THE FORM, FUNCTION, AND INTERRELATIONSHIPS OF NAVAL RAMS: A STUDY OF NAVAL RAMS FROM ANTIQUITY

A Thesis

by

MATTHEW GARNETT PRIDEMORE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

May 1996

Major Subject: Anthropology

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ABSTRACT

The Form, Function, and Interrelationships of Naval Rams: A Study of Naval Rams from Antiquity. (May 1996)

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The discovery of several naval rams from sites around the Mediterranean has given scholars a brief glimpse of one of the most widely used naval weapons of the ancient world. Examining these physical examples provides information that is unavailable from literary and iconographic sources. Personal observation of two examples has allowed for more detailed descriptions and comparisons than were previously available. It is commonly believed that five rams now exist, yet only two are without a doubt functional rams. The remaining three pieces are questionable in this regard on constructional grounds. Current information shows that naval rams, both primary and secondary, went through several developmental stages in terms of both style and function throughout a millennium of use.

ACKNOWLEDGMENTS

Although this thesis bears my name on the cover, the end product was greatly influenced by many people, not all of whom I can mention. Thus, to all my friends, the Nautical Program's faculty and staff, and my family go my deepest, heart-felt thanks for their help and encouragement.

There are, however, several gentlemen that I would like to single out for recognition. Mr. D. Schofield kindly opened up his home to me, allowing me to study the "Fitzwilliam" ram. His cooperation and enthusiasm greatly eased the process. Also, there is Dr. Detlev Ellmers of the Deutsches Schiffahrtsmuseum in Bremerhaven, Germany, who allowed me to monopolize the museum's ram while the museum was open. To both these gentlemen go my thanks.

I would also like to acknowledge all three members of my graduate committee: Dr. Fred van Doorninck, Dr. George Bass, and Dr. John Lenz. Each of these men gave much of their time to assist me. Their guidance and patience was greatly appreciated throughout the entire thesis-writing process. I was extremely fortunate to have had the opportunity to study under each of them.

However, most of all, I want to thank my loving parents Doris and Jerry. For twenty-five years they have put up with the "antics" of an infallible son.

Words cannot even begin to describe how much they mean to me and all that they have sacrificed on my behalf. They have always supported me, even when I didn't know what I wanted. Their patience and loving support have been wonderful and unwavering. What more could I have asked of them?

My "brief" stay at Texas A&M, along with the time I spent in Turkey, has left me with countless memories and friendships which will last a lifetime. There were the seventeenth-century-B.C. Dutch, the mother-of-all camp buildings, but most important of all there was Thorny Burnett and the Proto-Phoenicians. Thanks for the memories.

Apparent confusion is a product
of good order; apparent cowardice,
of courage; apparent weakness,
of strength.

Sun Tzu, *The Art of War*

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INTRODUCTION

Throughout naval history, certain developments in ship technology have had a significant effect on naval warfare, sometimes even altering the very nature of war at sea. Changes in ship design may result from the adaptation of existing ideas in other areas of life or be specifically developed for use aboard ships. In relatively recent times, the addition of gunpowder weapons and iron cladding are prime examples of such momentous changes. However, significant developments affecting naval warfare occurred in antiquity as well.

Soon after the first purpose-built warships were constructed, they were equipped with a weapon which would significantly alter naval warfare for over a thousand years: the naval ram. Really just a battering ram mounted to the bow of a ship, this seemingly simple addition marked a radical change in how warships were perceived. A warship was no longer just a means of transporting people or material from one point to another; the ship itself had been transformed into a weapon.

After the ram's introduction, warship designs changed through time and ram designs with them. Changes took place not only in the naval ram's form and function, but also in the number of rams a warship possessed. A warship had its primary ram located at the waterline, but it also could have

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This thesis follows the format of the *American Journal of Archaeology*.

one or more secondary rams. Secondary rams have not received nearly as much attention as primary rams, yet they also went through several changes in both design and function.

In this study of naval rams, I will begin by presenting some background material on the ram's introduction. I will then discuss the development of both primary and secondary rams, including the interrelationships between the two ram types. These first sections will rely mainly upon ancient textual and iconographic sources. Once this foundation has been laid, I will turn to an analysis of the actual rams that have been discovered to date.

RAM ORIGINS

There exists a quest among scholars to find the earliest evidence for the naval ram. This has resulted in numerous misinterpretations cluttering the literature. It is as if every forward-projecting bow appendage from the very earliest watercraft on has been labeled a ram at some point. In order to see through this confusion, one must first define what a naval ram is.

A naval ram is a forward-projecting structure mounted on the bow of a ship designed to inflict structural damage on an enemy vessel.[1] A warship could have both a primary ram and one or more secondary rams. The primary ram was located at the vessel's waterline. Its main function was to be driven against the hull or oarage of an enemy ship.[2] Using a modern analogy, Casson likened a ship equipped with a waterline ram to an "oar-

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[1] The earliest surviving use of the word ram appears in a fragment (Diehl, fr. 45) of Hipponax, a Greek writing in the middle of the sixth century B.C. (This particular passage is also the earliest reference to the trireme, the warship type that became the workhorse of Greek navies in the classical period.) The Greek word for ram was *embolos*, which simply meant a projection, though it is also often translated as meaning beak.

[2] Though the ram was first and foremost a weapon, it had other functions, such as being a cutwater. Geometric period representations also show the ram being used as an exit ramp during amphibious assaults, while there is also the possibility that the ram was the site of the ship's head: L. Casson, *Ships and Seamanship in the Ancient World* (Princeton 1971) figs. 65, 68; J. J. Simmons III, *Those Vulgar Tubes: External Sanitary Accommodations Aboard European Ships of the Fifteenth through Seventeenth Centuries* (College Station 1991) 2-3.

driven torpedo."[3] However, a more appropriate analogy would be an oar-driven battering ram.

Some scholars have claimed that the ram was already in use in the Mediterranean by the Early Bronze Age.[4] In support of this claim, they cite a clay boat model found at Mochlos on Crete. The model (fig. 1) dates to the Early Minoan I - Early Minoan II period (c. 3100-2600 B.C.), otherwise known as the prepalatial period on Crete, and has waterline projections at either end.[5] This particular claim has since been refuted on several points. The vessel's posts project further than the waterline projections, while there is also an identical projection at the other end of the craft. Finally, the vessel is equipped with only four tholes for rowing, so that the model is generally accepted as representing only a small rowboat.[6]

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[3] L. Casson, "The Ram and Naval Tactics," in L. Casson and J. R. Steffy, eds., *The Athlit Ram* (College Station 1991) 76; Casson (supra n. 2) 49.

[4] There are, of course, the controversial ship representations found on the Dorak knife, which Mellaart dated to the third millennium B.C. However, these vessels are much too developed in terms of certain ship features (i.e. crow's nest and oculus, etc.) to be from such an early period, if they are not fakes all together: L. Basch, *Le musée imaginaire de la marine antique* (Athens 1987) 91-93, fig. 189; J. Mellaart, "The Royal Treasure of Dorak," *The Illustrated London News* (November 28, 1959) 754.

[5] L. Cohen, "Evidence for the Ram in the Minoan Period," *AJA* 42 (1938) 487-89.
The dates given are those currently used by Aegean Bronze Age scholars, including the current excavators at Mochlos: O. Dickinson, *The Aegean Bronze Age* (Cambridge 1994) 12-21, figs. 1.2-3; J. S. Soles, "Mochlos: A New Look at Old Excavations: The University Museum's Work on Crete," *Expedition* 20 (1978) 6, fig. 2; J. S. Soles and C. Davaras, "Excavations at Mochlos, 1989," *Hesperia* 61 (1992) 417, n. 10.

[6] Casson (supra n. 2) 34-5; L. Basch, "Another Punic Wreck in Sicily: Its Ram. 1. A Typological Sketch," *IJNA* 4 (1975) 201; Cohen (supra n. 5) 489, n. 2.

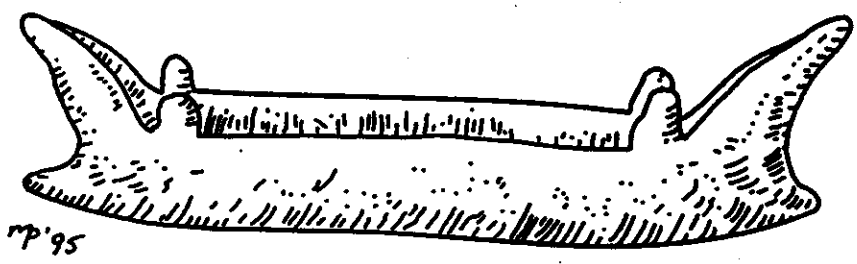

Fig. 1. Clay boat model from Mochlos, Crete (c. 3100-2600 B.C.). (After Casson, 1971, fig. 54)

There are also the Cycladic "frying pan" vessels (fig. 2) from the Early Bronze Age. These watercraft have a very distinctive shape. One end terminates in a high vertical post topped by a fish ensign, while the other end is horizontal with a small projection.[7] There has been much debate over which end of these vessels is the bow and which is the stern. Currently, scholars lean towards the vertical end being the bow, since the fish ensign would then be pointing forward. Yet in the past some scholars have claimed the horizontal end to be the bow, and point to the small horizontal projection at that end as being a ram.[8]

In order to clear up some of the confusion surrounding the ram's introduction, Cohen devised a set of guidelines to help identify which bow structures depicted in the iconography were in all probability rams. Cohen offered the following criteria:

(1) The ram is placed at the waterline.
(2) The ram necessarily projects a substantial distance, in order to protect the bows of the ship.
(3) The prow is of massive construction to withstand the impact of ramming.
(4) The ornament on the prow is bent sternward (otherwise it would be snapped off in collision).[9]

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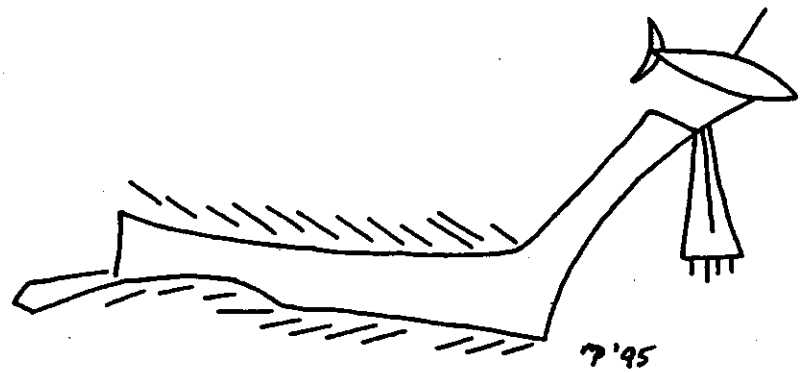
[7] J. E. Coleman, "'Frying Pans' of the Early Bronze Age Aegean," *AJA* 89 (1985) 198.

