time, leaving many of them devoid of preserved soil layers, pottery sherds, and material evidence of the mining. Diagnostic evidence is paramount to the archaeological process, though unfortunately these ancient sites are left with very few. However, some aspects of these sites remain to this day. In the past they have been misinterpreted by some rather prominent archaeologists, specifically Sir A. Evans.[188] In more recent years archaeologists have sought out these same marks, which have been connected to aspects of the quarrying: wedge marks from where the workers were splitting the stone, holes left by crane supports made of wood, and even drilling marks. These scars on the stone quarries and the surrounding landscape are the links archaeologists have to this time in the past, the keys to understanding the landscape and the theorized frame of time within which the marble quarries were operated.

Though these holes left in the stone are not extremely diagnostic, for the sites without in situ soil layers and artifacts, the holes are invaluable to the understanding of how and when they were active.[189] Not only this, but they give insights into the engineering, mining, and construction techniques employed during the Roman

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[186] Tziligkaki, "Quarrying the Coasts of Crete," 235.

[187] Tziligkaki, "Quarrying the Coasts of Crete," 236.

[188] Tziligkaki, "Quarrying the Coasts of Crete," 230-31.

[189] Tziligkaki, "Quarrying the Coasts of Crete," 236.

Imperial Period. If the marble which sank aboard a vessel had not been completely dressed before shipment, then it is possible that tool marks left from the wedges could still be present. This type of material evidence could theoretically help researchers trace the marble's provenance to another degree, in addition to the analysis of the stone's mineral composition.

The article written by Tziligkaki makes the point that using modern quarries as possible indicators for ancient ones is a viable technique that researchers may employ. Their example is as follows: a modern quarry operation which contains gray marble in the site of Dichali, has over time destroyed the ancient phases of quarrying due to continual usage.[190] If marble quarries have been used continuously from antiquity or at any point after the Roman period, then material evidence and tool marks left by these ancient workers has since been obliterated and contaminated. However, there still remains the possibility of sections from the ancient phases existing to this day, even if miniscule. These remainders, if found, would still offer greater insight towards an understanding of the quarry usage phases. On northern Crete (and elsewhere) there is evidence left over from the circular wedges used by quarry workers to split the stone, likely also using a sort of feathering technique. This technique of feathering is still used today, where the feathers (made of wood, iron or bronze perhaps) are inserted along with the wedge in lines. Then the workers would slowly feather their way down the line of wedges until they got a clean break. There is also evidence these wooden tools were reinforced with metal. In this region, in the Medieval period these tools were referred to as "*tsokos*."[191]

Various types of marble were used on Crete, which included forms of white, red, black, white with black veins and gray with white veins. White marble is of course

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[190] Tziligkaki, "Quarrying the Coasts of Crete," 236-37.

[191] Tziligkaki, "Quarrying the Coasts of Crete," 243.

the most commonly used marble, but polychrome marbles were extensively used.[192] Crete has gray marble deposits which have been quarried near Haghios Kyrillos. One quarry has been in operation since antiquity, which means that the majority of evidence from that time is likely all gone. Sometimes this marble is called *Phaistos marble*, or *marmo Gortinio*, which was suggested by Lazzarini (2002).[193] Through testing they found that many of the marbles found on Crete are much more fragile compared to other Aegean marble varieties, which makes it less suitable for architectural use, as it is often a load bearing material. This fragility would also make it more difficult to carve in all probability.[194] There is an instance of Roman period quarrying at Istron, Crete, though the area is heavily disturbed. As evidenced by many of these Cretan and more widely Aegean quarries, a great majority of them were coastal. It is by no means an absolute, as there are many exceptions, but quarries with water access had a significant advantage. Their heavy cargo could be placed with precision into the holds of ships by using cranes and winches.[195] The scholars involved with this project also re-interpreted the larger round and square holes associated with the marble quarries on Crete. The larger round holes were likely made to insert timber poles to support the lowering of quarried material in a more controlled manner, while the square holes were cut for the wooden supports of the cranes,[196] also referred to as treadwheel cranes, and *polyspastos* by the Romans.

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[192] Tziligkaki, "Quarrying the Coasts of Crete," 243-44.

[193] Tziligkaki, "Quarrying the Coasts of Crete," 244.

[194] Tziligkaki, "Quarrying the Coasts of Crete,", 244.

[195] Tziligkaki, "Quarrying the Coasts of Crete," 246.

[196] Tziligkaki, "Quarrying the Coasts of Crete," 246-47.

The continual work of Professor Ben Russell in this field of Roman stone trade is incredibly helpful and insightful. In his work titles "*Lapis Transmarinus,"*[197] he states that before the twentieth century, the amounts of marble quarried during the Roman Imperial period had never been overtaken. This alone speaks volumes to the level of Roman obsession with the highly prized and polishable material that shone like the waves of the sea across which most was carried. Though the Greeks properly introduced Romans to the wonders of this stone, the Romans took it to incredible levels of use, so much so that it inspired poets, playwrights, and historians to write about it. However, they did not write about it in a positive light, as Pliny the Elder was rather against the idea of leveling or maiming the mountains or, "boundaries of nations"[198] as he put it. However, the only thing that was dramatically shifting during this time period was the levels of stone exploitation. The utilization of local stone has been commonplace practice for larger scale construction, as long as it was plentiful nearby. It would appear that Pliny viewed this importation of foreign marble as a vulgarity.

