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The Battle of the Aegates Islands, 241 BC: Mapping a Naval Encounter, 2005-2019

Sebastiano Tusa, Peter Campbell, Mateusz Polakowski, William Murray, Francesca Oliveri, Cecilia Buccellato, Adriana Fresina, and Valeria Li Vigni

Abstract
The Battle of the Aegates Islands is significant as the naval engagement that ended the First Punic War and the only ancient naval battle site that has been located in the archaeological record. The Egadi Islands survey is a collaboration between the *Soprintendenza del Mare*, RPM Nautical Foundation, and Global Underwater Explorers, surveying an area of 270 km^2 with the main concentration of the battle spread over 4 km^2. This chapter provides an overview of the 2005-2019 maritime archaeological survey of the battle site, detailing the 23 bronze warship rams that have been found on site, along with helmets, swords, and cargo. The finds reveal cross-cultural interactions in the mid-3rd century BC, as well as the earliest assemblage of Roman and Carthaginian military equipment.

Introduction

The Battle of the Aegates Islands, the modern Egadi Islands, occurred on 10 March 241 BC. The battle was the final naval engagement of the First Punic War, which was fought between Rome and Carthage from 264–241 BC. The Roman victory secured naval supremacy in Sicily and led Carthage to sue for peace. Today, the battle is significant as the only ancient battle site that has been discovered and the earliest Roman Republican and Carthaginian assemblage of military equipment.[1] The artifacts from the battle represent the technological peak of Rome and Carthage in the mid-3rd century BC, while the absolute depositional date is significant for archaeologists seeking to understand the chronologies of ships, helmets, swords, amphoras, and the other finds.

The battle occurred off the coast of western Sicily, between the islands of Marettimo and Levanzo in the Egadi archipelago (Fig. 1). The site is a complex depositional environment with the concentration thus far located spread over 4km^2 at a depth of 70-90m. Due to low sedimentation rates and the saltwater conditions, there is limited preservation of organic materials, leaving primarily ceramic and metal artifacts. Nevertheless, the project's first phase from 2005-2015 located 9 warship rams[2] and associated artifacts, though one ram, Egadi 9, remained on the seafloor.[3] From 2016-2019, 12 rams were located and Egadi rams 9, 12-17, and 19 were raised. This article examines the project from 2005-2019, which is currently the longest running underwater excavation below recreation diving limits, as well as among the most expensive maritime archaeology projects in history. The article collates the findings and presenting a general interpretation of the battle site, as well as lessons learned from mapping an ancient naval encounter.

The project is the seminal work of Sebastiano Tusa, who initiated the project after the Carabinieri's recovery of the Egadi 1 ram.[4] This chapter is written by his team in his memory and he is listed as the first author in recognition of his foundational role in the project since its inception and the continuation of this legacy today.

<Figure 1 near here.>

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Historical Context

The First Punic War centred around Sicily and it featured a number of significant naval encounters. The size of fleets and quantity of battles during the war led Polybius to remark, "we shall find that no forces of such magnitude ever met at sea [previously]."[5] Warships sailed when traveling long distances, but were propelled by oars in battle. Vessels could reach high speeds in short bursts, which turned the ships into human-driven projectiles. Naval tactics in the 3rd century BC consisted of ship-to-ship boarding action and direct ramming.[6] Naval rams were designed to pierce an enemy's hull beginning in the 6th century BC;[7] however, by the 3rd century BC warships also struck head-to-head.[8] Due to the force of these collisions/impacts, warships were carefully fitted with bronze rams so as to protect their bows as well as deliver fatal blows to the enemy. The rams were designed to distribute the force of impact along the ship's major structural timbers.[9] Rome adapted the Carthaginian warship design and large fleets of the same design fought for naval supremacy.[10]

The two primary ancient accounts of the Battle of the Aegates Islands are provided by Polybius (1.60-61) and Diodorus Siculus (24.11), though there are several other sources.[11] By 242 BC, Rome and Carthage had exhausted their manpower and resources over 22 years of war.[12] In 243, Rome's wealthiest citizens donated the resources required to build a fleet of new ships that put to sea in early 242 BC under the consul Gaius Lutatius Catulus.[13] News of the Roman fleet sent by their garrison near Drepana prompted Carthage to send a relief force, under the direction of Hanno, on a mission to resupply the garrison camped on the slopes of Mount Eryx, and afterwards the fleet would engage the Romans at sea.[14] The Carthaginians, setting out from North Africa, made landfall on the island of Marettimo. The next morning, on 10 March 241 BC, their fleet set sail toward Hamilcar's encampment at Eryx on mainland Sicily.[15] Diodorus writes,

> "The consul Lutatius, with three hundred warships and seven hundred transports and carriers, a thousand vessels in all, sailed to Sicily and cast anchor at the trading-station of the Erycinians [Trapani]. Likewise, Hanno himself, setting out from Carthage with two hundred and fifty warships, together with cargo ships, came to the island of Hiera [Marettimo]. As he proceeded thence towards Eryx the Romans came out to meet him, and a battle ensued, hotly contested on both sides. In this battle the Carthaginians lost a hundred and seventeen ships, twenty of them with all men aboard (the Romans lost eighty ships, thirty of them completely, while fifty were partially destroyed), while the number of Carthaginians taken prisoner was, according to the account of Philinus, six thousand, but according to certain others, four thousand and forty."[16]

A longer account account is given by Polybius. He is in agreement that after arriving on Marettimo the night before, the Carthaginian fleet sailed in the morning for Eryx and a rendezvous with Hamilcar. However, the Roman fleet cut off their route and forced a battle.

> "Hanno, whom they had appointed to command the naval force, set sail and reached the so-called Holy Isle [Marettimo] from whence he designed to cross as soon as possible to Eryx, unobserved by the enemy, and, after lightening the ships by disembarking the supplies, to take on board as marines the best qualified mercenaries together with Barcas himself and then engage the enemy. Lutatius, learning of Hanno's arrival and divining his intentions, took on board a picked force from the army and sailed to the island of Aegusa [Favignana]… In the early morning, just as day was breaking, he saw that a brisk breeze was coming down favourable to the enemy, but that it had become difficult for himself to sail up against the wind, the sea too being heavy and rough. At first he hesitated much what to do under the circumstances, but reflected that if he risked an attack now that the weather was stormy, he would be fighting against Hanno and the naval forces alone and also against heavily laden ships, whereas if he waited for calm weather and by his delay allowed the enemy to cross and join the army, he would have to face ships now lightened and manageable as well as the pick of the land forces and above all the bravery of Hamilcar which was what they dreaded most at that time. He therefore