[8] S. Marinatos, "La marine créto-mycénienne," *BCH* 57 (1933) 183; Cohen (supra n. 5) 486-94.

[9] Cohen (supra n. 5) 487.



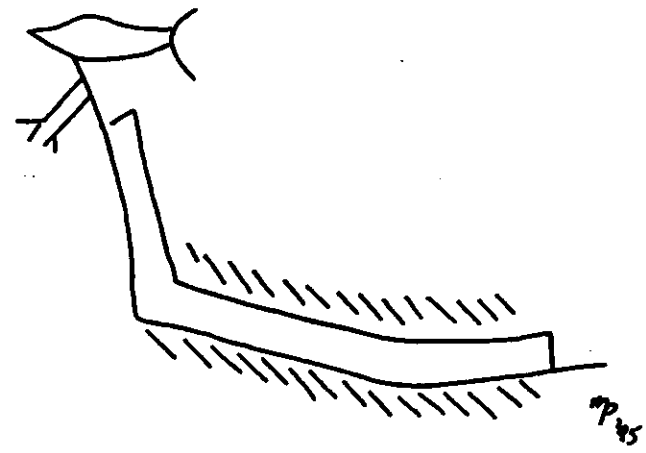


Fig. 2. Cycladic "Frying Pan" vessels (3rd millennium B.C.).
(After Basch, 1987, fig. 168)

Utilizing these criteria one can see that the many bow projections that appear in Bronze Age ship representations were probably not waterline rams. However, if these structures were not rams, what function could they have served? They were probably forefoots or gripes which protected the joint between the lower hull timbers and stem, and/or cutwaters which aided the ship in holding its course through the water.[10] Yet, it was out of these existing structures that the ram developed.[11]

A consensus among scholars has emerged that in the Mediterranean the primary naval ram was introduced sometime between 1200 and 850 B.C. The upper time limit or *terminus post quem* corresponds to the approximate date of a documented naval engagement between the forces of Ramesses III of Egypt and ships of the Sea Peoples,[12] while the lower limit or *terminus ante quem* corresponds to the approximate date of the earliest definitive waterline ram representation (fig. 3).

A graphic depiction of the naval battle between the Egyptians and the Sea Peoples survives.[13] The depiction was carved in relief upon

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[10] F. H. van Doorninck, Jr., "Protogeometric Longships and the Introduction of the Ram," *IJNA* 11 (1982) 283.

[11] Basch (supra n. 6) 150-1; J. S. Morrison, "The Classical Traditions," in B. Greenhill, ed., *Archaeology of the Boat* (Middleton, Connecticut 1976) 158; K. DeVries and M. J. Katzev, "Greek, Etruscan and Phoenician Ships and Shipping," in G. F. Bass, ed., *A History of Seafaring Based on Underwater Archaeology* (New York and London 1972) 42.

[12] N. K. Sandars, *The Sea Peoples* (London 1978) 117-31.

[13] This is not, however, the earliest depiction of a naval battle; that distinction goes to a scene found on the handle of the Gebel el-Arak knife, which was found in Egypt and dated to the Late Gerzean

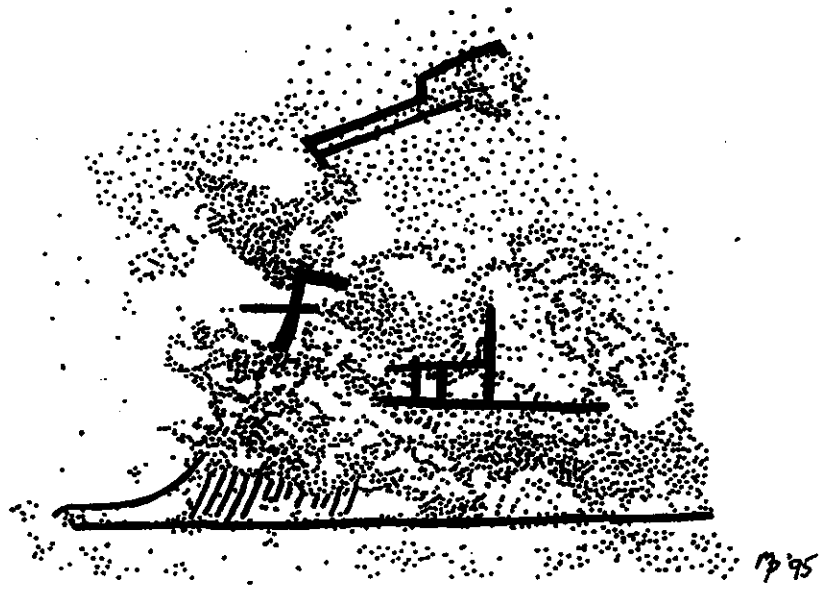

Fig. 3. Earliest known ram representation (c. 850 B.C.).
(After van Doorninck, 1982, fig. 7)

Ramesses III's mortuary temple at Medinet Habu.[14] The naval-battle relief (there was a corresponding land engagement depicted as well) documents an important episode of Ramesses' reign. In spite of the biased nature of the surviving account in favor of the victorious Egyptians who recorded the event and the stylized nature of Egyptian art, valuable information can still be obtained from the relief.

The naval-battle relief depicts four Egyptian ships engaging five ships of the Sea Peoples. The bows of the Egyptian ships have an upward sweep due to their rockered hulls, and they are capped by large figureheads in the form of the head of a lioness eating the head of an Asiatic (fig. 4A). Although the waterlines are not represented, comparison of the height of the Egyptian ships to that of the Sea Peoples' ships suggests the Egyptian figureheads were well above the water. The bows of the Sea Peoples' ships, on the other hand, are shown with vertical posts topped by large bird-head devices (fig. 4B).

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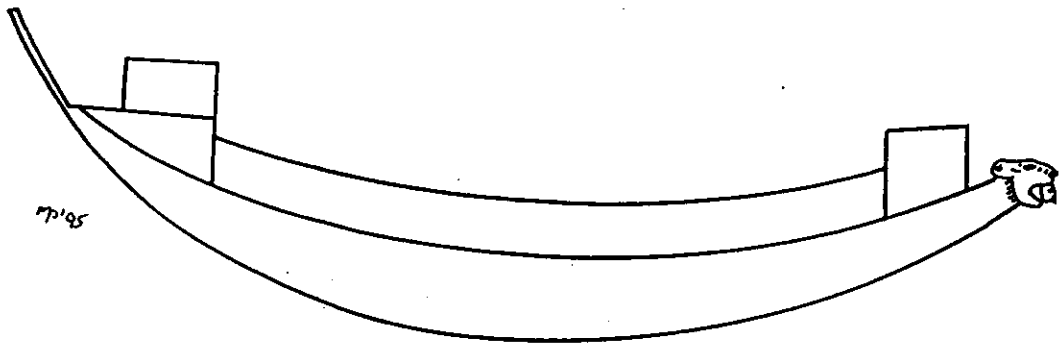
period (3200-3100 B.C.). The carving shows soldiers fighting between ships, but it does not depict ships being used as weapons against other vessels. The ships involved have strongly rockered hulls, with no evidence of any bow projections. The ships are simply acting as mobile fighting platforms: G. F. Bass, ed., *A History of Seafaring Based on Underwater Archaeology* (New York and London 1972) 26, fig. 5.

[14] The reliefs are recorded in H. H. Nelson, *Medinet Habu: Earlier Historical Records of Ramses III*, vol. 1 (Chicago 1930), while the accompanying texts can be found in W. F. Edgerton and J. A. Wilson, *Historical Records of Ramses III: The Texts in Medinet Habu* (Chicago 1936) and J. B. Pritchard, ed., *Ancient Near Eastern Texts: Relating to the Old Testament* (3rd ed., Princeton 1969) 262-63.

A



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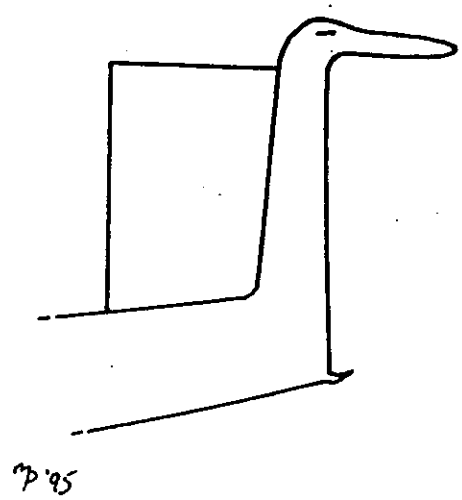

C

Fig. 4. Ship types depicted on Medinet Habu relief (c. 1200 B.C.).
(After Wachsmann, 1981, figs. 3 and 4)
A. Sea Peoples' ship
B. Egyptian ship
C. Detail of Sea Peoples' ship's stern

The Egyptian ships depicted on the Medinet Habu relief have been cited as evidence for the ram. In discussing the Egyptian ships, Marx wrote:

> ...they would smash through the side-screens protecting the rowers, if they were in the right position they would probably knock the mast out of the ship; but then they would ride up on the deck of the enemy, possibly smashing his gunwale as the deeper and wider part of the charging ship followed on, but more often pushing the nearer gunwale under water and so either crushing the ship underneath them or turning the enemy right over.[15]

However, it is important to note that Marx's scenario is not borne out by what is depicted on the relief.[16] Even though one of the Sea Peoples' ships is shown capsized, this was brought about through the use of grappling irons wielded by some of the Egyptian attackers.[17] The Egyptian ships are only being used as floating fighting platforms. There is no evidence for the waterline ram or its employment anywhere on the Medinet Habu relief.[18]

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[15] E. Marx, "The First Recorded Sea Battle," *MM* 32 (1946) 249.

[16] It is strange that Gibson thought that, even though the ram was not present at the battle, ramming tactics were still employed: C. E. Gibson, "The Origin of the Ram," *MM* 33 (1947) 164.

[17] H. H. Nelson, "The Naval Battle Pictured at Medinet Habu," *JNES* 2 (1943) 53.

[18] The bow structure on the Egyptian ships may have served as a boarding ram given the structure's height above the water and that several Egyptian soldiers are shown standing atop the projection.

The texts accompanying the relief specifically state that the Egyptians sent warships, as opposed to cargo or merchant ships, against the northern invaders.[19] These were vessels whose function was to take part in battles at sea and not simply serve as troop transports. Yet, these warships do not have rams, a weapon which would have been well-suited to just such a situation, so that their absence suggests the naval ram either did not yet exist or at best did not yet play any kind of significant role in naval warfare within the ancient world.