In this period of great change under the Roman empire, a preference for foreign marble and stone rose considerably amongst the elite, more specifically the Imperial administration. Pliny spoke many times of a praetorian named Marcus Scaurus, who he viewed in a poor light: "...the largest of those columns, which were each fully 38(11.5m) feet long and of Lucullan[199] marble…,"[200] The columns were then placed in the hall of Scaurus. This struck a nerve with Pliny, as he found it to be an action which should be outlawed by the state. So, would there have been more widespread

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[197] Russell, "*Lapis Transmarinus*," 137–52.

[198] Pliny, *Natural History*, 36.2.

[199] Lucullan is a term of Latin origin, which means lavish, luxurious, or sumptuous.

[200] Pliny, *Natural History*, 36.6.

opposition amongst the people towards foreign marble being imported? It would be logical for there to have been at least a minority who were against this marble trade, as in contrast to a plentiful number of Romans who were eager to expand this marble trade. The demand for local stone was likely always still present, but overshadowed by the more expensive market of colored, high-quality stone from the eastern Mediterranean. Russell states that imported marble became the symbol of Roman Imperial power in later centuries.

An example of this combined use of local stone and foreign marble is the villa of Emperor Hadrian, in modern Tivoli (*Tibur*). There was significant use of local construction supplies in the form of tufa and travertine. But like many structures which utilized eastern marbles, these more beautified stones were used to accent and often placed as a veneer on top of other materials. During construction the local materials of pozzolana and lime were used for cement production. The majority of the remaining structures on the World Heritage site were robbed of these once resplendent marbles, leaving only skeletons of brick, tufa, and cement.

Much of the stone imported to Italy during the Imperial period was reused locally, or turned into quicklime, as was the fate of so much marble, the symbol of Roman imperial power. It is ironic that this highly prized stone would be turned into mortar. But the reason for mentioning the villa beyond what was already said, is that Hadrian wished to demonstrate the many aspects of the empire. One of those aspects was the prominent use of stone, especially from the east. Another great example used by Russell was a man named Sestus Julius Aquila in central Germania Superior.[201] Sestus requested the importation of *lapis transmarinus* from Luna (Carrara), for his tomb. The stone alone would have been an investment, but the overland transport of such a material would be exorbitantly expensive. The utilization of rivers for transport

[201] Russell, "*Lapis Transmarinus*," 139.

would have likely been used as much as possible. Returning to the matter of quarrying, Luna marble was the most regularly chosen marble for construction in Rome as it was a short distance from the city. The convenience of the marble deposits, and quality, made it quite popular, especially in the first century AD.

In the second century AD, Rome had radically escalated the import of foreign extracted marble, from places such as Thasos and Prokonnesos. One factor which likely played a role in the marble trade, which has not been mentioned as of yet, were the many banks of the Mediterranean. There would have been banks of varying success throughout the many regions of the Roman Empire. These banks would have operated much like the one which Lionel Casson describes in 4th century BC Athens.[202] The banks ensured the ability to essentially make long distance transfers through contacts and offices in other cities and ports, which was done through means of debiting the bank's account.

This meant that no large amounts of money needed to be transported over the treacherous waters of the sea. It also eased the request and transfer of goods between the producer and clients. For example, a wealthy Roman senator in Iberia (Spain) wishes to purchase Proconnesian marble from the eastern Mediterranean. They contact the quarry, or their intermediary, and a deal is struck. The money is then debited to the bank of that region in the east, and the marble will be shipped overseas to the senator, where the awaiting craftsmen will begin their processing of the marble. The marble could be in any range of form from dressed blocks straight from the quarry, or partially roughed designs.[203]

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[202] Lionel Casson, *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times*, (Princeton, N.J.: Princeton University Press, 2020), 97-99.

[203] This example has no historical reference, it was created simply to demonstrate the process.

The Island of Marmara in Turkey, and its famous quarries of Saraylar were ideally located, and produced a desirable marble.[204] The marble produced was referred to as *Marmor proconnesium*, which is a type of white marble that normally possesses a blue-gray veining making it preferable for architectural design. These quarries, which were both privately and imperially owned and operated, saw great success during the Roman Period, in large part due to their immediate access to the harbor.[205] Marmor proconnesium was used in many contexts and periods before, during and after the Roman Period, but especially in architectural elements. It was very common for slabs of the marble to be cut and polished for veneer and pavement, but there are also many examples of sarcophagi being carved from it. This affordable eastern marble would quickly become a favorite amidst the Roman market.

Eventually it would even outpace the widely popular *Marmor lunense* from Carrara. Though during the Antonian (138-193 AD) and Severan (193-235 AD) dynasties this white marble from Turkey would reach the peak of its trade and popularity, within the Roman Period. However, this affordably traded marble would reach Italy in the Flavian Period (69-96 AD) but was limited to regions outside of Rome. It would permeate this market bubble around Rome during the Trajan Period (98-117 AD), where it grew rapidly in popularity.[206] The scholar Beltrame refers to this marble from Asia Minor as a material of great renewal for the state of Rome, in both its western and eastern regions. It saw extensive use in Roman civic monuments such as the prominent Arch of Septimius Severus, and the Baths of Caracalla.[207]

6.3 - Peaks and transitions within the trade

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[204] Beltrame, “Four Shipwrecks,” 437.
[205] Beltrame, “Four Shipwrecks,” 437.