> decided not to let the present opportunity slip. When he saw the Carthaginian ships under full sail, he at once got under weigh. As his crews easily mastered the waves owing to their good training, he soon brought his fleet into a single line with their prows to the enemy. The Carthaginians, seeing that the Romans were intercepting their crossing, lowered their masts and cheering each other on in each ship closed with the enemy… The Romans had reformed their system of shipbuilding and had also put ashore all heavy material except what was required for the battle; their crews rendered excellent service, as their training had got them well together, and the marines they had were men selected from the army for their steadfastness. With the Carthaginians it was just the opposite. Their ships, being loaded, were not in a serviceable condition for battle, while the crews were quite untrained, and had been put on board for the emergency, and their marines were recent levies whose first experience of the least hardship and danger this was. The fact is that, owing to their never having expected the Romans to dispute the sea with them again, they had, in contempt for them, neglected their naval force. So that immediately on engaging they had the worst in many parts of the battle and were soon routed, fifty ships being sunk and seventy captured with their crews."[17]

Having made landfall from North Africa at Marettimo, the natural route to Eryx passed north of Levanzo. Under sail and heavily loaded, the Carthaginian fleet found its route cut off by the Roman fleet waiting along this predicable route. The rough sea-state reported by Polybius would have caused problems for the heavily laden Carthaginian ships.[18] Indeed, the battle was a rout for the prepared and drilled Romans, who sank 50 Carthaginian ships, laden with relief supplies and poorly trained crews, and captured 70 according to Polybius. Diodorus states that 117 Carthaginian ships sank as compared to 80 Roman vessels.[19] An afternoon wind arose that allowed the surviving part of the Carthaginian fleet to raise sail and escape.[20] However, this surviving segment of the fleet was too small to continue the war effort.

The defeat left Carthage unable to challenge Roman control of the sea or accessible ports in western Sicily. Unable to carry on the war, Carthage gave permission for the army in Sicily to sue for peace.[21] The resulting treaty greatly expanded Rome's territory and influence, making the Battle of the Aegates Islands among Rome's most significant victories.

Methodology

The Egadi Islands Survey Project is a collaboration between the Soprintendenza del Mare - Sicilia (SM), RPM Nautical Foundation (RPMNF), and Global Underwater Explorers (GUE).[22] The initial survey mapped 270km^2 using Kongsberg EM3002 dual 300 kHz multibeam sonar heads on RPMNF's DP1 category research vessel *Hercules* from 2005-2010 and created a 2m resolution seafloor map.[23] A methodology for large-scale marine survey was developed to locate small objects (c.1m max. dimension) at a depth of over 70m in an area large enough that Manhattan could fit inside 4.5 times.

The project entered a new phase in 2016-2019 through the collaboration with GUE and updated methodology on the research vessel including improvements to the ROV technology and the addition of an Autonomous Underwater Vehicle (AUV). The limits of underwater robotics are met by the use of the GUE divers, who are able to see items that are otherwise obscured in the ROV and AUV data and locate obscured items utilizing metal detectors. The divers use rebreathers and scooters to conduct visual survey along linear transects. In the area of Ram 16, limited sub-surface excavation was undertaken to determine whether there were intact deposits. A 40m baseline was installed and surveyed, then selected 2m grid squares were excavated with a dredge aided by a metal detector. Finds were found buried to a depth of 15cm, including small finds not identifiable by the ROV survey.

The ROV was overhauled in 2016 and equipment upgraded, including the installation of a Teledyne BlueView 2D imaging sonar. This forward-facing multibeam device allows for the

identification targets at 40m with a 130° field of view. Positioning and navigation now follow offshore industry standards with a USBL (Ultra Short Base Line) positioning system and Fledermaus QPS software with accompanying risk assessment, dive logs, and daily progress reports. Artifact position, photographs, HD video, and the pilot camera were logged in accordance with industry standards, increasing the quality of positioning, documentation, and data archiving. In 2019-2020, in partnership with the University of Malta, a Teledyne GAVIA AUV with a 500kHz sidescan sonar began mapping one km^2 grid sections on the site, identifying a large number of targets including additional potential rams. Survey transects and target ground-truthing were undertaken with a SeaEye Panther XT ROV. The updated methodology for the 2016-2020 seasons increased the quality of survey data and quantity of finds, rapidly outpacing the earlier survey in terms of identifying warship rams, military equipment, and small finds.

Artifacts are raised by RPMNF and GUE at the request of the Soprintendenza, who have custodianship for conservation and long-term storage. Over the course of the project, this has resulted in exhibitions in Palermo, Rome, Trapani, Parma, Taormina, and the primary permanent exhibition at Favignana, as well as international exhibitions in the Netherlands, France, Germany, Denmark, UK, and Australia.

Naval Finds

The 2005-2015 seasons consisted of ROV survey using a multibeam bathymetry map and it identified 923 mid-3rd century BC artifacts, which are published in *The Site of the Battle of the Aegates Islands at the End of the First Punic War,* including 9 rams, 11 pieces of armour, 571 ceramics, and 330 associated materials.[24] Two rams, Egadi 1 and 7, were found by fishermen and are also published in the same volume. The 2016-2019 seasons identified 436 mid-3rd century BC artifacts, including 299 Greco-Italic amphoras, 29 Punic amphoras, 31 tableware, 30 non-diagnostic ceramics, 12 rams, 23 helmets and cheekpieces, 2 iron sword concretions, 2 anchors, and 2 coins.[25] Given the scale of the survey area, and its position along a well-travelled route between North Africa and Sicily, archaeological material was located dating to other periods, such as 31 non-3rd century BC amphoras and 1 anchor during the 2016-2019 survey, as well as remains of WWII aircraft and ordnance. There are methodological differences between data collection and storage between the 2005-2015 and 2016-2019 seasons, resulting in different quality of data. Certain data, such as the orientation of the rams and a full catalogue of in situ photographs, do not exist for the earlier seasons.

Presenting this quantity of artifacts in $270km^2$ is a challenge, considering artifacts are on average 20m or more apart. The site plan (Fig. 2) provides an overview. The site is divided into $1km^2$ grid squares, which are further sub-divided in the text into 500m grid based on direction. For example, $1km^2$ grid K8 is composed of four $500m^2$ squares NE, NW, SE, and SW.

<Figure 2 near here.>

In total from 2005-2019, the survey has located 852 Greco-Italic amphoras, 80 Punic amphoras, 52 tableware, 57 non-battle related ceramics, 51 non-diagnostic ceramics (typically buried), 46 helmets and cheekpieces, 23 rams, 10 anchors, 2 swords, and 2 coins. In addition, inside of the raised warship rams were found 201 small finds, primarily ballast stones, iron nails, and non-diagnostic iron concretions. Of the 1,376 total, 1,208 artifacts have a mid-3rd century BC date and can be ascribed to the battle.