Turning to the ships of the Sea Peoples, two of them have hook-like projections at the base of their sternposts (fig. 4C). (Although the ships of the Sea Peoples are symmetrical in appearance, their sterns can be identified by the location of the steering oars.) The size, shape, and location of these projections all show that this feature is not a waterline ram.[20] The location of these projections may indicate that they served to protect the joint between the sternpost and bottom hull timbers, possibly a keel or a keel-plank. Such protection would be needed if the vessel was beached stern-first, a common practice in the ancient world.[21]

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[19] Edgerton and Wilson (supra n. 14) 54, n. 20b.

[20] Yadin claimed that the bird-head devices topping both the stem and sternposts could serve as "battering instruments". However, there is no evidence to support such a claim: Y. Yadin, *The Art of War in Biblical Lands in the Light of Archaeological Discovery* (London 1963) 341.

[21] *Iliad* 15.704, 716-17, 729.

One must also take into consideration how the Sea Peoples used their ships when attempting to determine the presence or absence of the waterline ram. The Sea Peoples' common tactic was to sail to a coastal town, but then to attack the town on foot. Their ships would simply act as transports for soldiers and their spoils, and were not intended to fight at sea. Thus, given how the Sea Peoples utilized their ships, one would not expect to see them equipped with waterline rams.

The lower time limit for the ram's introduction corresponds to the earliest known representation of a primary naval ram (fig. 3), a representation that satisfies Cohen's four criteria. This representation is found on a catchplate to a bronze fibula recovered from a burial at the Kerameikos cemetery in Athens, Greece. On the basis of the pottery found with the catchplate, it can be firmly dated to the Early Geometric II - Middle Geometric I periods, or approximately 850 B.C.[22]

Thus, at some point within the 350 years between the battle depicted in the Medinet Habu relief and the Kerameikos fibula ship representation, conditions were conducive in the Mediterranean for the introduction of the naval ram. Casson has suggested that the ram's introduction was related to attempts to control piracy.[23] The Sea Peoples are a prime example of the

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[22] van Doorninck (supra n. 10) 283-84.

[23] S. Wachsmann, "The Ships of the Sea Peoples," *IJNA* 10 (1981) 217.

type of waterborne threat facing people in the eastern Mediterranean at the beginning of the twelfth century.[24] By mounting waterline rams on ships, one could have confronted enemies before they landed or even entered one's territorial waters. Thus, Rodgers wrote that, "the encounter of man against man is the decisive thing in land warfare; but in war afloat the sea is always ready to drown the fighters, and so the attack on ship material may be as fatal as the direct attack upon life."[25] As yet, however, there is no evidence that waterline rams were mounted on ships toward the end of the Late Bronze Age.

With the information currently available, it is not possible to state with any assurance where or by whom the ram was invented.[26] The political and economic conditions in Greece at the end of the tenth and first half of the ninth century B.C. were perhaps suited to the ram's introduction.[27] Greece was emerging from the so-called "Dark Age". This was a time of economic

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[24] Piracy was a continuous problem in the Mediterranean throughout antiquity: H. A. Ormerod, *Piracy in the Ancient World* (New York 1987) 13; Thuc. 1.5.1-3.

[25] W. L. Rodgers, *Greek and Roman Naval Warfare* (Annapolis 1964) 6.

[26] Pliny the Elder attributed the ram's invention to an Etruscan named Piseaus. Piseaus was the son of Tyrrhenus, the eponymous founder of Etruria in northern Italy. However, one must consider the fact that Pliny was writing in the middle of the first century A.D., well over eight centuries after the ram's appearance in the iconography: Pliny the Elder, *Nat. Hist.* 7.56.209; J. W. Hagy, "800 Years of Etruscan Ships," *IJNA* 15 (1986) 226.

[27] van Doorninck (supra n. 10) 285; J. N. Coldstream, *Greek Geometric Pottery* (London 1968) 342-43.

revival and expansion outside of the Aegean.[28] Goods, particularly luxury items and materials, and ideas were being transported to and from the eastern Mediterranean. Along with this exchange one sees the reemergence of class stratification.[29] However, this increased activity came at a price and necessitated other changes. In general, one sees a reluctance for people to settle along the coast.[30] The expanded economic activity surely caused an increase in piracy to feed on the new shipping lanes and growing commerce.

However, in looking for ram origins, one cannot rule out the Phoenicians, who were already well known for their shipbuilding and seafaring prowess, so that they may have been the first to see the potential of such a weapon. Although Egyptian ship construction techniques may not have been entirely suitable for developing the waterline ram, one cannot completely rule the Egyptians out, since they did possess an organized navy, that is a fleet of ships used for military purposes and under military control, with "warships" at the close of the New Kingdom.[31]

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[28] Coldstream (supra n. 27) 332, 335.

[29] It is from this period that the first "rich" graves begin to appear at Athens: A. M. Snodgrass, *The Dark Age of Greece* (Edinburgh 1971) 43, 330, 333, 414.

[30] Coldstream (supra n. 27) 336; Snodgrass (supra n. 29) 413.

[31] The first clear indications for a military-controlled navy may be found during the reign of Amenophis II (1427-1401 B.C.), a pharaoh of the eighteenth dynasty. Records from this period show that the head stablemaster of the army's chariotry was made "Admiral of the Fleet": E. Linder, "Warfare in the El-Amarna Age," *Colston Papers* 23 (1971) 318.

Unfortunately, one is hindered in this search by the lack of appropriate ship representations, as well as suitable textual sources from this period. Some cultures, such as the Phoenician, did not depict their ships.[32] There is also the problem that there are no scenes of ships actually ramming from the Geometric period or earlier. The one possible exception may be found on a Geometric vase fragment where the ram of one ship is extremely close to the stern of another vessel (fig. 5).[33]

One must also take into consideration the possibility that different groups were responsible for different aspects of the naval ram's development. For example, Greek shipwrights may have developed the necessary hull form and construction techniques, but it might have been the Phoenicians who adapted the hull form with its forefoot and/or cutwater, capping it with a bronze ram.

The organizational mechanisms required for the successful development and deployment of the naval ram cannot be over stressed. Several requirements needed to be met and maintained for the naval ram to become a viable weapon. First, there were technological factors. A warship equipped with a waterline ram needed to be designed and constructed in such a manner as to withstand the stresses of ramming. As

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[32] Casson (supra n. 2) 58.

[33] G. Ahlberg, *Fighting on Land and Sea in Greek Geometric Art* (Stockholm 1971) 26.

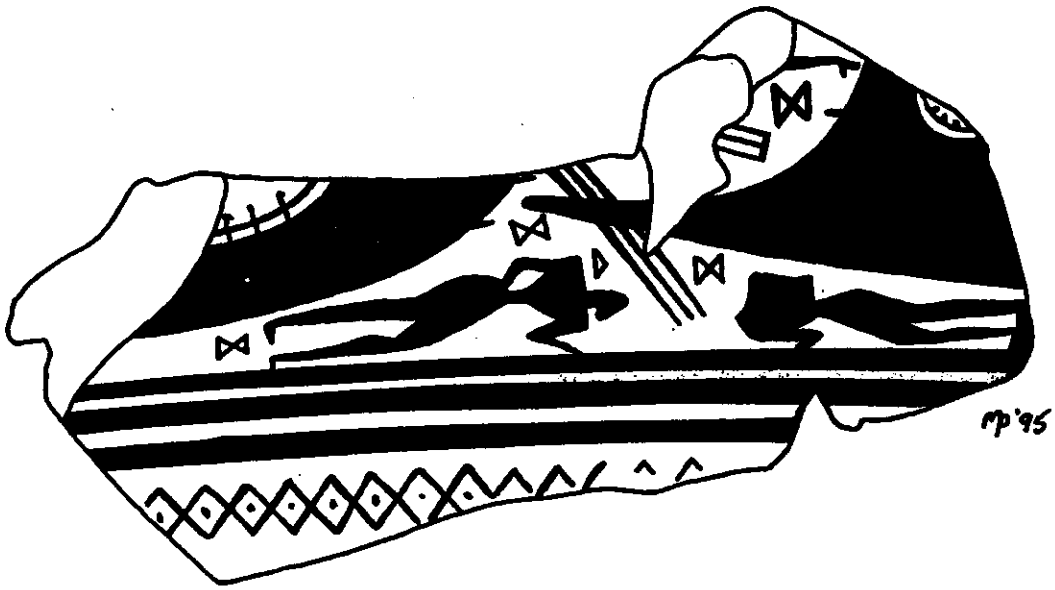

Fig. 5. Possible ramming scene (c. 760-735 B.C.).
(After Morrison and Williams, 1968, pl. 2B)

one will see, it was a ship's keel and wales which played an important role toward this end. This particular point may have ruled out the ram's introduction in the Bronze Age, even though the palace-based communities of the Aegean had the general organization apparatuses needed.[34]

However, several other factors may have prohibited the naval ram's development in the Bronze Age. There were additional technological considerations concerning the manufacture of the actual rams. The necessary metal-working skills and equipment may not have even been available until the Late Bronze Age.[35] There is also the feature from which the waterline ram developed: the cutwater. Our earliest evidence for ships with cutwaters occurs in the Aegean, but not until the twelfth century B.C.;[36] perhaps such ships came into being too late for the ram to be developed prior to the disasters at the end of the Late Bronze Age.

Another limiting factor in developing a navy with ram-equipped warships is population. Because the naval ram is a fleet weapon, large numbers of trained men would have been needed to make up the warship

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[34] The Uluburun wreck (14th century B.C.) found off the southern Turkish coast has only a keel-plank and not a deep keel, that is not to say that the keel-plank was not a functioning keel, but that it does not have the dimensions necessary for ramming: C. Pulak, "The Shipwreck at Uluburun: 1993 Excavation Campaign," *The INA Newsletter* 20.4 (1993) 8.

[35] K. Branigan, *Aegean Metalwork of the Early and Middle Bronze Age* (Oxford 1974) 68.

[36] The earliest representations of ships equipped with cutwaters date to 1200-1100 B.C. These representations include a ship depicted on a clay box found at Pylos and a ship drawn on a vase fragment, both of which are Mycenaean: Casson (supra n. 2) figs. 28 and 29.

crews. Thus, the waterline ram could not have been introduced during the Dark Age due to the lack of required population levels. Once the necessary human resources existed, they must also be trained. This is another important organizational factor. The warship crews needed to be able to control a warship under combat conditions, properly executing and recovering from ramming maneuvers.[37]

[37] It is not until the Ionian Revolt (499-94 B.C.), well after the ram's introduction, that mention is made of training warship crews: Hdt. 6.11-12.