[206] Beltrame, “Four Shipwrecks,” 437.

[207] Beltrame, 438.

The marble trade of the eastern Mediterranean was largely localized before the great surge in Roman obsession over polychrome stone from across the empire. Though Greece and Turkey offered some of the most prized, high-quality marble, before the Romans sought out and discovered their own deposits of marble, such as Luna. The transition from earlier construction methods for important civic and religious structures, which once used mudbrick, terracotta and wood, to marble, did not happen overnight. The Romans were enamored with the status and beauty which was awarded to marble in the eastern Mediterranean. This is partially how it would not only become one of their most expensive and traded materials, but also a personal, and imperial symbol of power. A marble trade may have been the most offensive trade to some Romans, as it represented the perversion of nature, and of an overvaluation of personal wealth. Though it was not frowned upon for Roman citizens to be wealthy, it was perhaps the action of displaying one's affluence through imported, expensive marble in many colors and forms.

The importance of great monuments constructed of this beautiful, yet difficult to transport material was elevated by some of the earliest leaders, such as Augustus. As mentioned previously, the great obelisks of Egypt, the once powerful kingdom now a Roman territory, were brought to Rome purportedly upon barges. However, the exact method by which these barges sailed is debated. There is great debate upon whether they were towed or traveled swiftly by their own sails. The transportation of the obelisks to Rome was an incredible feat. The transfer of these massive obelisks represented the union of Egyptian tradition, power, elegance, and their subjugation to the Roman Empire.

There should not be a misconception that the Romans revolutionized the use of *marmor*. Yes, they revolutionized its trade, and distribution. But marble[208] was utilized and quarried from the earth long before the Romans rose to power in the Mediterranean. Marble was a piece of the puzzle in Rome's ultimate rise to a level of decadence and frivolity in some ways. This is not to say that their quest for beauty and elegance to fill their cities and homes was wrong, but that their economy had largely become one of import, rather than export. They imported literal mountains of marble to their cities throughout their long imperial history. In fact, this trend continued in the east after the western empire collapsed. The famous Proconnesian marble was a local, and prized stone in Byzantium, also known as Constantinople. Of course, Luna marble was quarried not far from Rome and was widely prized for its beauty. But the Roman taste for foreign marble was insatiable. There is a general misconception that Roman cities were filled with stark white marbles, when in reality much of this white marble was covered in polychrome paints. This represented their quest for beauty and grandeur.

The marble trade was never one of necessity, though it certainly bolstered the economies of regions in the empire which had fewer forms of production. Unlike olive oil, salt, grain, legumes, dried foods, livestock, and wine, marble was a luxury good. The many merchantmen of the Roman world hailed from a variety of nationalities, including Greeks, Syrians, and Phoenicians,[209] all of whom were well known for their sailing abilities, and trade networks. There are many shipwrecks around Sicily, Calabria, and Croatia, which have been dated between the second and fourth centuries AD, and they were carrying cargoes of marble. The focus of this study is the trade of marble in the eastern half of the Mediterranean. The seas around Sicily and Calabria

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[208] Marble was an umbrella term which referred to any stone that could be polished to a high degree, this is a reminder.

[209] Casson, *The Ancient Mariners,* 191.

were a hotspot for activity, as these waters were a very popular route for merchants going to and from Rome. But they were also used by those who were passing from east to west, or west to east. Generally, however, vessels carrying marble came from the east, as many of the most famous quarries were in that direction.

There is a deep historical connection between Greece and southern Italy, which can be described as *Magna Graecia*, or "Greater Greece." This connection was furthered by the overall Greek community, and their many colonies spread throughout the Mediterranean. This common thread of culture, seafaring, architecture, and so on, is largely the basis of the Roman's enthusiasm for marble. What was once a much smaller, localized exchange of marble and stone would be forever changed by the Roman economy. These quarries which once produced stone for nearby cities, towns, and the wealthy, became the suppliers of the empire, and its many emperors. Wealthy Roman citizens quickly latched onto this connection between the highest held office and marble, as a symbol of power. What would most aristocrats wish to emulate? They would want to follow their own emperor, and if they were wealthy senators or governors, then they must also follow suit. What better way to demonstrate your affluence than through architecture constructed from foreign marble, the literal land of assimilated regions.

As stated before, the transfer of obelisks which were sailed from Egypt to Rome, was a significant signal to the greater political community. This extended to the general citizens as well as anyone witnessing the arrival of these great symbolic monoliths, and their enshrinement in the capital, would have been unable to question their growing empire's affluence. The once embattled Republic had thrown down the rulers of great kingdoms, city states, and coalitions. The transport of huge amounts of marble across the domain of Neptune would have been quite the demonstration of power. Even though the many seafaring peoples of the Mediterranean were well accomplished in their craft, they still gave great reverence to the power and danger

which the sea represented. There is a plethora of shipwrecks at the bottom of the Mediterranean, more specifically in the Aegean, the Adriatic, the Ionian, and the Levantine seas, which are all regions of the larger sea itself. However, there is an unfortunate trend of larger wrecks being given much more attention, especially to detail.