Greco-Italic Amphoras	852
Small finds (iron concretions and ballast stones)	201
Punic Amphoras	80
Non-Punic War Ceramics	57
Tableware	52
Non-Diagnostic Ceramics	51
Bronze Rams	23
Armour - Helmets and cheek-pieces	46
Anchors	10
Swords	2
Coins	2

Table 1. Finds at the Battle of the Egadi Islands site 2005-2019.

Prior to the discovery of the Egadi site, three waterline rams were known: Athlit, Piraeus, and Bremerhaven. [26] However, more have since been found at Acqualadroni and Follonica.[27] These are distinguished from *proembolia*, or upper rams, which were metal fittings that covered and protected the upper wale joint, offering an above-water striking surface.[28] It is important to note that these other rams have been isolated finds, making the Egadi rams the only assemblage from a battlefield. Rams 1-11 are presented in previous publications,[29] but 12-23 are presented here. Of the 23 Egadi rams identified through the 2019, 11 possess Roman inscriptions or recognizable symbols, 2 possess Punic inscriptions, and the remainder are either fragmentary (2 examples), currently unreadable due to marine encrustations, or uncertain for other reasons (e.g. equivocal symbols). Whereas the 10 rams presented in *The Site of the Battle of the Aegates Islands at the End of the First Punic War* might display four building programs (if only two of the six quaestors approved rams for the fleet as the authors assume), the rams presented here show broader diversity, as discussed below.[30] All 23 rams appear to be of the same class of vessel, as they are all 84-100cm in length and 34-47cm in width.

Ram	**Manufacture**	**Decorative Features**	**Inscription**
1	Roman	Rosettes on sides	C SESTIO P F ⎪ Q SALONIO Q F ⎪ SEXVIROEN[/] ⎪ PROBAVER[-?-]
2	Unknown	None, fragmentary ram	None, fragmentary ram
3	Punic	None	Punic inscription
4	Roman	Victoria; quaestor inscr.	M · POPVLICIO · L · F · Q · P C · PAPERIO · TI · F *vacat*
5	Unknown	None, fragmentary ram	None, fragmentary ram
6	Roman	Victoria, quaestor inscr.	C · PAPERIO · TI · F *vacat* M · POPVLICIO · L · F · Q · P
7	Roman	Helmet, quaestor inscr.	[L · QVINCTIO] C · F · QVAISTOR · PROBAVET
8	Roman	Helmet, quaestor inscr.	L · QVINCTIO · C · F · QVAISTOR · PROBAVET
9	Roman	Helmet, quaestor inscr.	[--?--] C · F · QVAISTOR · PROBAV[et]
10	Roman	Helmet, quaestor inscr.	L · QVINCTIO · C · F · QVAISTOR · PROBAVET
11	Roman	Victoria, quaestor inscr.	M · POPVLICIO · L · F C · PAPERIO · TI · F · Q · P
12	Roman?	Eagle sword handles	Concreted, illegible
13	Punic	None	Awaiting translation

14	Unknown	None	Concreted, illegible
15	Punic?	None	Concreted, illegible
16	Roman	Helmet, quaestor inscr.	Concreted, partially visible but consistent with *L · Quinctio · C · F · Quaistor · Probavet*
17	Roman	Victoria very high relief	Concreted, partially visible but consistent with *L · Quinctio · C · F · Quaistor · Probavet*
18	Unknown	Unknown	Concreted, illegible
19	Roman?	Swords	Concreted, illegible
20	Roman?	Helmet?	In situ, illegible
21	Unknown	In situ	In situ, illegible
22	Unknown	In situ	In situ, illegible
23	Roman	Helmet	In situ, illegible

Table 2. Bronze rams located at the Battle of the Egadi Islands site 2005-2019.

Ram 9 was raised in 2017 following its discovery in 2014 during ROV survey in sector K8SW. It was located in a sandy bottom buried nose-down with the bow oriented 261°. It bears an inscription in Latin and is decorated with a Montefortino helmet motif.[31]

Ram 12 was discovered in 2016 during diver survey in sector K8SW and raised in 2017. It was located on a rocky reef with its bow oriented 086°. An inscription is not visible under heavy marine incrustation. However, a decoration of swords along the wale pockets (with eagle headed finials on the upper and lower handles) indicate that this ram is different from the others that have been located, including the only other ram with a sword decoration on the middle fin, Egadi 19. Ram 13 was likewise discovered during diver survey,[32] but in sector J14NE. It was located on a rocky reef and was raised in 2017. It has a Punic inscription.

Ram 14 was discovered in 2018 during ROV survey in sector K8SW and raised in 2019. It was located on a sandy bottom with the bow oriented 278°. The inscription is below marine encrustation and there is no visible decoration. Given the lack of decoration comparable to Egadi 3, this ram may be Punic.

Ram 15 was discovered in 2018 during ROV survey in sector K9NW and raised the same year. The bow was oriented 323°. Any inscription is below a layer of marine incrustation, but the lack of decoration indicates that it may also be Punic.

Ram 16 was discovered in 2018 during ROV survey in sector K9SW and raised in 2019 (Fig. 3). It was located on a sandy bottom with the bow oriented 272°. It is decorated with a Montefortino helmet bearing three feathers and a Latin inscription on its cowl nosing; however, the ram has additional decoration in the form of tridents on the tips of its fins which separates it either from the other Montefortino-decorated building programs or indicates a different workshop. Timbers from an enemy vessel were found stuck in the upper cavity of the ram's starboard fins. This ram is the most well-investigated, as divers surveyed a 40m grid visually and with a metal detector, locating ballast, helmets, cheek-pieces, swords, and coins.

Ram 17 was discovered in 2018 during ROV survey in sector K9SW and raised the same year. It was located on a sandy bottom with the bow oriented 356°. It is decorated with a Victory in raised relief and bears a Latin inscription on its cowl nosing. This ram was displayed in the Colosseum exhibition *Carthago: Il mito immortale*.

Ram 18 was discovered in 2018 during ROV survey in sector K9SW. It was located on a sandy bottom with the bow oriented 270°. It was raised in October 2020, but an inscription, if one is present, is not legible.

Ram 19 was discovered in 2018 during ROV survey in sector J15NE. It was located on a sandy bottom with the bow oriented 044°. It was raised in 2018. An inscription (if one is present) is not legible under marine encrustation, but the driving centre is decorated with a sword handle motif on the middle fin.