PRIMARY RAM DEVELOPMENT

The primary waterline ram took on three distinct forms in over a thousand years of use. The first rams were pointed, as can be seen in the earliest known ram depiction, along with other early representations (figs. 3, 5, 6). Pointed rams would have been extremely effective at holing an enemy ship's hull. However, there were several drawbacks associated with this pointed shape, some of which could be fatal to an attacking ship and its crew. Since a pointed ram was meant to penetrate an enemy ship's hull, there was the chance of an attacking ship becoming stuck after delivering a ramming blow. Such an event would expose an entangled ship to attack from other vessels, or by soldiers stationed on board the rammed ship.

There was also the possibility of a pointed ram bending or having its tip broken off. This is exactly what is recorded in the earliest literary reference to rams being used in battle. Herodotus described a battle which took place in the Straits of Sardinia off Alalia in 535 B.C. This engagement was fought between the Phocaeans and a combined force from Carthage and Tyrrhenia. After the battle the Phocaeans had twenty ships which "were useless, their rams being twisted awry."[38]

[38] Hdt. 1.166.

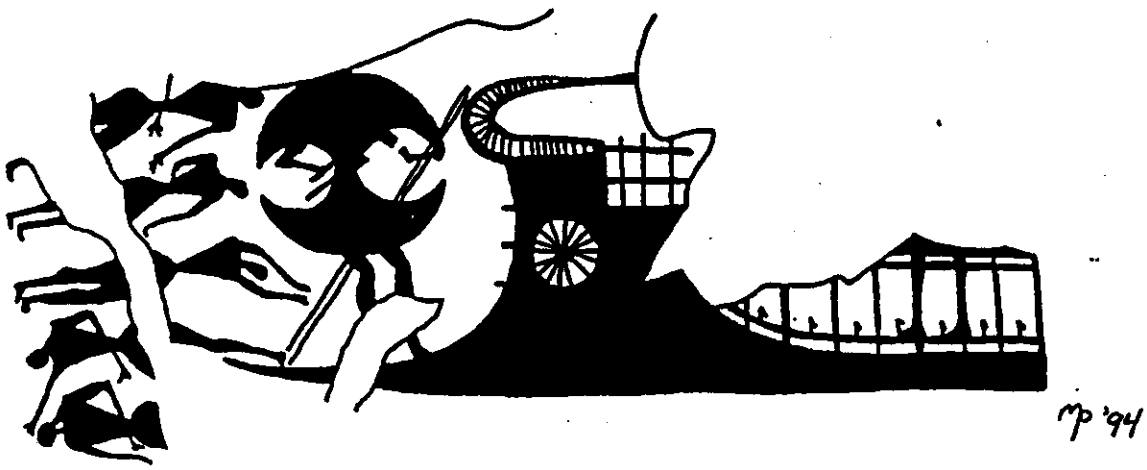

Fig. 6. Ship equipped with pointed ram (c. 760-735 B.C.).
(After Morrison and Williams, 1968, pl. 1E)

A new style of waterline ram was introduced at the end of the seventh century B.C.[39] The blunt-ended ram was introduced, undoubtedly in hopes of solving some of the problems associated with the pointed ram. By enlarging the ramming head, the chances of penetrating an enemy ship's hull were reduced, though not totally eliminated. Another passage from Herodotus provides evidence that problems still occurred. In describing the Battle of Salamis of 480 B.C., Herodotus wrote that, "Aminias of Pallene, an Athenian, pushed out to the front and charged a ship, which being entangled with his, and the two not able to be parted, the others did now come to Aminias' aid and joined battle."[40]

A distinguishing characteristic of the blunt-ended ram was that it took on the appearance of a boar's head (fig. 7).[41] Frost suggested that the

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[39] L. Casson and E. Linder, "The Evolution in Shape of the Ancient Ram," in L. Casson and J. R. Steffy, eds., *The Athlit Ram* (College Station, Texas 1991) 68.

[40] Hdt. 8.84.

[41] The boar was repeatedly used as a decorative element in Greek art. No representations of boars can be found in or before the Protogeometric period, and boars are seen only twice in the Geometric period. Boar representations are more often seen in the Archaic period on black and red figure pottery, usually associated with hunting scenes. However, representations of boars were used to decorate objects other than pottery. For example, there is a bronze Corinthian helmet recovered from the Giglio wreck (c. 600 B.C.) off Italy that has a boar prominently depicted on either cheek piece: Coldstream (supra n. 27) 208; R. M. Cook, *Greek Painted Pottery* (London 1960) 55; J. Boardman, *Athenian Black Figure Vases* (London 1974) 43, 118; J. Boardman, *Athenian Red Figure Vases of the Archaic Period* (London 1975) 149; H. Payne, *Necrocorinthian: A Study of Corinthian Art in the Archaic Period* (Oxford 1931) 70; G. M. A. Richter, *Attic Red-Figured Vases: A Survey* (New Haven 1946) 98; M. Bound, "Early Observations of the Construction of the Pre-Classical Wreck at Campese Bay, Island of Giglio: Clues to the Vessel's Nationality," in S. McGrail and E. Kentley, eds., *Sewn Plank Boats*, BAR International Series 276 (Greenwich 1985) 49; M. Bound, "The Search for the Giglio Wreck: Part I," *Minerva* 1 (1990) 5-6.

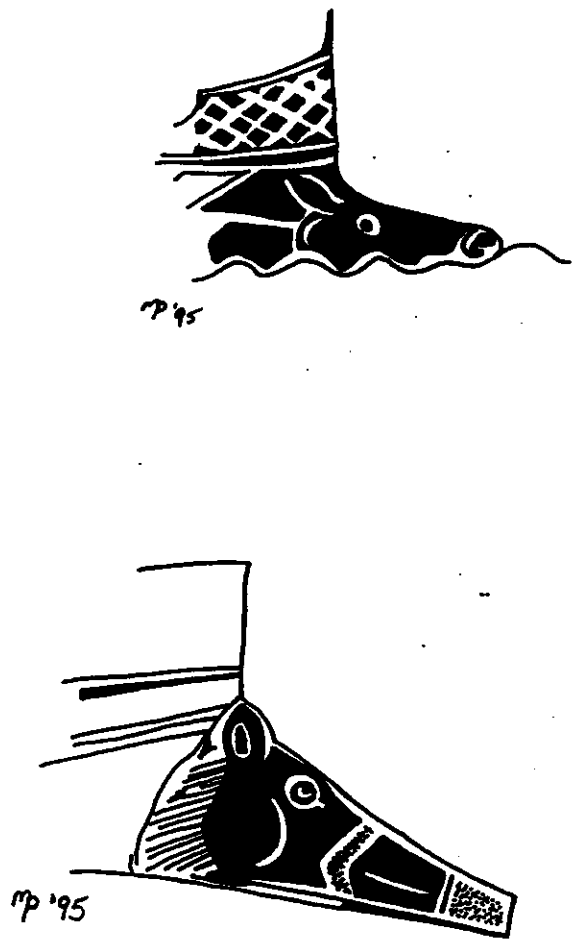

Fig. 7. Ships equipped with boar's head ram (mid-6th century B.C.).
(After Basch, 1987, figs. 440B and 472)

boar's head configuration of blunt-ended rams was symbolic of an actual boar attack. Just as "a boar's tusks attack the soft underbelly of his prey," a blunt-ended ram penetrated an enemy ship's hull.[42] It is also interesting that contemporary battering rams from Assyria are very similar to blunt-ended rams in both ramming-head design and decorative motifs (fig. 8).[43] This may show that contemporaneous battering and naval rams sometimes shared both design and constructional features.

The third style of primary ram was the three-finned ram.[44] Three-finned rams first appear in the iconographic record at the end of the fifth century B.C.[45] The earliest representation is found on a coin from Cyprus (fig. 9), although a marble stele of similar date also depicts a three-finned ram.[46] From the iconography, the overall appearance of the three-finned ram is somewhat misleading as it is most often represented from a side view. In these cases, the ram is often shown simply as a trident. The form can be seen more clearly in some of the actual examples which have been

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[42] H. Frost, "Another Punic Wreck in Sicily: Its Ram. 2. The Ram from Marsala," *IJNA* 4 (1975) 227.

[43] Yadin (supra n. 20) 400-01.

[44] Casson sites two examples of a two-pronged ram type which preceded the three-fin form. However, neither of these representations is clear enough to be conclusive: Casson (supra n. 2) 85, n. 41.

[45] Basch (supra n. 6) 206; Casson and Linder (supra n. 39) 68.

[46] Basch (supra n. 6) fig. 8; Basch (supra n. 4) fig. 633.

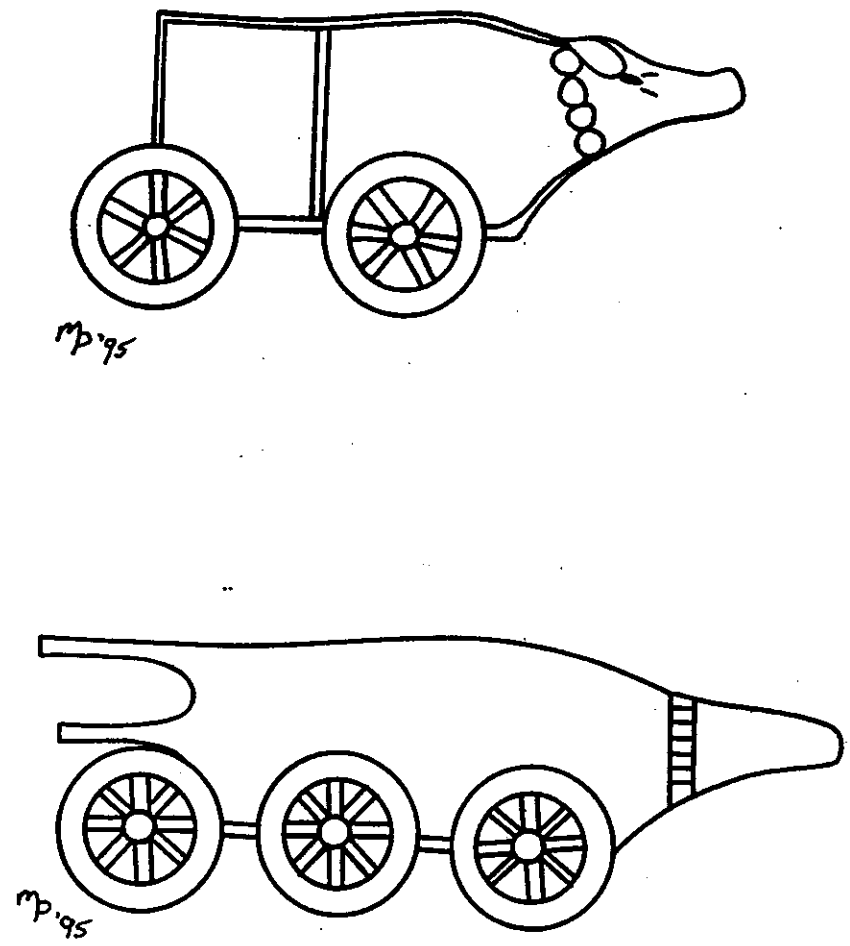

Fig. 8. Assyrian battering rams from Gates of Shalmaneser III (c. 858-24 B.C.). (After Yadin, 1963, p. 401)

Fig. 9. Earliest known representation of three-finned ram on a coin from Cyprus (end 5th century B.C.). (After Basch, 1987, fig. 582)

recovered (see pp. 50-98). One can see that it consists of three horizontal fins bisected by a vertical post.