This is a trend which prevents a proper examination of the wider marble trade, which was transporting a variety of cargo sizes. Not every single buyer would have needed 350 tons of marble at one time. The issue at hand is a negligible amount of recorded data surrounding many of these smaller shipwrecks. Some examples of which are as follows: Capo Cimiti, Capo Taormina, Cavo Doro (in Greece), Arwad C, Anzio, and Ayas. Capo Cimiti is a promontory on the Crotone Peninsula of Calabria. This is where the name of the wreck originates. There have been multiple investigations of other shipwrecks along the peninsula, including Punta Scifo D, and Punta Cicala. According to D.G. Bartoli, the only scholar who studied the Punta Scifo A and Capo Cimiti sites prior to the intensive INA[210] surveying conducted in 2005, was Patrizio Pensabene.[211] Bartoli also states that the only published analysis of these two wreck sites was made by Pensabene and Orsi, where they confirmed through visual analysis that the marble present was of the types Docimium and Proconnesus.[212]

There were many variations of marble from the eastern Mediterranean; the islands of Greece and Asia Minor produced many of the most prolific and commonly traded types of marble. Marmor proconnesium from the Island of Marmara, which was mentioned before, was one of these extremely popular types of marble. Some scholars have concluded that it reached a peak of success in the Roman sphere around

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[210] The Institute of Nautical Archaeology was founded by Dr. George F. Bass in 1972.

[211] Bartoli, “Marble Transport in the Time of the Severans,” 41.

[212] Bartoli, “Marble Transport in the Time of the Severans,” 48.

the year 180 AD. It even usurped the Roman marble of Carrara, ushering in a new era for the marble trade, and for both civic and private architecture throughout the empire. It was used extensively in renewing older architecture, especially in Rome itself. It was an affordable option and could be used in multiple applications due to its contrasting veins.[213] Material evidence would suggest that this marble was at its height of trade and usage during the dynasties of the Antonines and Severans, so between 96 AD and 235 AD. This success would continue in the eastern provinces, especially Asia Minor where it originated, particularly throughout the fourth, fifth, and sixth centuries AD, with large amounts being used in Constantinople.[214]

A rather famous piece of written evidence of the marble trade, and more specifically Marmo proconnesium, can be found in an edict issued by Emperor Diocletian in 301 AD, called the "*Edictum de Pretiis*."[215] The document specified that this marble from Asia Minor was amongst the cheapest that could be purchased. However, its price would not diminish its overall recognition for its reliability and beauty. It could be argued that Marmor proconnesium is one of the most recognizable, especially in Rome, as it still stands the test of time in so many of its civic monuments.

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213 Beltrame, "Four Shipwrecks," 438.

214 Beltrame, 438.

215 Beltrame, 438.

Conclusion:

The Roman marble trade would reach its peak during the third century AD and would necessitate the transportation of bulk cargoes. A vast majority of these cargoes, of which we have evidence, were constituted of unworked blocks or architectural elements. The necessity for trading marble in bulk rather than piecemeal was due to a number of factors. The first factor was mone; the levies placed on Roman cargoes surely varied, but there was no meaningful difference between the levies upon smaller or larger cargoes. This meant that it was advantageous to transport larger quantities of marble from the east, while still allowing for cargoes of a lesser size. Merchants who specialized in transporting statues or veneer, probably offset their lighter weight cargo with a ballast of largely biodegradable goods, such as sacks of lentils. This absence of tangible ballast in some shipwrecks has led archaeologists to believe that many times the ballast of a ship transporting marble could be a lighter secondary cargo of food which was situated in the spaces surrounding the stone.

The marble trade, which was once one of local significance, became one which held affluence and influence throughout the Roman Empire. Local quarries would transition into being imperially operated, bringing both jobs and wealth to these often small localities. Marble quarrying, craftsmanship, and trade all quickly expanded in their scope and significance. Once a stone valued for its appearance and workability, it became a symbol throughout a rapidly expanding empire. The dispersed populaces now had access to the many types of marble, but especially the bright white variations so prized for their application in architecture and sculpture. The identification of white marble variants in archaeology is difficult, and often requires techniques beyond the naked eye. This includes a process called X-ray diffraction, which analyzes a powdered sample from the marble. Processes such as this may allow for more accurate identification of type, and the origin for the marble itself, informing researchers upon the movements of the ship before it sank.

This data on the marble can then be used to form hypothetical ports of departure and stops along the journey to their eventual location of sinking. This whole process of reverse identification informs upon many aspects of the archaeology and history of the Roman marble trade, including well-traveled routes and harbors. The archaeological surveying and excavation of sites in and around marble quarries in Greece and Turkey fill in additional gaps throughout the economy of the stone, how it functioned, and how it changed over time. These studies are also influenced by past tectonic activity and the part it has played on the many seaside quarries of the eastern Mediterranean. In addition, sea-level changes have affected the archaeological landscape of many sites, eroding evidence in some cases, making more accurate theories difficult. These cases often highlight how archaeology is both about understanding the human influence on the landscape and preventing the loss of these often fragile traces left behind.