The remaining rams were located in the 2019 ROV survey and remain *in situ*. Ram 20 was discovered in sector K13SE and the bow is oriented 217°. An inscription is not currently legible, but the ram appears to be decorated with a Montefortino helmet. Ram 21 is in sector K13NW with the bow oriented 158°. An inscription is not legible. Ram 22 is in sector K13NW with the bow oriented 108°; an inscription is likewise not legible. Ram 23 is in sector K13NW with the bow oriented 325° and also has an illegible inscription; it appears to have a Montefortino helmet on the cowl nosing.

<Figure 3 near here.>

The 2005-2015 data offered interesting insights into the variability among the warships found taking part in the battle. The 2016-2019 results offer significant new information on this subject. If the earlier corpus of rams was typified by a few types, then the new corpus offers variety. Based on the Latin inscriptions and decorations, Jonathan Prag identified three building programs for the Roman rams. Building Program I is identified as rams 7, 8, 9, and 10, with an inscription bearing the name of quaestor Lucius Quinctius and a Montefortino helmet motif. Building Program II consists of rams 5, 6 and 11 with the names of questors Gaius Papirius and Marcus Publicius with a Victory motif. The third building program consists of ram 1, bearing the names Caios Sestius and Quintos Salonius and rosettes as decoration.[33] Egadi 2 and 5 are fragmentary rams missing their cowls, so no inscriptions are extant. Egadi 3 has a Punic inscription, providing information about the Carthaginian vessels. This completes the 2005-2015 data, offering evidence of 4 variations on the Punic-pattern ram used in the battle, with the majority of the rams grouping into two main Roman building programs.

The 2016-2019 rams differ considerably, though it should be noted that the majority of these new rams have not been cleaned or remain in situ, so the interpretation for most of the rams is based on decoration rather than inscriptions. Rams 16, 20, and 23 bear Montefortino motifs fitting with Building Program I, but 16 also has trident tips decorating the fins, which the others do not. Prag noted variability in the inscriptions within building programs, suggesting multiple workshops which this trident design may attest to.[34] Rams 12 and 19 both lack evidence of inscriptions or cowl decorations through the marine encrustation, but they both bear swords on the wale pockets. However, the designs are different, making Ram 12 and 19 unique decorative cases. Ram 17 was conserved by the Istituto Superiore per la Conservazione ed il Restauro, revealing a winged Victory quite different from those in Building Program II, though the quaestor is the same. Victory's leg is raised physically clear of the cowl's surface and the wings wrap around the cowl, indicating perhaps another workshop or hand. Ram 13 has a Punic inscription, but its physical appearance is quite different from the other Punic ram, Egadi 3, suggesting a lack of homogeneity in the Carthaginian fleet. Egadi 14 lacks a visible inscription or decoration, but it is physically small

and the ram is attached to the timbers through the face of the cowl, in a manner that differs from the other Egadi rams, as well as rams found elsewhere in the Mediterranean. Finally, Egadi 15 has no visible inscription or decoration. The bronze patina of Egadi 3 and 13 are a deep green, whereas the Roman rams are typically a brownish tone. Egadi 15 shares the greenish hue of the Punic rams, but its physical dimensions differ from the two earlier Punic rams. As a result, Egadi 15 may represent a third variation among the Punic rams. In total, there are ten variations seen among the 23 rams found at the Egadi Islands. While the 2005-2015 rams grouped primarily into two Roman building programs with similar details, the later 13 rams show more variety. There is no indication of inscriptions or decorations for rams 18, 21, and 22. This is a preliminary interpretation and doubtless once the rams have been cleaned and inscriptions revealed, then Prag will update the Roman building program list and more insights will be gained on the Carthaginian rams.

Evidence of the construction of the Egadi warships is provided by the shape of the bronze rams over the timbers, as well as a few surviving timbers. Based on the shape of the bronze casting, it appears as though the ships had the same general structural design as the Athlit and Acqualadroni vessels, which had well-preserved wood.[35] Interestingly, the Egadi warships show at least three construction variations that are evident in the sparse timber remains.

These sparse remains show that the warships were built using shell-based construction techniques, which led to the convergence of the main structural timbers at the bow, inside the ram. The timbers inside the ram included the keel, wales, stem, and a specifically designed ramming timber.[36] Fragments of wood found inside the rams allow for basic analysis of the timber species, showing that wood species differ for each of the component timbers, though analysis is still underway. The rams were nailed to the keel, stem, and wales using bronze fasteners, while the timbers were fastened using mortise-and-tenons, treenails, and iron nails. Strakes survive in the ram's external fin cavities (Fig. 3), representing enemy vessels that were struck. These strakes show they were attached to frames using treenails. The scantlings, or dimensions, of the structural elements are smaller than expected; in fact, they are significantly smaller than Athlit and Acqualadroni. In addition to their small dimensions, the wales on vessels 9, 13, and 15 are composites, making use of several timbers to fulfil the role of the wale (Fig. 4).

The use of different bow timber configurations should not be a surprise, given the time and cultural differences between the Carthaginian-pattern Egadi rams and the Greek-pattern Athlit and Acqualadroni rams, the latter two dating to at least a century later. The configuration of the ramming timber understandably underwent a number of iterations by shipbuilders. The composite wales are a surprise given the small dimension of the timbers, the wales range in size from 14.4-21.5cm in height and 8.6-13.7 in width, and the fact the wale timbers are not scarphed, but are instead butt-joined. As the most important structural element after the keel, one would expect a single timber to be used given their size, or a scarph to join the components. In timbers of these diminutive dimensions, a composite wale is weaker than a single timber, which may indicate one of three scenarios. First, Rome and Carthage were under great financial stress, as well as loss of resources after more than two decades years of war. It could indicate that the large timbers necessary to build fleets of 200 warships were either unavailable or unaffordable. The primary use of iron fasteners in the hulls could likewise indicate economic stress, since bronze fasteners are reserved solely for attaching the ram. Second, perhaps these are older vessels that required repair. The *Olympias* trireme reconstruction found that rot sets into timbers quickly underneath the rams,[37] so vessels that were several years old may have needed to add new timbers to rotted parts,

especially the wales to which the rams attached. Third, there is a pattern of twisted fasteners on rams contain wood in their fin cavities from striking enemy vessels. This damage would need repair if the vessel survived, so perhaps the composite timbers indicate repairs from vessels that had seen action in earlier battles. Further investigation is needed and, hopefully, better preserved timbers.

<Figure 4 near here.>

There is significant evidence of ballasting on the Egadi warships.[38] Around and inside the rams have been found rounded river stones, which do not match the natural stones of the marine environment (Fig. 3). Much of the ballast is likely buried on site; however, it offers an opportunity for future excavation to potentially identify general length and beam dimensions of these vessels if exposed.