Just as the blunt-ended ram was introduced to overcome some of the problems associated with pointed rams, the three-finned ram was developed to improve upon blunt-ended rams. The three-finned ram combined the best attributes of both earlier ram types. The three thin, horizontal fins concentrated the force of the ramming blow into small areas like a pointed ram. However, the large rectangular area of the ramming head helped prevent the three-finned ram from penetrating an enemy ship's hull as far as would a pointed or even a blunt-ended ram.[47]

The three-finned ram first appears in the iconography during a pivotal time with respect to the size and design of warships. In the first years of the fourth century B.C., warships larger than triremes make their first appearance.[48] These larger ship classes allowed more soldiers to be carried on their decks and also shipboard artillery pieces to play a significant role in naval warfare for the first time. These vessels would have been of heavier construction in order to support the increased weight of crew and

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[47] Polybius described the Battle of Chios in 201 B.C. where a Rhodian quinquereme's ram broke off after delivering a ramming blow, thus showing the problem still occurred: Polybius 16.5.2.

[48] Carthage is credited with building the first quadriremes, while Dionysius of Syracuse is believed to have had the first quinqueremes constructed around 399 B.C.: Casson (supra n. 2) 97; J. S. Morrison, "Hellenistic Oared Warships 399-31 B.C.," in R. Gardiner, ed., *The Age of the Galley: Mediterranean Oared Vessels Since Pre-Classical Times* (Annapolis 1995) 68-71; Pliny, *Nat. Hist.* 7.207; Diodorus 14.41.3, 14.42.2, 14.44.7.

weaponry. Thus, these larger ship types may have brought into being a new weapon with which to attack them. The efficient design of the three-finned ramming head might have been needed to damage these behemoths effectively.

Changes in ram design would also have led to different battle tactics. Each successive ram design would have allowed warship captains to become more aggressive. Because the odds had decreased that a ramming ship would become caught by the hull of an enemy ship, warship captains could look to delivering more ramming blows.

Ancient texts record that there were specific ramming maneuvers, the most famous of which were the *diekplous* and *periplous*. The *diekplous* involved ships "breaking through" an enemy line, while the *periplous* involved a ship or ships "sailing around" an enemy line.[49] Either maneuver set up an attack on the enemy's rear, although an attacking ship executing a *diekplous* could also look to sweep away the oars of an enemy ship while going through the enemy line.[50]

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[49] J. S. Morrison and J. F. Coates, *The Athenian Trireme: The History and Reconstruction of an Ancient Greek Warship* (Cambridge 1986) 43; J. S. Morrison and R. T. Williams, *Greek Oared Ships 900-322 B.C.* (Cambridge 1968) 338; Hdt. 6.11-12.

[50] Morrison contends that a *diekplous* involved a column of ships breaking through an enemy line at a particular point. However, Shaw has shown that this need not be the case and that single ships could simultaneously attack at several points along an enemy line: J. S. Morrison, "The Trireme," in R. Gardiner, ed., *The Age of the Galley: Mediterranean Oared Vessels Since Pre-Classical Times* (Annapolis 1995) 60; T. Shaw, ed., *The Trireme Project* (Oxford 1993) 102-03.

Even with the introduction of a new ram design, the previous ram types would still have seen use in a transitional period. Thus, one sees blunt-ended rams still appearing in the iconography with three-finned rams in the fourth century B.C.[51] Three-finned rams are still seen in the iconography up through the first century A.D., but they were themselves replaced by a new group of blunt-ended rams, although these no longer resembled boar's heads.[52]

The design of naval rams changed once again around the second century A.D. This change is first seen on the warships depicted on Trajan's column. These vessels (fig. 10) no longer have horizontal waterline rams but up-curving waterline rams. Examples of this ram type are rare, but warship representations as a whole become scarce in the first millennium A.D.[53] The upturned waterline ram is still seen in the iconography up to the fifth century A.D.[54]

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[51] Casson and Linder (supra n. 39) 68-9.

[52] A three-finned ram is still seen on a Roman frieze dated to the beginning of the second century A.D. However, this frieze likely records rams and other equipment from an earlier period, namely those items taken as spoils of war at the Battle of Actium in 31 B.C. Thus, these items do not necessarily represent types still in use in the second century A.D.: Basch (supra n. 4) fig. 928.

[53] Basch (supra n. 6) 213-16.

[54] Warships with this type of ram are represented in a fifth century A.D. manuscript of Virgil's *Aeneid*. This is also the earliest known depiction of a dromon: J. H. Pryor, "From Dromon to Galea: Mediterranean Bireme Galleys A.D. 500-1300," in R. Gardiner, ed., *The Age of the Galley: Mediterranean Oared Vessels Since Pre-Classical Times* (Annapolis 1995) 102.

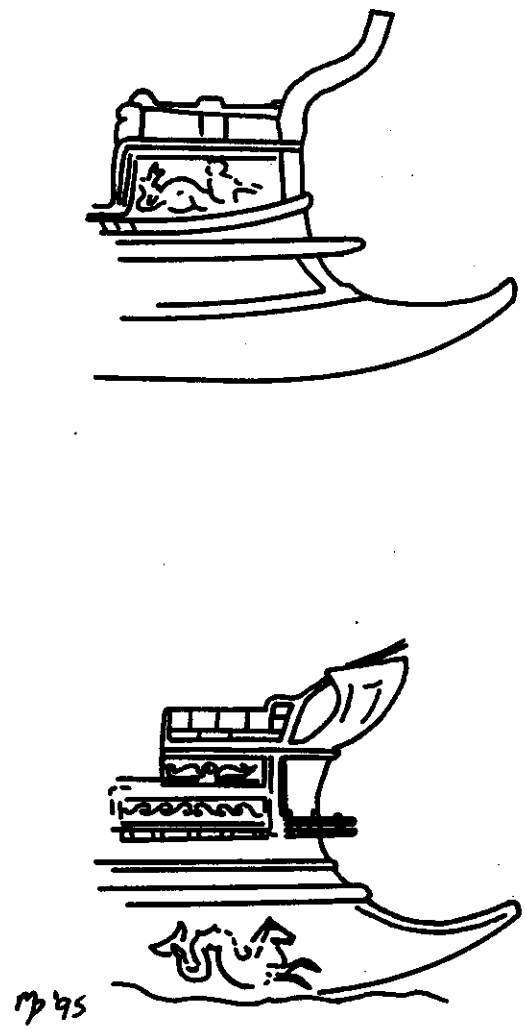

Fig. 10. Ships depicted on Trajan's column (2nd century A.D.). (After Basch, 1983, fig. 10)

The upturned waterline ram is associated with the liburnian. The liburnian developed from a type of light galley called a *lembos*, which was used by groups of Dalmatian pirates. The liburnian was used as both a reconnaissance and combat vessel, and it was during the Imperial period that it formed the core of the provincial fleets.[55] That the liburnian with its upturned ram developed from a pirate vessel may show that this particular ram design served a special purpose. Pirates were not looking to sink ships, but to disable and capture them for what was onboard. The upturned ram may have been designed to strike and grab hold of an enemy vessel.[56] Thus, when the two ships were locked together, the pirates could more easily transfer people and materials between the two vessels.

Clearly the representations of upturned projections show that such a ram existed. Ancient authors specifically state that the liburnian was equipped with a ram, although how functional its shape was is hard to determine.[57] If the curvature of the ram was too great, the head of the ram would snap off when used, because the force of the ramming blow could not be adequately transferred to the warship's hull. There would also have

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[55] Appian 5.103; Casson (supra n. 2) 141-42; F. Hocker, "Late Roman, Byzantine, and Islamic Galleys and Fleets," in R. Gardiner, ed., *The Age of the Galley: Mediterranean Oared Vessels since Pre-Classical Times* (Annapolis 1995) 88.

[56] Personal communication, Dr. F. H. van Doorninck, Jr., September 1995.

[57] Pliny, *Nat. Hist.* 10.63; Propertius 3.11.44.

been the task of separating the two ships once the engagement was completed, if this design was in fact meant to hold onto an enemy vessel.

It has been suggested that the three-finned ram was no longer needed as an offensive weapon beginning in the first century A.D. because the Romans were virtually unopposed on the sea. Even so, a ram was still the distinguishing feature of a warship. It may have been the case that the skill and money needed to manufacture three-finned rams did not make them a viable "peacetime" weapon, but it is equally clear that there were changes taking place in naval warfare, and hence the naval ram's role, even though ramming with the aim of sinking enemy vessels was still practiced up through the sixth century A.D.[58]

The latest literary reference to a naval battle in which ramming was employed can be found in Procopius. In the Battle of Sena Gallica, which took place in A.D. 551 off the east coast of Italy, the Romans used ramming attacks against the Goths.[59] Claims have been made that ramming continued thereafter to be employed into the Byzantine period. These claims cite a passage from Leo VI's naval manual *Tactica*.[60] However,

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[58] Casson and Linder (supra n. 39) 69.

[59] Procopius, *Wars* 8.23.31, 34.

[60] R. Dolley, "The Warships of the Later Roman Empire," *JRS* 38 (1948) 49.

van Doorninck has clearly shown that this passage can just as easily describe a maneuver which does not require a ram.[61]

The abandonment of the waterline ram as a weapon in the medieval period may coincide with the changes taking place with respect to ship construction. There is a transition from shell-first construction, where the strength of the hull resides in the numerous mortise and tenon joints, to frame-first construction, where the strakes are simply nailed to pre-erected frames, and it is the frames, keel, and keelson which provide the hull's strength.[62] Frame-first construction would have been ill suited to distribute the shock of a ramming blow.[63]

Warship representations are absent for much of the first millennium A.D., particularly its second half. When representations of warships reappear in the twelfth century A.D., the ships no longer have waterline rams. These vessels (fig. 11) still have large bow projections, but they are now positioned at deck level: the waterline ram has given way to the boarding ram. With the disappearance of the waterline ram, naval battles were once again decided by hand-to-hand fighting between soldiers

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[61] F. H. van Doorninck, Jr., "Did Tenth-Century Dromons Have a Waterline Ram? Another Look at Leo, *Tactica*, XIX, 69," *MM* 79 (1993) 387-92.