The Roman Period shipwrecks examined in the case studies were carrying massive amounts of marble enroute to their buyers, which unfortunately for the merchants, never reached their customers. In the case of Punta Scifo D, the vessel is believed to have been a barge which was towed by ships equipped with sails. This allowed the sailors to transport much larger amounts of marble blocks and slabs, but this barge became literal deadweight likely during a storm. This was the gamble merchants and clients played alike, as it would normally save both money and time. The shipwrecks discovered and surveyed thus far are but a small fraction of the entire marble trade of the Roman Period. This can also be said for the remaining Roman structures which were built with eastern marbles, as the vast majority of them are now gone. However, these remaining cargoes of marble, and the many impressive feats of architecture and art, are testament to these Romans whose lives revolved around this iconic stone.

For thousands of years, the Mediterranean Sea has united the many regions and peoples that call it home, allowing for an incredible dispersion of cultural, scientific, and religious practices. The Hellenistic tradition of using marble in their most prominent structures, art, and in their necropolis, would be amongst those adopted by the Romans. Not only would they assimilate these practices, but expand upon them as well, the stone itself morphing into a symbol of the Roman Empire's power and affluence. Marble would also become a reflection of their insatiable desire for the exotic. Its influence was not limited to the many imperial projects but would find its way into the luxurious mansions of the Roman elite. As the demand for eastern marble grew, so too did the market, the quarries, and of course the vessels which would transport this luxury good.

The foreign marble trade would defy the very sea itself, delivering massive cargoes of the stone to far away shores. The merchants still adhered to the common practices of maritime trade, avoiding the winter months for fear of loss of life, ships, and their goods. There were still plenty of cases when merchants tried their luck, or were caught at sea when freak seasonal storms scuttled their ships and provided modern researchers with archaeological sites. The scope of this manuscript has focused upon the corridor of exchange from eastern marble quarries to the western Roman markets, the majority of which passed through the Strait of Messina. There are many other routes which the marble traders took, but in the waters around Calabria and Sicily lie some of the largest cargoes of marble from the peak of its trade. Much of this marble was sourced from both imperial and private quarries on the Island of Marmara, in modern Turkey.

Marmor proconnesium is the name commonly used when referring to the marble from these quarries in Turkey, and it was one of the most popular and widely used in the Roman Empire. The combined tonnage of the two cargoes of the chosen case studies amounts to roughly 500 tons of Proconnesian marble, with some being

small amounts from other quarries. These two wrecks are a fraction of the number surveyed during the project to which they belong. This reinforced the question that many scholars have asked before which is whether a specialized type of ship actually existed for the transportation of marble. I believe that this research, though not focused on this question, does tend to suggest that these vessels were not specially made solely for holding marble. It is however evident that they were reinforced in some cases to provide a level of rigidity which was necessary when carrying such a robust cargo. These towed barges which were commonly used in the Roman marble trade, were surely varied in their design, but shared the trends of the time. The ships relied upon the mortise and tenon method, with evidence of both treenails (wood) and iron nails.

The research presented in this manuscript illustrates the Roman's favor towards the affordable, and beautiful Proconnesian marble from the Island of Marmara. It also demonstrates that the eastern Mediterranean quarrying economy was much stronger than that of the west, as all evidence points to the flow being almost entirely from east to west. It is very possible that if a cumulative study of this trade from east to west were to be conducted by researchers, that a pattern within the cargoes, the form of the marble, the favored types of marble, their routes, and possibly time period could be observed. Additionally, an average proposed ship size could be reached if such a study were to be conducted, along with a minimum and maximum size. Other future studies should consider investigating evidence related to localized marble trade in the Aegean during the Roman Period. This is dependent upon the future surveying and excavation of shipwrecks throughout the Aegean Sea.

This manuscript aimed to further expand on the nuances of this complex facet of Roman trade, and hopefully bridging a divide between schools of thought. Progress made in this field of archaeological study can surely be expedited by adopting a flexible approach, especially in theory. Without the discovery of evidence that refutes or proves marble trade on a reduced, local level, or the deposition of marble in middle-

markets, then the search for evidence must continue. There is a vast gap in both our archaeological and historical knowledge of this subject of study; but with every step forward in research, theories may be restructured and adapted to newly published information. New technologies and techniques also play a huge part in the progress researchers may achieve. A step towards better understanding the Roman marble trade could come in the form of a macro-study compiling data from known and surveyed shipwrecks, followed by a series of micro-studies based upon the previous findings of the macro-analysis.

There is still much to be explored within this diverse archaeological landscape that is the Roman marble trade, both terrestrial and maritime. The export of marble from the quarries of the eastern Mediterranean gave rise to new trends in important aspects of Roman life and has managed to continually define their culture and civilization throughout history. It elicits grandeur, power, affluence, and a solid, tangible mark upon the many corners of the Roman Empire. Monuments and structures built from eastern white marble still remain as prominent reminders amidst the terrestrial landscape, just as shipwrecks and their cargoes are testament to this incredible trade, and the Romans who drove it forward.