The large quantity of mid-3rd century BC ceramics interspersed among the naval and military equipment surely represent the resupply materials intended for the Carthaginian forces on Eryx. While a significant quantity of water would be needed to be stowed onboard each warship to provision the crew during each day of rowing, these amphoras likely represent oil, wine, and foodstuffs such as grain. An experiment conducted in the battle zone during the 2019 season support the conclusion that many of the amphoras carried contents of specific gravities of 0.8 or less. This allowed the amphoras, once released into the water, to float at the surface for a while and separate before settling to the sea floor.[39] One would expect auxiliary merchant ships to transport these goods in a fleet kept behind the warships; however, the large quantity of amphoras and their spatial patterning surrounding the rams and helmets indicate the warships were transporting a large amount of material, as Polybius (1.60.1) implies. There appear to be two different patterns indicated by the amphora and helmet scatters. Some sank quickly (like the helmets and some of the amphoras) while others (like the amphoras filled with grain) sank more slowly and floated for varying periods with the current. In this way, the amphora scatter differs from the classic Mediterranean merchant ship deposition of an amphora pile.

Greco-Italic amphoras represent 91% of the mid-3rd century BC amphoras found during the survey (852 amphoras). While traditionally discussed in the context of production on the Italian peninsula, Greco-Italic kilns have been found in North Africa and examples raised from the Egadi site included stamps and sgraffito with Punic letters, clearly indicating that these were Carthaginian cargo.[40] The remaining 9% of the mid-3rd century BC represent amphoras of several types.[41] The vast majority of the amphoras are intact, 82% of Greco-Italic and 79% of Punic amphoras. Of the broken amphoras, many appear to have broken *in situ*, as evident from the fragments in the vicinity, which can be ascribed to fishing activity by trawlers and dragnets. The significant percentage of intact amphoras suggests that they came to rest in their current positions following the break-up of ships on the surface and have remained where they landed, rather than coming from one or more merchant shipwrecks that have been scattered widely due to dragging nets.

The Egadi Islands assemblage represents the earliest known Roman Republican and Carthaginian military equipment. [42] It consists of 37 helmets, of which 36 are Montefortino and one of undetermined type,[43] and 9 cheek-pieces (Fig. 5). Inside one helmet was found a small piece of fabric, perhaps part of a helmet liner.[44] The two cheekpieces (along with one hinge) found in Ram 6 are both left-side pieces, while all the cheek-pieces found in the vicinity of Egadi 16 are right-side pieces. All the helmets, with the one exception, are of the

Montefortino style; however, they differ considerably in quality and decoration. It is evident that the Egadi assemblage is personal armour designed for an individual, rather than standardized, as is expected for First Punic War armour.[45]

The Egadi Montefortino helmets correspond to Paddock Type VI and several of the helmets are larger than the other known examples.[46] The Type VI helmets are the largest type of Montefortino, with the largest known example being 26.1cm, which also comes from a First Punic War shipwreck in Sicily.[47] The most impressive helmet found to date is the "Griffin Helmet", a well-preserved example decorated with a griffin and a silvered finish, probably tin (Fig. 5). At 28cm in height, it is larger than any Montefortino helmet in Paddock's catalogue. For comparison, it is 37% larger than the Type I, II, and IV Montefortino helmets in the British Museum, which average 20.4cm in height.[48] The Egadi helmets average 25.1cm, fitting with the larger Type VI found in Sicilian and Southern Italian contexts.[49] The purpose of this larger helmet has not been determined. It is understood that feathers attached to helmets increase their size by as much as 45cm, and the Montefortino helmets depicted on the rams show three feathers standing to significant height.[50] Perhaps the helmets were meant to increase visibility of the wearer and intimidate the enemy, with larger helmets used by marines rather than the terrestrial army. Of the 46 helmets found at the battle, the silvered Griffin Helmet is the largest and most impressive, suggesting it belonged to a person of stature, perhaps a naval or military commander.

Goldman and Rose argue that while Montefortino helmets would become the standard Roman helmet, and an unknown helmet type could possibly be Carthaginian, that the ownership of the helmets at the time of the battle is uncertain.[51] Certainly Montefortino helmets are known from Roman contexts and appear as a decorative motif on the Roman rams. However, the sheer quantity of Montefortino helmets found at the site of a decisive Carthaginian loss, suggests that a number of these represent Carthaginian marines, especially in the area of Ram 16 which included Punic coins. These findings may indicate that Montefortino helmets were used by the Carthaginians, as well as the Romans. It could be the result of re-using armour captured after previous battles, as Hannibal did during the Second Punic War.[52] In 249, Carthage captured 93 warships at Drepandum, at least 63 of which were sent back to Carthage along with the prisoners (Polybius 1.53.1); this could represent the source of some of this armour.[53] Bishop and Coulston argue, "One of the great strengths of the Roman army was its willingness and ability to learn from contacts with enemies", which led to the frequent adoption of weapons or armour. [54] This statement surely applies to the Carthaginians as well, which is evident in the later adoption of the *gladius Hispaniensis*, showing that Spanish mercenaries had an impact on both Roman and Carthaginian armies. Whether the armour was Carthaginian or Roman, they represent the militaria that would become emblematic of the Roman army in centuries to come.

<Figure 5 near here.>

Two iron sword concretions were found during the diver-based survey. Their heavily concreted nature leaves questions about the sword type: spatha, *gladius Hispaniensis*, falcata, or another unknown type? The first (PW19-007) is a fragment that is broken at either end and measures 21.6cm in length and 5.4cm in width. The second (PW19-008) is complete and measures 67.9cm in length, and 9.0cm at its widest point to 4.1cm at the distal tip (Fig 5). The blades are too wide to be *spatha* long-swords, which typically have blades 3-3.5cm wide.[55] The shape roughly corresponds to the *gladius Hispaniensis*, but it could be another, less attested, type. The dimensions of known *gladius Hispaniensis* examples are from Delos

at 76.0cm long by 5.7cm wide dating to the 1st century BC, and from Šmihel in western Slovenia at 62.2-66.1 long by 4.0-4.5cm wide dating to the 2nd century BC.[56]

Besides the personal armour, two coins were located in the region behind Egadi 16. The coins are Carthaginian Æ/billon dishekels, complicating the fact that ram 16 has a Latin inscription. The first coin is 25.7mm in diameter and weighs 8.77g, while the second coin is 26.1mm and 7.57g (Fig. 6). Both coins depict the head of Tanit on the obverse and a horse head on the reverse, bearing resemblance to coins minted during the First Punic War in Carthage and Sardinia.[57] Coins are exchanged, so it is possible that a Roman had Carthaginian coins. Punic coinage at the end of the First Punic War and Libyan Revolt are few in number, making these finds significant for understanding Carthaginian coinage in this period of crisis.[58] The differences in cultural identity between the ram and coins highlight the mobility of material culture in the 3rd century BC that is evident throughout the Egadi site. The coins do not appear to be part of a large hoard, such as for payroll, as the 3,422 Carthaginian First Punic War coins found by the GUE and Soprintendenza del Mare team at Pantelleria.[59] Instead, it may have belonged to an individual, though further investigation is needed.