[62] J. R. Steffy, *Wooden Ship Building and the Interpretation of Shipwrecks* (College Station 1994) 83-85.

[63] Hocker (supra n. 55) 99.

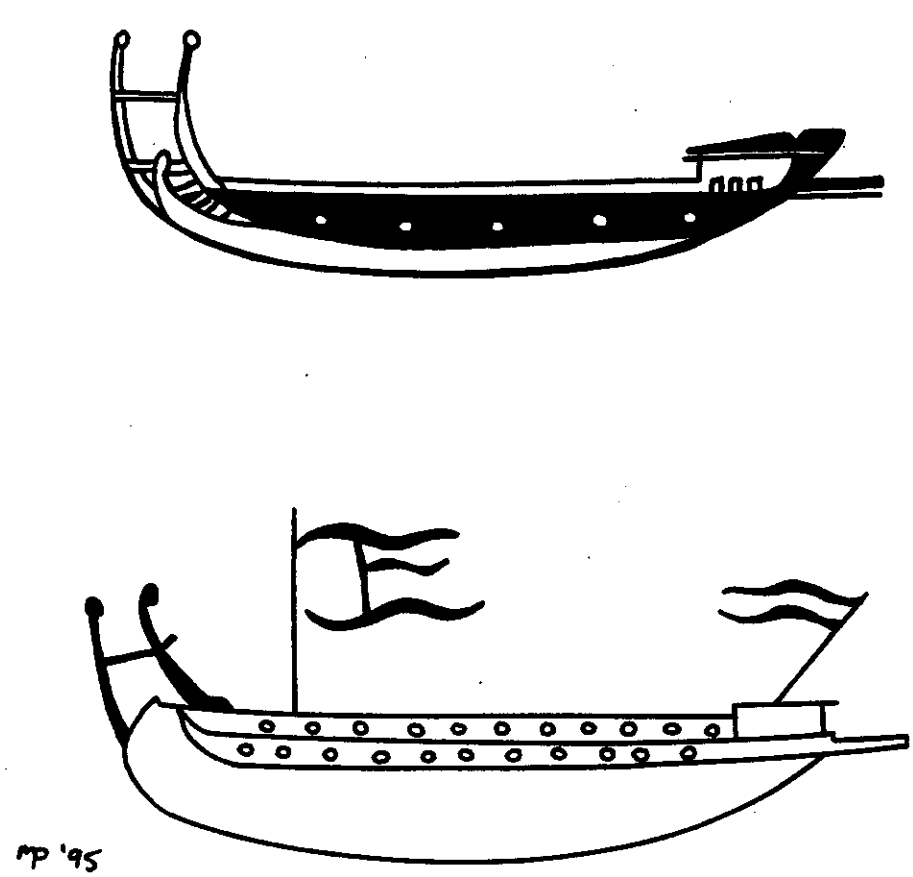

Fig. 11. Warships equipped with boarding ram (12th century A.D.).
(After Anderson, 1962, fig. 11)

stationed onboard the warships. The boarding ram, very reminiscent of the *corvus* employed by the Romans,[64] allowed the easy transfer of soldiers between ships.[65]

Even in its early years of use, the primary ram consisted of a metal sheathing, typically bronze, around a wooden core. This can clearly be seen in an early ram depiction on a fresco from the Assyrian palace of Til-Barsib dated to 745-727 B.C. One sees a distinct color difference between the wooden hull and the metal ram.[66] Further evidence is found in a relief from the palace of Sennacherib dated to around 700 B.C. In this case two vertical lines mark the extent of the metal sheathing.[67] There are also literary references to rams being made of bronze. In his play *The Persians*,

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[64] The *corvus* or "raven" was developed by the Romans for use against the Carthaginians. The *corvus* consisted of a platform, with a large spike at the end, suspended from a post on the bow of a warship. When an enemy vessel was close enough, the platform would be dropped and the spike would securely hold the enemy ship in place so that it could not disengage. The attacking soldiers could then proceed across the bridge created by the *corvus*. This device allowed the Romans to take advantage of their excellent foot soldiers during a naval battle: Casson (supra n. 2) 121, n. 85; Polybius 1.22; H. Wallinga, *The Boarding-Bridge of the Romans* (Groningen 1956).

[65] A wreck recently discovered near Marsala, Sicily reportedly carries an iron ram. The construction technique seen in the surviving timbers suggests the ship is from the medieval or post-medieval period, though a more detailed study is in order before too many conclusions are made. The exact form of the ram is unclear from the published photographs. If the vessel is from such a late period, one would not expect to see a waterline ram, but a boarding ram: E. Riccardi, "An Ancient Warship Near Marsala, Sicily," in M. Bound, ed., *Archaeology of Ships of War* (Oxford 1995) 19-21.

[66] The color difference can be seen quite clearly in Bass (supra n. 13) 56, fig. 9, and also in F. Thureau-Dangin and M. Durand, *Til-Barsib* (Paris 1936).

One must be leery of Basch's reconstruction of the Til-Barsib ship. He has incorrectly shown the ram as three-finned. Unfortunately, the fresco is damaged in the area of the ram's tip: Basch (supra n. 6) fig. 20; Basch (supra n. 4) fig. 649.

[67] Casson (supra n. 2) fig. 76.

Aeschylus in describing the Battle of Salamis states, "warships struck their brazen beaks," with "bronze jaws gaping."[68]

Torr attempted to estimate the weight of a trireme ram using inscriptions recovered from the Athenian naval yards.[69] These particular inscriptions date to the second half of the fourth century B.C. Torr concluded that the average trireme ram weighed just 77 kg (170 lbs). Because this weight seemed low to Torr, he concluded the ancient naval ram could only consist of an outer sheathing and not be solid metal, a point borne out by the actual rams discovered since Torr's initial publication.[70] However, in light of new inscriptions unavailable to Torr, Murray has recalculated the weight of a trireme ram to have been 216 kg (476 lbs).[71]

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[68] Aeschylus, *Persians* 408, 415.

[69] Records were kept of a ship's equipment, which included the ship's ram. The ship's trierarch (financial backer) was responsible for this equipment, which had to be returned to the yard when a ship returned to port. Even if the ship was lost in combat or a storm while on patrol, the trierarch was still held responsible for returning the ram or monetarily compensating the yard for the loss: *IG* II^2 1629.841-43, 1623.6-13; B. Jordan, *The Athenian Navy in the Classical Period* (Berkeley 1975) 67-69.

[70] C. Torr, *Ancient Ships* (Cambridge 1895; 2nd ed., Chicago 1964) 63-4, n. 144.

[71] W. M. Murray, "The Weight of Trireme Rams and the Price of Bronze in Fourth Century Athens," *GRBS* 26 (1985) 143-44, 149.

SECONDARY RAM DEVELOPMENT

In addition to their primary waterline ram, ancient warships might also be equipped with secondary rams or *proembolia*. The Greek word *proembolion* simply means a forward projection. Secondary rams took the form of one or more smaller rams positioned above the primary ram, but below the bow ornament on a warship's stem.

Secondary rams were placed at the ends of wales, as were primary rams, a fact that is repeatedly demonstrated in the iconography.[72] The thickness and length of a ship's wales made them ideal for this job. The force of a ramming blow could be transferred and absorbed along the wale's length. As warships grew progressively larger, the number of wales would also have increased to provide more strength to a heavier hull. Thus, Torr wrote that, "there was probably an extra (secondary) ram for every extra pair of waling-pieces."[73]

Parallels to secondary rams may once again be made with land-based battering rams. A bronze battering ram (fig. 12) dedicated to Zeus and recovered from the Olympia sanctuary in Greece shows how the ram was fitted to a rectangular timber (like the structure formed by joining the ends

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[72] Casson (supra n. 2) figs. 107, 115, 125, 129.

[73] Torr (supra n. 70) 63.

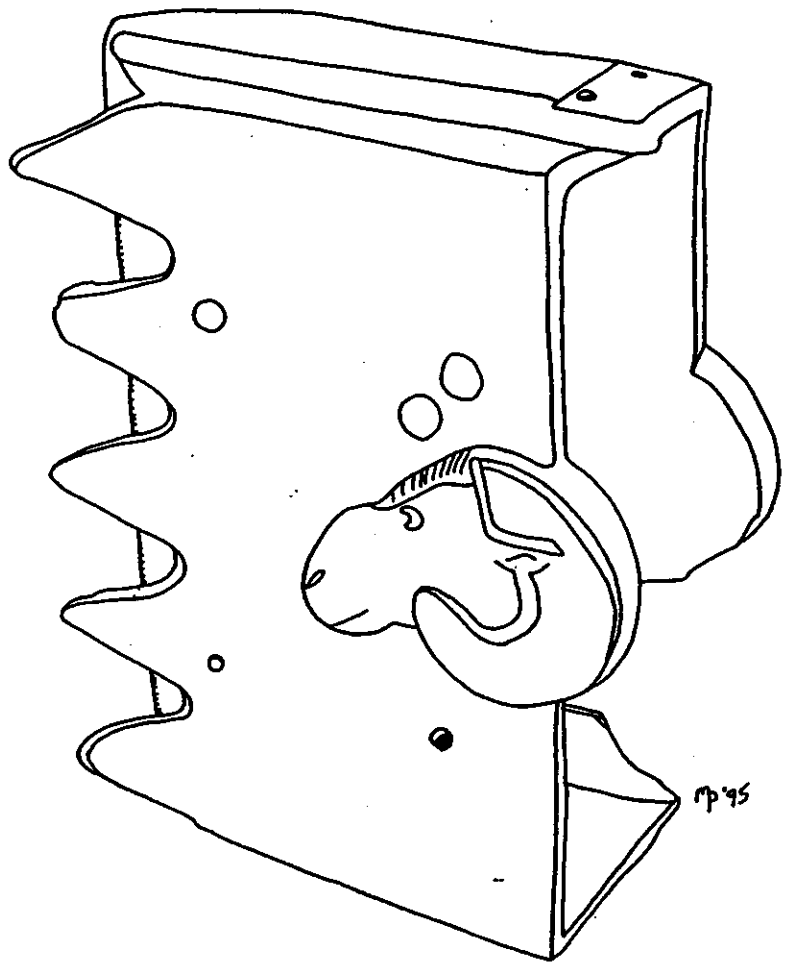

Fig. 12. Bronze battering ram (1st half 5th century B.C.). (After Ducrey, 1985, fig. 120)

of two projecting wales) and then secured with several bronze nails. This particular battering ram dates to the first half of the fifth century B.C.[74]

What function did secondary rams serve? Torr believed that *proembolia* served to extend the damage caused by a primary ram.[75] Torr's description envisions a crack extending up the side of the rammed vessel. However, except for the pointed ram, blunt-ended and three-finned rams were more likely to open up the seams of an enemy ship.[76] The height of secondary rams with respect to the water would suggest they were not used to penetrate a hull with the intent of swamping or sinking an enemy vessel.