Figures

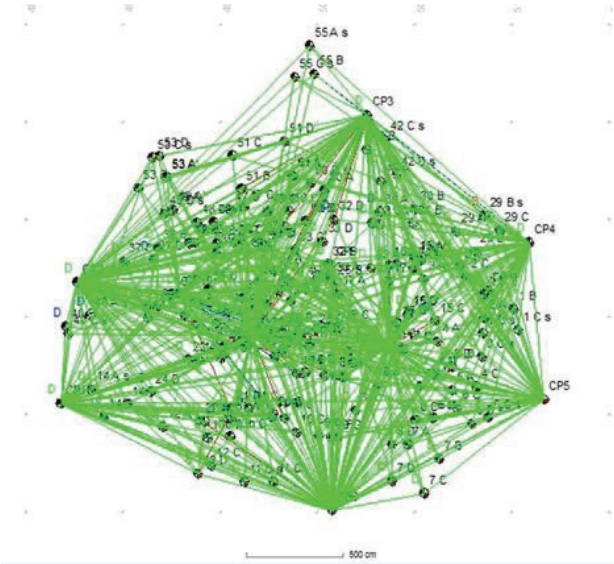

Figure 1. This tangled web is a visual representation of all the points taken during the DSM of Punta Scifo D, processed by Elisa Costa.[216]

Figure 2. A photograph of part of the marble cargo of the Punta Scifo D shipwreck.[217]

[216] Figure from Elisa Costa, "Potentialities of 3D Reconstruction in Maritime Archaeology," (Archaeopress, 2015), figure 14.
[217] Photo by D. Della Libera, "Potentialities of 3D Reconstruction in Maritime Archaeology," (Archaeopress, 2015), figure 13.

Figure 3. A 3D reconstruction of the marble cargo of Punta Scifo D completed by Elisa Costa, utilizing the program Rhinoceros.[218]

[218] Reconstruction by Elisa Costa, "Potentialities of 3D Reconstruction in Maritime Archaeology," (Archaeopress, 2015), figure15.

Bibliography

Books

Arnaud, Pascal, “Reconstituting the Maritime Routes of the Roman Empire,” in *Advances in Shipping Data Analysis and Modeling: Tracking and Mapping Maritime Flows in the Age of Big Data*, ed. Cesar Ducruet (Routledge 2018) 21-25.

Bianchetti, S., Cataudella, M., and Gehrke, H.J., eds. *Brill's Companion to Ancient Geography*. Leiden, The Netherlands: Brill, 24 Nov. 2015: pp. 21-42. doi: https://doi.org/10.1163/9789004284715.

Beltrame, C., Vittorio, V. “Roman Ships Carrying Marble: Were These Vessels in Some Way Special?” in *Between Continents: Proceedings of the Twelfth Symposium on Boat and Ship Archaeology*, ed. Nergis Günsenin (Istanbul 2009: Ege Yayınları, 2012) 141-48.

Caruso, Ada. "A New Athenian Gymnasium from the 4th Century BC?" In *Development of Gymnasia and Graeco-Roman Cityscapes*, Ulrich Mania and Monika Trümper eds. Berlin: Edition Topoi, 2018, 197–214.

Casson, Lionel. *The Ancient Mariners: Seafarers and Sea Fighters of the Mediterranean in Ancient Times*. New Jersey: Princeton University Press, 1991.

Charlesworth, M.P. *Trade-Routes and Commerce of the Roman Empire*. New York: Cooper Square Publishers, Inc., 1970.

Costa, E., Beltrame, C., and Guerra, F. “Potentialities of 3D Reconstruction in Maritime Archaeology.” In *CAA2014: 21st Century Archaeology: Concepts, Methods and Tools. Proceedings of the 42nd Annual Conference on Computer Applications and Quantitative Methods in Archaeology*, edited by F. Giligny, F. Djindjian, L. Costa, P. Moscati, and S. Robert, 549–56. Archaeopress, 2015. https://doi.org/10.2307/jj.15135883.66.

Ducruet, Cesar, ed. *Advances in Shipping Data Analysis and Modeling: Tracking and Mapping Maritime Flows in the age of Big Data*. Routledge, 2018: 21–25.

Gould, Richard A. *Archaeology and the Social History of Ships*. Cambridge: Cambridge University Press, 2000.

Günsenin, Nergis, ed. *Between Continents: Proceedings of the Twelfth Symposium on Boat and Ship Archaeology, Istanbul 2009*. Istanbul: Ege Yayınları, 2012.

Janni, Pietro. “The Sea of the Greeks and Romans.*”* In *Brill's Companion to Ancient Geography*, Bianchetti, Serena, Michele Cataudella, and Hans-Joachim Gehrke, eds. Leiden, the Netherlands: Brill, 24 Nov. 2015.

Leidwanger, Justin. *Roman Seas: A Maritime Archaeology of Eastern Mediterranean Economies*. Oxford: Oxford University Press, 2020.

Papahatzis, Nicos. *Ancient Corinth: The Museums of Corinth, Isthmia, and Sicyon*. Athens: Ekdotike Athenon S.A., 1996.

Rodrigue, Jean-Paul. *The Geography of Transport Systems*. New York: Routledge, 2024.

Rougé, Jean. *Ships and Fleets of the Ancient Mediterranean*. Edited and translated by Susan Frazer. New York: Columbia University Press, 1981.

Journal Articles

Beltrame, Carlo, Percic, Thalia, Lazzarini, Lorenzo. "The Archaeometric Identification of the Marbles of the Roman shipwrecks of Capo Granitola (TP), Isola delle Correnti and Marzamemi I (SR)." *Journal of Archaeological Science*: Reports 23 (2019): 953-967. https://doi.org/10.1016/j.jasrep.2018.11.021.