<Figure 6 near here.>

Discussion

As the only ancient naval battle discovered to date, the site provides significant information about the site formation processes of ancient naval battles. Maritime archaeology has documented thousands of ancient merchant ships which manifest as piles or dense trails of amphoras.[60] The battle site is more complex, as the artifacts are generally 20m or more apart from each other. There is little coherence to each wreck as indicated by its ram; however, scatter patterns emerge. Rams tend to be the furthest east object in a scatter with helmets clustering nearby. The ballast stones that have been found are immediately behind the ram or collected inside by octopuses. Amphoras are widely distributed, though there are more closely distributed clusters in the area of rams – discounting jettison. The corpus of thousands of Mediterranean merchant ships suggests that the amphoras scattered on the Egadi site were not carried in merchant vessels, but on board the warships. The amphoras are scattered over 8 km^2 which is too wide an area for a single merchant ship. Equally, there are too few amphoras to represent multiple merchant ships. Instead, the spatial patterning fits a different site type than the classic Mediterranean merchant wreck: warships carrying some cargo that broke apart on the surface. These findings have been suggested by a drop experiment that examined the behaviours of helmet and amphora replicas filled with different contents when dropped over the battle zone in periods of high and minimal surface current.[61] The assemblage of artifacts demonstrate a pattern of vessels breaking apart at the surface with some items sinking quickly through c.80m of the water column to the sea floor, while others floated for varying periods of time at the surface before settling on the bottom. Such an explanation accounts for the wide spread of the artefact scatter, particularly the amphoras, when compared to clusters of helmets. Battle sites have been difficult for maritime archaeology to identify in the past, but with new understanding of their spatial patterning perhaps others can now be found.

After the scale of the site, the next biggest challenge is interpreting material culture in what is emerging as a highly interconnected central Mediterranean in the 3rd century BC. The ships, armour, weapons, and cargo indicate that battles are sites of exchange, not just of blows but ideas. Polybius writes that on at least two occasions the Roman copied Carthaginian ship designs.[62] Replication of ship design is not a unique case among the Egadi assemblage, but,

rather, it is characteristic of the cultural material on the site. Ascribing a cultural identity to any object is a challenge, even those bearing inscriptions. William Murray has argued that a number of the warship rams came from Roman-built vessels captured at the Battle of Drepanum in 249 BC and re-used by the Carthaginian navy.[63] The lop-sized nature of the Roman victory should indicate that the majority of material on the seafloor relates to the Carthaginian fleet. The number of Roman losses are unclear, since Polybius follows Pictor and downplays the Roman casualties, while Diodorus, perhaps drawing on Philinos, suggests the Roman losses were greater than Polybius implies. The unknown factor of Roman losses makes the identification of any single artefact as belonging to one side or the other difficult. However, it can be reasonably asserted that the cargo items on the seafloor belong to the Carthaginian side. It also stands to reason that the majority of the rams and helmets belong to the losing side, unless a larger area of the battle remains to be found with purely Carthaginian warship remains.

While Greco-Italic amphoras, Montefortino helmets, and the rams with Latin inscriptions at first cry out for identification as Roman, the recent findings and scientific analyses further support the hypothesis of re-use or exchange. The Egadi 16 ram may be one such example. While it bears a Latin inscription, gridded survey behind its location revealed Punic coins and Montefortino helmets. Petrographic analysis shows that ballast stones found inside the amphoras around the battle site originate from Pantelleria and North Africa, suggesting a Punic origin, despite the majority of rams found in the area bearing Latin inscriptions.[64] Exchange of design or re-use could equally be true for armour. Montefortino helmets are traditionally associated with Rome, but Iberian tombs have been found to contain them.[65] The Griffin Helmet could be Roman, since griffins appear in Roman iconography and on later helmets, but the helmet was found behind the enigmatic Egadi 16. Rome is known to adopt military equipment from enemies, such as the *gladius Hispaniensis*, which Rome adopted from the Carthaginians who were using the sword in Iberia in the later Punic Wars.[66] The Greco-Italic amphoras offer further evidence of material culture traditionally associated with the Italian peninsula, but in the battle context these are Carthaginian goods to resupply their forces at Eryx. The emerging story from the battle's artifacts is not one of distinct cultures at war over their differences, but two closely interconnected cultures fighting over territorial overlap. The material culture of Carthage and Rome indicates a complex relationship of exchange between the two, revealing an interconnected central and western Mediterranean, especially considering the significant Spanish influence evident through military equipment and amphoras.[67] It is a higher degree of exchange at an earlier date than has previously been acknowledged.

The Egadi survey has raised as many questions as it has answered. The large quantity of artifacts has emphasized several conspicuous absences that were expected to be found at a naval battle. No *proembolia* have been located, which one would expect to find in equal quantities to the waterline rams. The same is true for *oculi*, mounted on the bows of ships and known from merchant shipwrecks, as well as the naval ship sheds in Piraeus.[68] No 3rd century BC anchors had been found until 2019, when two iron stock-weighted anchors were located to the east of the main concentration (Fig. 7). This anchor type has been found at several sites in France and are attested as donations at Delos.[69] Their relation to the battle site is still being determined, but as yet they are the only anchor finds fitting the time period. Rigging elements, such as lead brailing rings, have not been found, yet the Carthaginian ships would have had a full complement of sailing gear stowed, rather than jettisoned, since the vessels fled by sail when the wind changed.[70] Similarly, certain military equipment is missing, including standards, shield bosses, and spears. For some of these artifacts, it is likely that they

were made of iron and have corroded. More intensive diver-based surveys may reveal these missing items in the future; nevertheless, their absence is notable. At the least, it is evident that these warships were not fitted with bronze *proembolia* or inorganic *oculi*. Perhaps the most surprising element of the survey is the fact that all the rams appear to be the same size, given the diversification seen in the eastern Hellenistic fleets during the 3rd century BC. The Egadi warships appear to correspond with triremes, rather than the quinqueremes that Polybius states comprised each fleet.[71] Surely the fleets in the First Punic War were less homogenous than Polybius asserted, who was writing a century later, or perhaps larger vessels await discovery on the site.