The first definitive *proembolia* appear in the iconography around the second half of the eighth century B.C., approximately one century after the earliest definitive primary ram representation.[77] Some of these first *proembolia* exhibit very unusual shapes, while others are simply pointed (fig. 13A, B). These "odd" forms are only seen in combination with pointed primary rams. Their shape may have been functional in that they acted to

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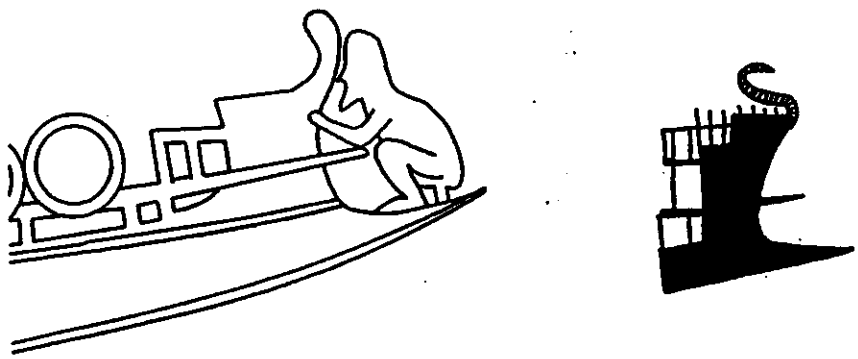
[74] P. Ducrey, *Warfare in Ancient Greece*, trans. J. Lloyd (New York 1985) 170.

[75] Torr (supra n. 70) 63.

[76] J. R. Steffy, "The Ram and Bow Timbers: A Structural Interpretation," in L. Casson and J. R. Steffy, eds., *The Athlit Ram* (College Station 1991) 38.

[77] Some form of bow projection may already be present on the earliest ram representation (fig. 3). Basch's reconstruction of this ship representation shows one, possibly two, projections above the primary ram (fig. 14). However, the engraving shows considerable damage in the area of the ship's bow, hindering any reconstruction.

A



B

Fig. 13. Early examples of secondary rams.
A. "Other" (After Basch, 1987, figs. 398, 395, 323)
B. Pointed (After Pridemore, 1995, fig. 2 and Basch, 1987, fig. 328)

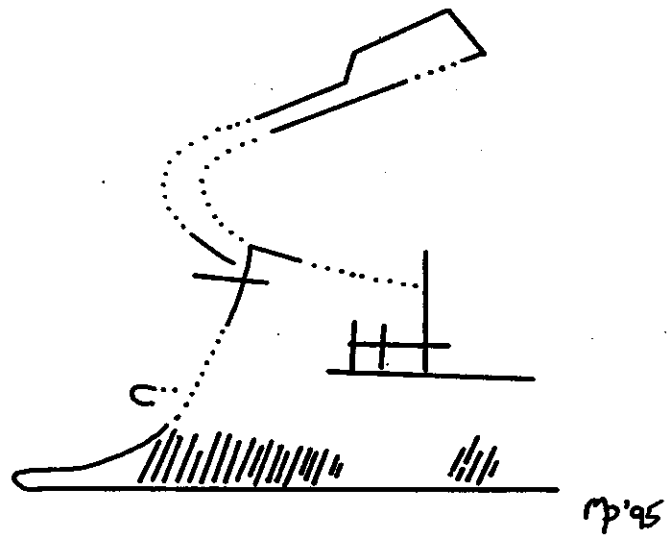


Fig. 14. Basch's reconstruction of earliest ram representation.
(After Basch, 1987, fig. 402)

limit the penetration of the primary ram.[78] The length of the *proembolion* would establish a maximum penetration distance for the waterline ram.

The fact that these designs are not found on the earliest vessels with pointed waterline rams suggests they were added to cope with some situation encountered with this early ram type. Possibly too many warships were getting stuck after ramming, and instead of changing the shape of the primary ram, an existing structure, namely an upper pair of projecting wales, was modified to deal with the problem.[79]

Secondary rams are absent from representations of warships with blunt-ended rams. This is not surprising considering the role secondary rams likely played with pointed primary rams. Since a blunt-ended ram was less likely to penetrate an enemy hull, a *proembolion* would not have been needed to limit primary ram penetration.

The same could also be said for warships equipped with three-finned rams. Yet the reappearance of secondary rams just prior to the Hellenistic period shows that they again served some function. Secondary rams could still have served to protect a warship's stem if primary ram penetration occurred, but they may have served a new purpose. Given the general level

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[78] R. C. Anderson, *Oared Fighting Ships* (London 1962) 20.

[79] Basch thought that Phoenician ships lacked secondary rams because they lacked wales. To make up for the absence of wales, and hence *proembolia*, their primary rams were made longer to absorb all of the ramming blow, and to protect the vessel's stem, since the ram would never penetrate its entire length: L. Basch, "Phoenician Oared Ships," *MM* 55 (1969) 156.

of *proembolia* in the hull, they may have been targeted against an enemy ship's outrigger (*parexeiresia*). On a trireme, for example, the outrigger supported the upper (thranite) bank of oars, providing these oars with a pivot point.[80]

In looking at ancient warship representations, one must be careful about which projections are designated secondary rams. Identification problems similar to those encountered for primary rams exist for *proembolia* as well. For a projection to be a functional *proembolion*, it must be long enough to strike an enemy hull during ramming. For example, Late Geometric I period (760-735 B.C.) (fig. 15A) and early Archaic period (700-650 B.C.) (fig. 15B) ships show several small stem projections. However, given their meager length, these projections could not have been functional *proembolia*, although they too were formed by extending the ship's wales. In these cases, these features are just structural elements of the hull and not weapons.

After the reappearance of secondary rams in the fourth century B.C., the secondary ram type displays several different designs. Some *proembolia* are blunt-ended, while there is also evidence for three-finned secondary

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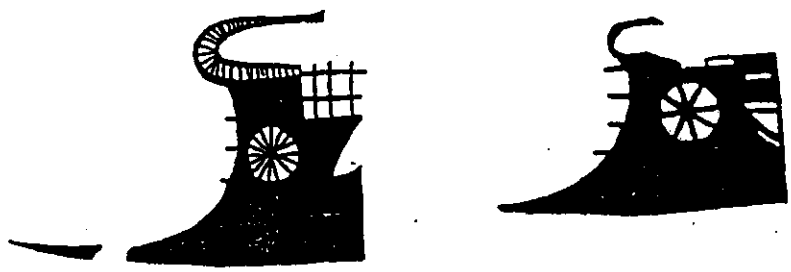
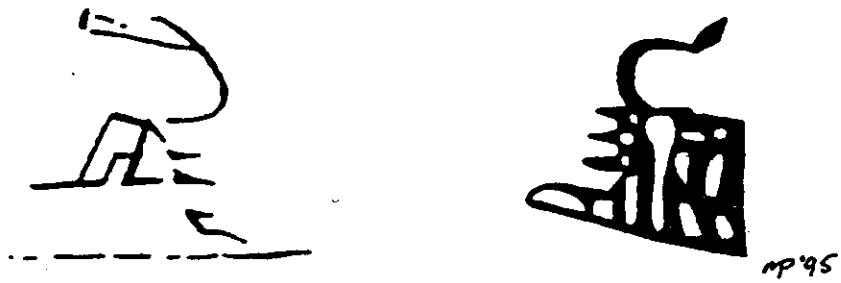
[80] Morrison and Coates (supra n. 49) 212.

From sea trials on the reconstructed trireme *Olympia*, it was found that the thranite oarsmen had the best view of the oars, so that they were better able to set the stroke for their rowing "triad". Thus, any damage to the outrigger would have affected the thranite's stroke, which in turn would have affected the strokes of the other rowers: P. Lipke, "Trials of the Trireme," *Archaeology* 41.2 (1988) 27.



A



B

Fig. 15. Multiple projections on warship bows.
A. Late Geometric I period (c. 760-735 B.C.).
(After Morrison and Williams, 1968, pls. 1E and 2C)
B. Early Archaic period (c. 700-650 B.C.).
(After Basch, 1987, figs. 403A and 408)

rams.[81] One of the more dramatic changes to take place with regard to secondary rams is a change to zoomorphic shapes. A representation of a zoomorphic *proembolion* appears to exist from the third century B.C. (fig. 16).[82] In this case the projection differs from earlier *proembolia* in that it contains a protrusion atop the projection and a rounded end, probably representing an animal's ear and snout respectively. Zoomorphic *proembolia* are still present up until the second century A.D.[83] In each case there is only ever one *proembolion* present, possibly because zoomorphic *proembolia* were larger than more conventional ram shapes and there was only so much space available on a warship's stem.

Just as primary rams were made of bronze, so were secondary rams. This point can be verified through several different sources. First, there are the physical examples that have been recovered, but there is also written evidence. Several inscriptions dating to 374/3 B.C. describe how groups of captured ships were found that had, "not even the upper bronze piece."[84] These inscriptions led Casson to believe that primary rams consisted of two

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[81] A three-finned secondary ram is seen on a marble monument at Cyrene in Libya: Basch (supra n. 4) 391, fig. 816.

[82] There may be an example of a zoomorphic secondary ram from the fourth century B.C.: Basch (supra n. 4) fig. 634.

[83] Basch (supra n. 4) figs. 930-31.

[84] *IG* II^2 1606.27, 32, 89.

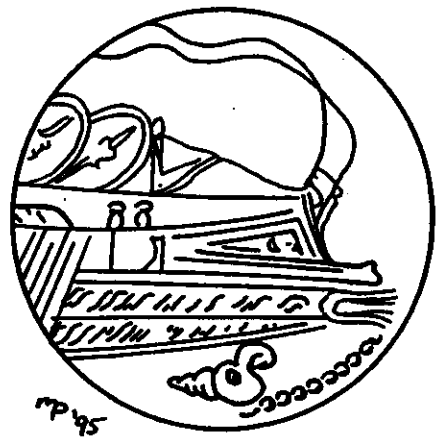

Fig. 16. Earliest definitive zoomorphic *proembolion* (3rd century B.C.). (After Basch, 1987, fig. 746)

pieces, an upper and a lower piece.[85] Yet these passages clearly refer to secondary rams and not to primary rams.