Beltrame, Carlo, Lazzarini, Lorenzo, Parizzi, Simone. "The Roman Ship 'Punta Scifo d' and its Marble Cargo (Crotone, Italy)". *Oxford Journal of Archaeology* 35: (2016) 295–326. https://doi.org/10.1111/ojoa.12091.

Beltrame, Carlo, Antonelli, Fabrizio, Carrerac, Francesco, Pipere, Maria Francesca. "A Roman Marble Cargo from a Shipwreck at Porto Cervo, Sassari, Sardinia, Italy". *International Journal of Nautical Archaeology*, 50(5) (19 July, 2021): 1-8. https://doi.org/10.1080/10572414.2021.1943402.

Beltrame, Carlo. "The Contribution of Four Shipwrecks to the Reconstruction of the Trade Dynamics of Proconnesian Marble in the Roman Period." *L'Erma di Bretschneider*, Archeologia Classica: Rivista del Dipartimento di Scienze Storiche Archeologiche e Antropologiche dell' Antichità: LXXII, n.s. II, 11: (2021): 437-462. https://doi.org/10.48255/J.ArchCl.LXXII.2021.14.

Bernard, Seth G. "Pentelic Marble in Architecture at Rome and the Republican Marble Trade." *Journal of Roman Archaeology* 23 (2010): 35–54. https://doi.org/10.1017/S1047759400002294.

Bradley, Mark. “Colour and Marble in Early Imperial Rome.” *The Cambridge Classical Journal* 52 (2006): 1-22. https://doi.org/10.1017/S1750270500000440.

Casson, Lionel. “Maritime Trade in Antiquity.” *Archaeology* 34, no. 4 (1981): 37–43. http://www.jstor.com/stable/41727170.

Geraga, Maria, Dimitris Christodoulou, Dimitrios Eleftherakis, George Papatheodorou, Elias Fakiris, Xenophon Dimas, Nikos Georgiou, Stavroula Kordella, Michalis Prevenios, Margarita Iatrou, and et al. 2020. "Atlas of Shipwrecks in Inner Ionian Sea (Greece): A Remote Sensing Approach" *Heritage* 3, no. 4: 1210-1236. https://doi.org/10.3390/heritage3040067.

Gianfrotta, Piero A. “Relitti con Marmi (*Naves Lapidariae*?): Trasporti di Stato, Maestranze Iteneranti e Coincidenze Ostiense.” *Archeologia Classica* 67 (2016): 341–60. https://www.jstor.org/stable/26379396.

Hayward, Chris L. “Geology of Corinth: The Study of a Basic Resource.” *Corinth* 20 (2003): 15–42. https://doi.org/10.2307/4390714.

Hayward, Chris L., and M. Schvoerer. "First results from high resolution study of ancient construction stone quarries of the Corinthia, southern Greece." In *Archéomatériaux: marbres et autres roches: actes de la IVe Conférence internationale de l’Association pour l’étude des marbres et autres roches utilisés dans le passé, ASMOSIA IV, Bordeaux, Talence, 9–13 October 1995*: (1999) 91-9.

Hayward, Chris L., and Pitt, Robert K. "Inscriptions from Limestone Quarries at Kenchreai, Greece." *Zeitschrift für Papyrologie und Epigraphik* (2017): 89-96. https://www.jstor.org/stable/26604075.

Houston, George W. “Ports in Perspective: Some Comparative Materials on Roman Merchant Ships and Ports.” *American Journal of Archaeology* 92, no. 4 (1988): 553–64. https://doi.org/10.2307/505250.

Karambinis, M., and Lorenzo Lazzarini. "The Roman marble quarries of Aliko Bay and of the islets of Rinia and Koulouri (Skyros, Greece)." *The Roman marble quarries of Aliko Bay and of the islets of Rinia and Koulouri (Skyros, Greece)* (2015): 791-804.

Kokkorou-Alevras, Georgia, Eirene Poupaki, Alexis Eustathopoulos, Efstathia Rigatou, and Achilleas Chatziconstantinou. “An Overview on Ancient Quarries of Southeastern Attica." *Athens University Review of Archaeology* 2, (2019): 117-36. http://aura.arch.uoa.gr/.

Justin Leidwanger. “From Time Capsules to Networks: New Light on Roman Shipwrecks in the Maritime Economy.” *American Journal of Archaeology* 121, no. 4 (2017): 595–619. https://doi.org/10.3764/aja.121.4.0595.

Michael L. Brennan, Robert D. Ballard. “Deepwater Ancient Shipwrecks of the Mediterranean, Aegea, and Black Seas: 1988-2012”. *Oceanography* 26 (1) (March 2013): 24-27.

Parker, A. J. “Artifact Distributions and Wreck Locations: The Archaeology of Roman Commerce.” *Memoirs of the American Academy in Rome. Supplementary Volumes* 6 (2008): 177–96.

Rankov, Boris. “Roman Shipsheds and Roman Ships.” *Memoirs of the American Academy in Rome. Supplementary Volumes* 6 (2008): 51–67.

Rickman, Geoffrey. “Plenary Address: Ports, Ships, and Power in the Roman World.” *Memoirs of the American Academy in Rome. Supplementary Volumes* 6 (2008): 5–20.

Royal, Jeffrey G. “Discovery of Ancient Harbor Structures in Calabria, Italy, and Implications for the Interpretation of Nearby Sites.” *The International Journal of Nautical Archaeology* 37.1 (2008): 49-66.