Future research will further elucidate these conspicuous absences through expanding the survey and more intensive investigation of the seafloor. New technologies and methods, such as AUVs, machine learning, and environmental modelling, will help to map the enormous site, as well as better understand the relationships between the artifacts. It is hoped that the research will lead to better understanding of the naval tactics and strategies employed during the battle. As the data is interrogated, perhaps the economic and human toll of the battle will become better understood.

Conclusion

The 2005-2015 Battle of the Egadi Islands survey has been formative for the field's understanding of ancient naval battles as complex archaeological sites, while the 2016-2019 findings demonstrate that there is considerably more to learn from the site. Successful deep-water excavations, such as the Phoenician shipwreck at Xlendi, Gozo, indicate the potential of excavations by divers at the relatively shallower battle site.[72] It is evident that the battle site contains enough material for many generations of archaeologists. The current and future projects will continue the legacy of Sebastiano Tusa, who first saw the potential for identifying naval battles in the waters of Sicily.

Acknowledgements

This chapter is written in memory of Sebastiano Tusa, the project director and Assessore of Sicily, who tragically passed away before his time. The recent founding of the Fondazione Sebastiano Tusa will continue his legacy of impactful and collaborative maritime research. The authors would like to thank the principal collaborative team: Soprintendenza del Mare, RPM Nautical Foundation, especially George Robb Jr and James Goold, and GUE, especially Francesco Spaggiari and Mario Arena, and the entire dive team. The AUV survey was conducted by Timmy Gambin and Alberto Rodríguez at the University of Malta. The project is funded by RPMNF, GUE, and grants from the Honor Frost Foundation, Explorers Club, Southampton Marine and Maritime Centre, University of South Florida, and Stathis Family Partnership.

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Figures

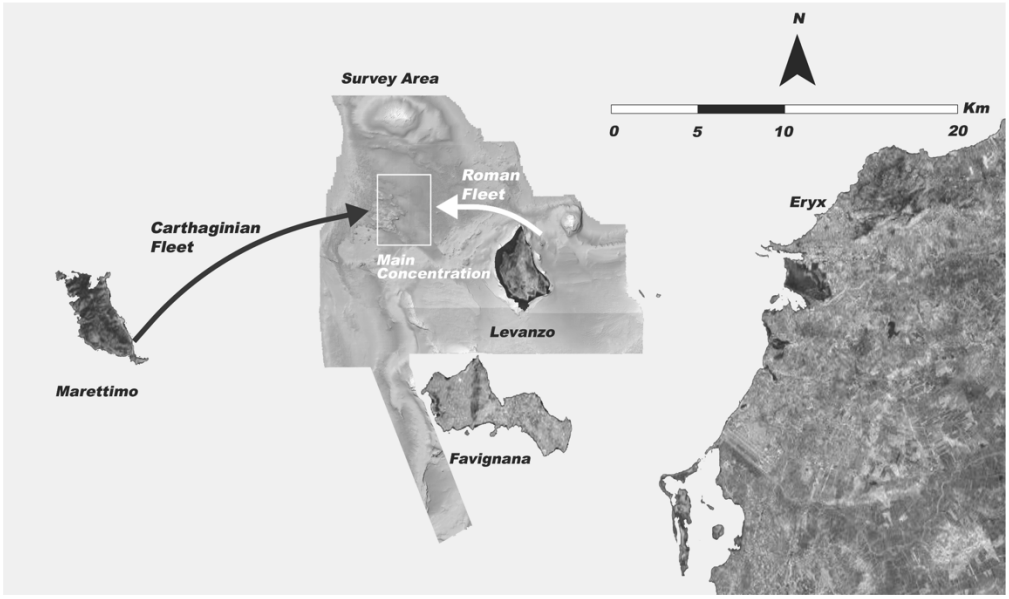


Figure 1. Map of western Sicily and the Egadi Islands with the presumed route of the Carthaginian fleet on March 9-10 241 BC (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).

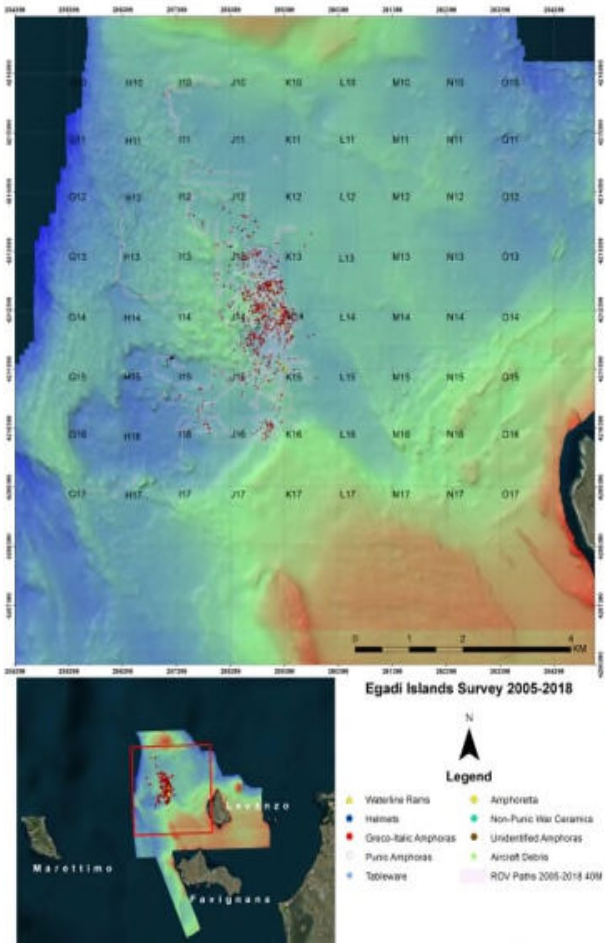


Figure 2. Site plan of the Battle of the Egadi Islands 2005-2019 (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).



Figure 3. Ram 16 in situ on the seafloor surrounded by ballast stones (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).

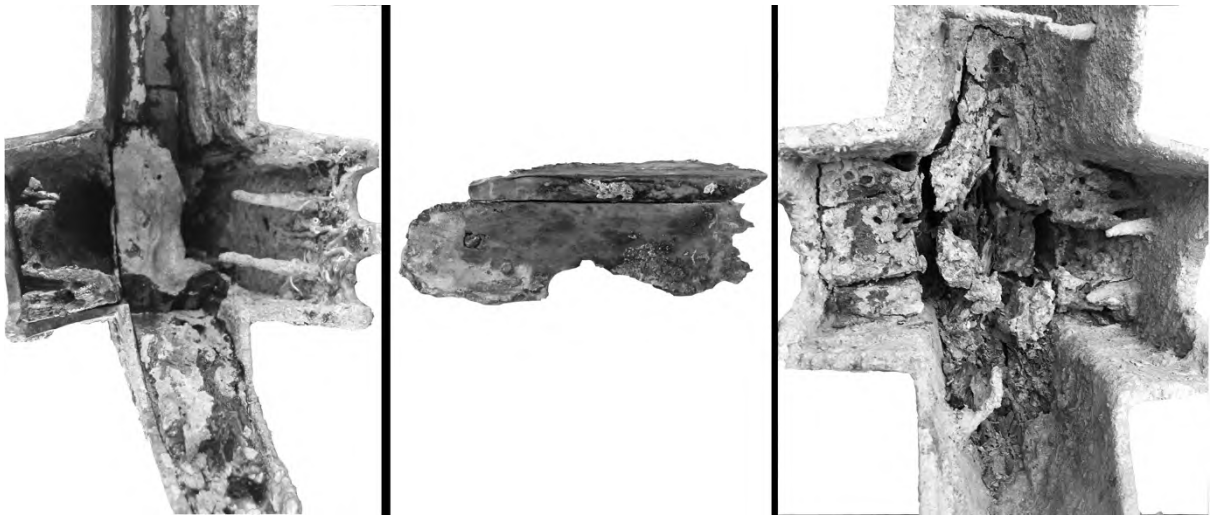


Figure 4. Wooden timbers surviving in rams 14 (left), 15 (center), and 9 (right) showing wales composed of one, two, and three timbers; Ram 13 (not pictured) has the design as 15 (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).



Figure 5. Examples of military equipment from the Egadi site including a Montefortino helmet (the “Griffin Helmet”), a right-side cheekpiece (interior, showing the method of attachment), and a sword concretion (PW19-008), all found in the area behind Ram 16 (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).



Figure 6. Punic coin (PW19-018) found during diver-based survey in the grid behind Ram 16 (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).



Figure 7. One of two anchors found within the search area that could date to the mid-3rd century BC (Soprintendenza del Mare Regione Siciliana/RPM Nautical Foundation/Global Underwater Explorers).

[1] Goldman and Rose 2020, p.143.
[2] Two rams, numbers 1 and 7, were recovered by fishermen.
[3] Tusa and Royal 2012; Royal and Tusa 2020.
[4] Tusa 2020.
[5] Polybius 1.63.8.
[6] Murray 2012.
[7] Morrison, Coates, and Rankov 2000.
[8] Murray 2012.
[9] Steffy 1991.
[10] Polybius 1.20.15.
[11] Murray 2020, p. 37.
[12] Polybius 1.58.9.
[13] Polybius 1.59.6.
[14] Polybius 1.60.1-3.
[15] Diodorus 24.11.1.
[16] Diodorus 24.11.1-2
[17] Polybius 1.60.3-61.7.
[18] Polybius 1.60.7.
[19] Polybius 1.61.6; Diodorus 24.11.1.
[20] Diodorus 24.11.2.
[21] Polybius 1.62.
[22] Tusa 2020, p. 17.
[23] Tusa and Royal 2020.
[24] Royal and Tusa 2020.
[25] The 2020 season is not reported here. It consisted of diver-based operations and extending the AUV survey.
[26] Casson and Steffy 1991; Steinhauer 2002; Bockius 2014.
[27] Buccellato and Tusa 2013.
[28] Casson 1995, p. 85.
[29] Tusa and Royal 2012; Royal and Tusa 2020.
[30] Tusa and Royal 2012; Royal and Tusa 2020; Prag 2020.
[31] For more on the decorative motifs see Oliveri 2020a.
[32] Tusa 2020, p. 18-19.
[33] Prag 2014 had four building programs, but to fit the edited volume he changed it to three in Prag 2020.
[34] Prag 2020, p. 91.
[35] As argued by Royal 2020; for Athlit see Steffy 1991; for Acqualdroni see Buccellato and Tusa 2013.
[36] Similar to the Athlit Ram, Steffy 1991.
[37] Boris Rankov, pers. comm.
[38] Royal 2020, p. 206-213.
[39] Murray and Robb, 2021, forthcoming.
[40] Discussion on Greco-Italic diffusion, Woolf 1992, p. 285; North African production, Will 1982, p. 344; Egadi amphoras, Oliveri 2020b. For images of the Egadi amphoras see Royal 2020, p. 193.
[41] Oliveri 2020b, p. 178-180; Royal 2020, p. 189-193.
[42] Goldman and Rose 2020, p. 143.
[43] Goldman and Rose 2020, p. 171-174.
[44] Travis and Travis 2014, p. 137.
[45] Goldman and Rose 2020, p. 159.
[46] Paddock 1993, p. 515; Goldman and Rose 2020, p. 159-160.
[47] Paddock 1993, p. 478.
[48] British Museum catalogue 1881,0725.2; 1867,0508.202; 1982,1002.1; 1873,0820.226.
[49] Goldman and Rose 2020, p.160.
[50] Bishop and Coulston 2006, p. 66.
[51] Goldman and Rose 2020, p. 164.
[52] Polybius 3.87.3, 3.114.1
[53] Polybius 1.53.1.
[54] Bishop and Coulston 2006, p. 248–49.
[55] Bishop and Coulston 2006, p. 82.
[56] Bishop and Coulston 2006, p. 56.
[57] E.g. SNG Copenhagen (Africa) 162-3 and 197.

[58] Visonà 2010.
[59] Pappa 2016, p. 34.
[60] Parker 1981; Parker 1992.
[61] Murray and Robb, 2021, forthcoming.
[62] Polybius 1.20.15, 1.59.8.
[63] Murray 2020.
[64] Tusa and Royal 2020, p. 215.
[65] Quesada Sanz 1997.
[66] Bishop and Coulston 2006, 56.
[67] For discussion of the distribution of Greco-Italic amphoras in the western Mediterranean see Woolf 1992, p. 285, though clearly the Egadi finds indicate an earlier diffusion than presented therein.
[68] Carlson, 2009.
[69] For archaeological examples see Lamboglia 1964; Tchernia 1969; Joncheray 1994.
[70] Polybius 1.62.
[71] See Murray 2020 for the full discussion.
[72] Gambin et al., 2018.

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Chapter 16: the battle of the Aegates Islands, 241 BC: mapping a naval encounter, 2005-2019

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