Russell, Ben. “Lapis Transmarinus: Stone-Carrying Ships and the Maritime Distribution of Stone in the Roman Empire.” *Maritime Archaeology and Ancient Trade in the Mediterranean. Proceedings of the 2008 OCMA Conference, Madrid*. Oxford Centre for Maritime Archaeology 7 (2011), Ed. by D. J. Robinson and A. I. Wilson (Oxford), 137–52.

Russell, Ben. "Roman and Late-antique Shipwrecks with Stone Cargoes: A New Inventory." *Journal of Roman Archaeology* 26 (2013): 331-61. doi:10.1017/S1047759413000184.

Russell, Ben. "Stone Quarrying in Greece: Ten Years of Research." *Archaeological Reports* 63 (2017): 77-88. doi:10.1017/S0570608418000078.

Scheidel, Walter. “The Shape of the Roman World: Modelling Imperial Connectivity.” *Journal of Roman Archaeology* 27 (2014): 7–32. https://doi.org/10.1017/S1047759414001147.

Taelman, Devi. “Marble Trade in the Roman Mediterranean: A Quantitative and Diachronic Study.” *Journal of Roman Archaeology* 35, no. 2 (2022): 848–75. https://doi.org/10.1017/S1047759422000447.

Toma, Natalia. “Standardization and Mass Customization of Architectural Components: New Perspectives on the Imperial Marble Construction

Industry." *Journal of Roman Archaeology* 31 (2018): 161–91. https://doi.org/10.1017/S1047759418001277.

Tusa, S. "Ancient lithic naval cargos around Sicily." In *Interdisciplinary studies on ancient stone: ASMOSIA X: proceedings of the tenth International Conference of ASMOSIA, Association for the Study of Marble & Other Stones in Antiquity, Rome*, 21-26 (May 2012): 831-841. " L'Erma" di Bretschneider, 2015.

Tziligkaki, Eleni. "Quarrying the coasts of Crete in antiquity; some geoarchaeological considerations." *Bulletin of the Geological Society of Greece* 53, no. 1 (2018): 229-265.

Ward-Perkins, John B., and Peter Throckmorton. "New Light on the Roman Marble Trade: The San Pietro Wreck." *Archaeology* 18, no. 3 (1965): 201–9.

Wirsching, A. "How the obelisk reached Rome: evidence of Roman double-ships. *IJNA* 29(2) (2000): 273-83.

Sources from websites

Beltrame, C. "The marble routes: Capo Taormina shipwreck project – 2017." Honor Frost Foundation. 2017. Accessed November, 2024. https://honorfrostfoundation.org/2019/09/24/the-marble-routes-capo-taormina-shipwreck-project/.

Flohr, Miko. 2010-2024. "OXREP: Shipwrecks Database." Oxford, University of Oxford. http://oxrep.classics.ox.ac.uk/databases/shipwrecks_database/713to730/ Accessed 2024.

Pike, Scott. March 2, 2021. “ASMOSIA: Roman Trade in White Marble from Mani.” http://asmosia.willamette.edu/?p=323. Accessed 2024.

UNESCO. 2012. “Villa Adriana (Tivoli).” https://whc.unesco.org/en/list/907/.

Papers, Lectures, and Manuscripts

Bartoli, D.G., “A New Analysis of the Punta Scifo Shipwreck at Croton.” Krotoniate Archaeological Group, 2009.

Bartoli, Dante G., “Marble Transport in the Time of the Severans: A New Analysis of the Punta Scifo A Shipwreck at Croton.” PhD diss., Texas A&M University, Texas, 2008.

Costa, E., Manfio, S., Tusa, S. “Virtual Reality and Virtual Dives among Sicilian Marble Cargoes.” Paper presented at the ‘Under the Mediterranean’ The Honor Frost Foundation Conference on Mediterranean Maritime Archaeology, 20th – 23rd October 2017 Short Report Series, 1-14. https://doi.org/10.33583/utm2020.03.

Freed, Dorothea Mary. "Trade routes of the Roman Empire." PhD diss., University of British Columbia, British Columbia, 1941.

Ancient Sources

Pausanias. *Description of Greece*, 1.1.1. Translated by W.H.S. Jones, Litt.D., and H.A. Ormerod, M.A., in 4 Volumes. Cambridge, MA, Harvard University Press; London, William Heinemann Ltd. 1918.

Pliny, the Elder. *The Natural History*, 36.1. Translated by John Bostock, M.D., F.R.S., H.T. Riley, Esq., B.A. Digital version in Perseus Digital Library online. London. Taylor and Francis, Red Lion Court, Fleet Street. 1855.

Pliny, the Younger. *The Letters of Pliny the Younger*. New York: G. E. Stechert, 1936.

Strabo. *Geographica* 5.3.6. Translated by H.C. Hamilton, Esq., W. Falconer, M.A., London. George Bell & Sons, 1903. Digital version in Perseus Digital Library online: A. Meineke (ed.), Strabonis Geographica: recognovit Augugtus Meineke., Lipsiae, 1877.

Reference Works

Russell, Ben. *Gazetteer of Stone Quarries in the Roman World*. Oxford Roman Economy Project, *Version 1.0*, 2013.