Another inscription dating to 353/2 B.C. records how the *Eueteria* "had no fore-ram" when it returned to port and an inventory was taken of the ship's equipment.[86] The fact that the "fore-ram" (προεμβόλιον) was part of the ship's inventory meant that it was probably more than just a wooden structure. A warship captain's responsibility for returning the vessel's bronze primary ram must have extended to secondary rams as well.

[85] Casson (supra n. 2) 85, n. 43.

[86] *IG* II^2 1614.27-30.

EXTANT RAMS

Having examined the development of both primary and secondary rams, let us now turn to the actual examples that have been discovered. Unfortunately for naval-ram scholars, only five rams are currently available for study.[87] Two of these examples are primary rams, while two are considered secondary rams. The fifth example has previously been classified as a primary ram, but as one will see this hypothesis is problematic.

For each of the five rams, certain basic information will be given. Where possible, provenience data will be supplied, followed by a general description of the ram. Particular attention will be paid to the method of attachment and the ornamentation. Finally, information on the dating and classification of each piece will be presented.

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[87] A sixth example of a waterline ram is now thought to exist on a wreck found off the coast of Sicily (see n. 65). However, the published photographs are unclear as the actual form of the "ram": Riccardi (supra n. 65) 19-21.

A seventh example has just recently come to light. Reportedly found somewhere off the coast of Greece, the ram is three-finned and appears to be slightly larger than the Bremerhaven ram discussed below. The ram does not have a cowl but it does have a bottom plate. It is damaged with the upper starboard fin being severely bent, possibly due to a collision. Instead of a trident design on the side of the ram, the fins are shown as sword blades, a design seen from the third century B.C. to first century A.D. in the iconography: Personal communication, Dr. Fred Hocker, October 1995; Basch (supra n. 4) figs. 816-7.

Athlit Ram

In November of 1980 a remarkable discovery was made off the coast of Athlit, Israel (fig. 17). A scientific diver conducting an underwater survey came across the remains of a large bronze ram.[88] This discovery has since become known as the Athlit ram, and it is by far the largest and most impressive example of a ram yet found.[89] Further searches conducted in the area in which the ram was found revealed no additional material. Because the Athlit ram has been extensively studied and published, only a brief description will be presented here.

The Athlit ram is a single piece of cast bronze weighing 426 kg. The ram consists of three basic components which Steffy refers to as "functional areas". These three main areas include the driving center or main ram body, the cowl, and the bottom plate (fig. 18 and 19).[90]

From the ramming head to the end of the tailpiece, the Athlit ram measures 2.26 m in length. Its maximum height, measured to the forward

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[88] E. Linder and Y. Ramon, "A Bronze Ram from the Sea of Athlit, Israel," *Archaeology* 34.6 (1981) 62.

[89] Figure 18 is a scale drawing of the ram, while Fig. 19 depicts the various parts of the ram with their appropriate labels.

[90] Steffy (supra n. 76) 12.

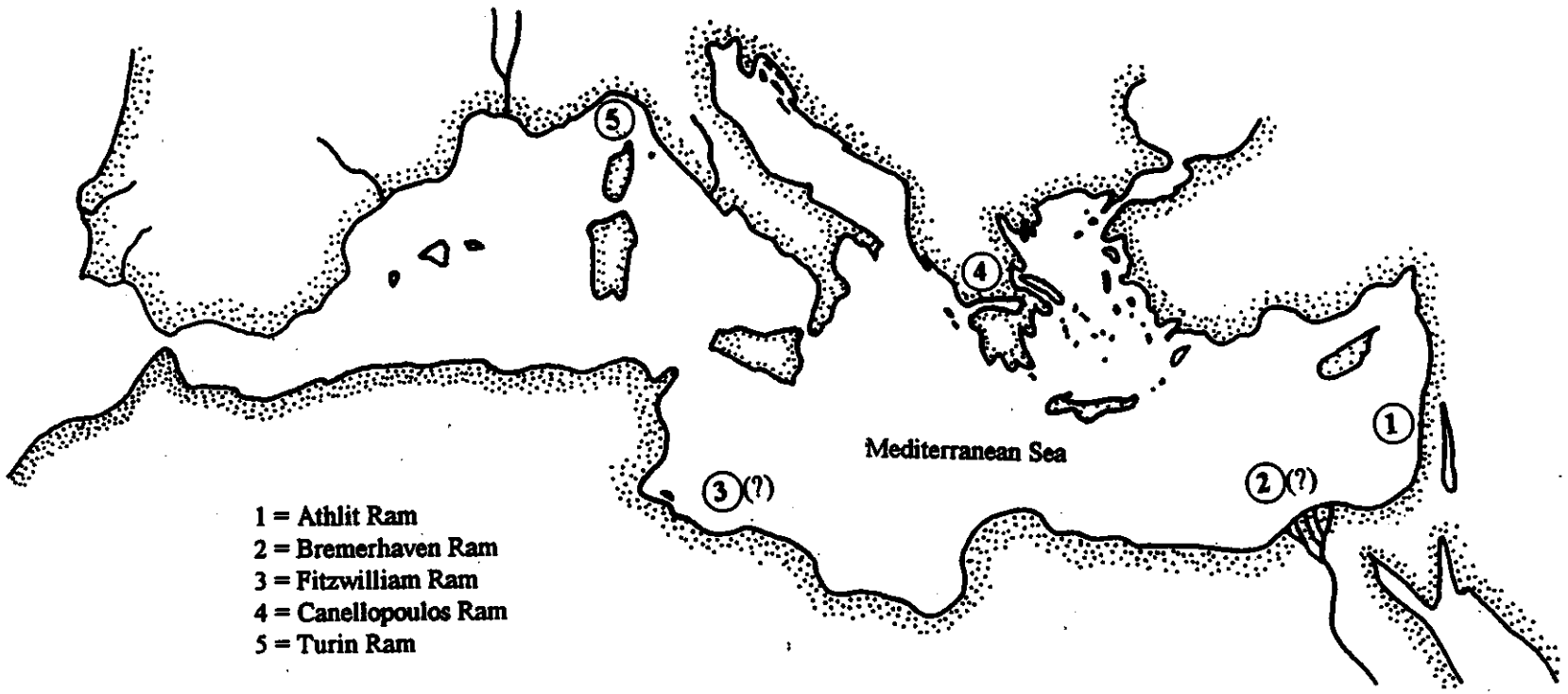

Fig. 17. Map of ram find-spots. (Drawing by M. Pridemore)

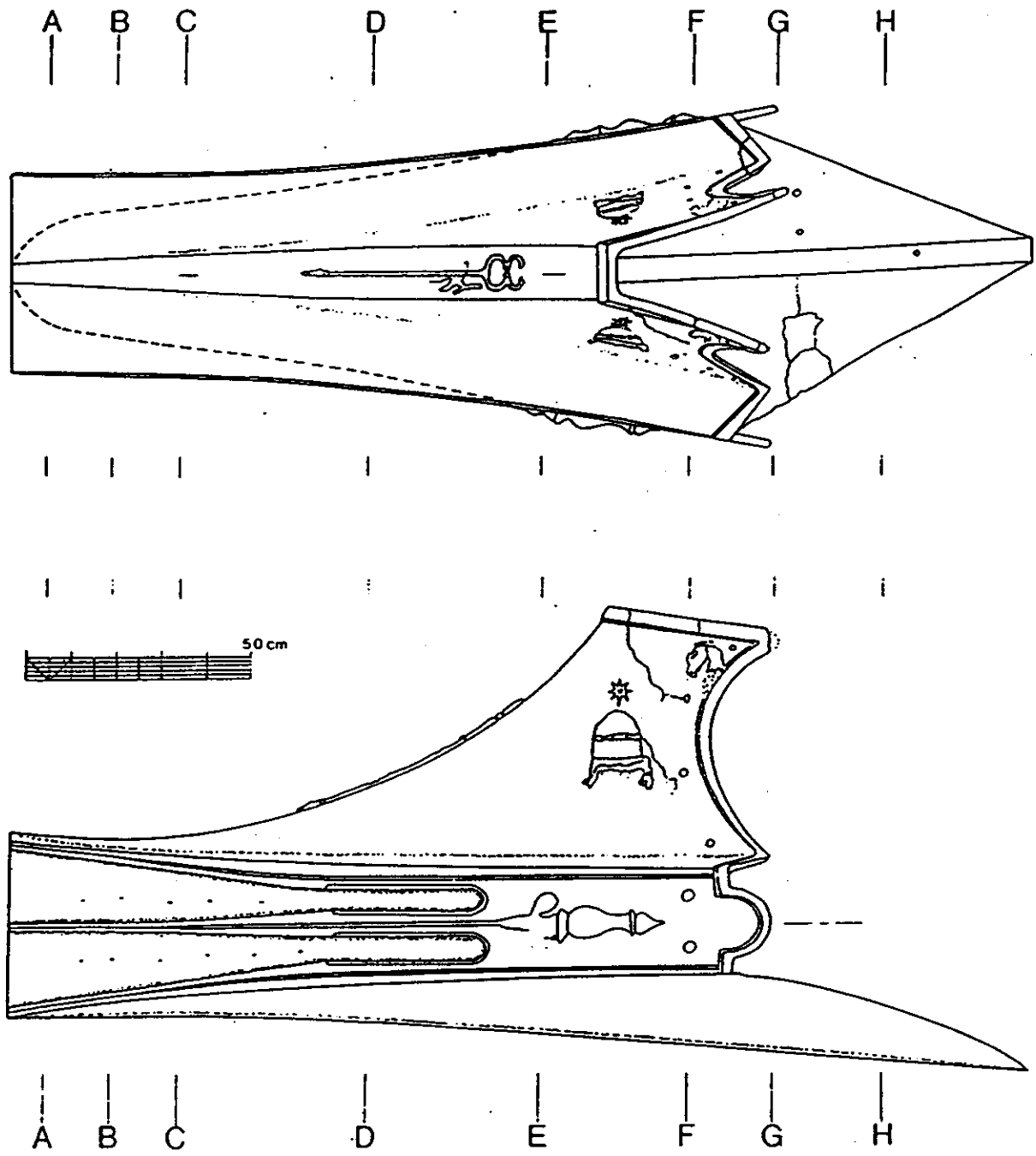

Fig. 18. Athlit ram. (Drawing courtesy of J.R. Steffy)

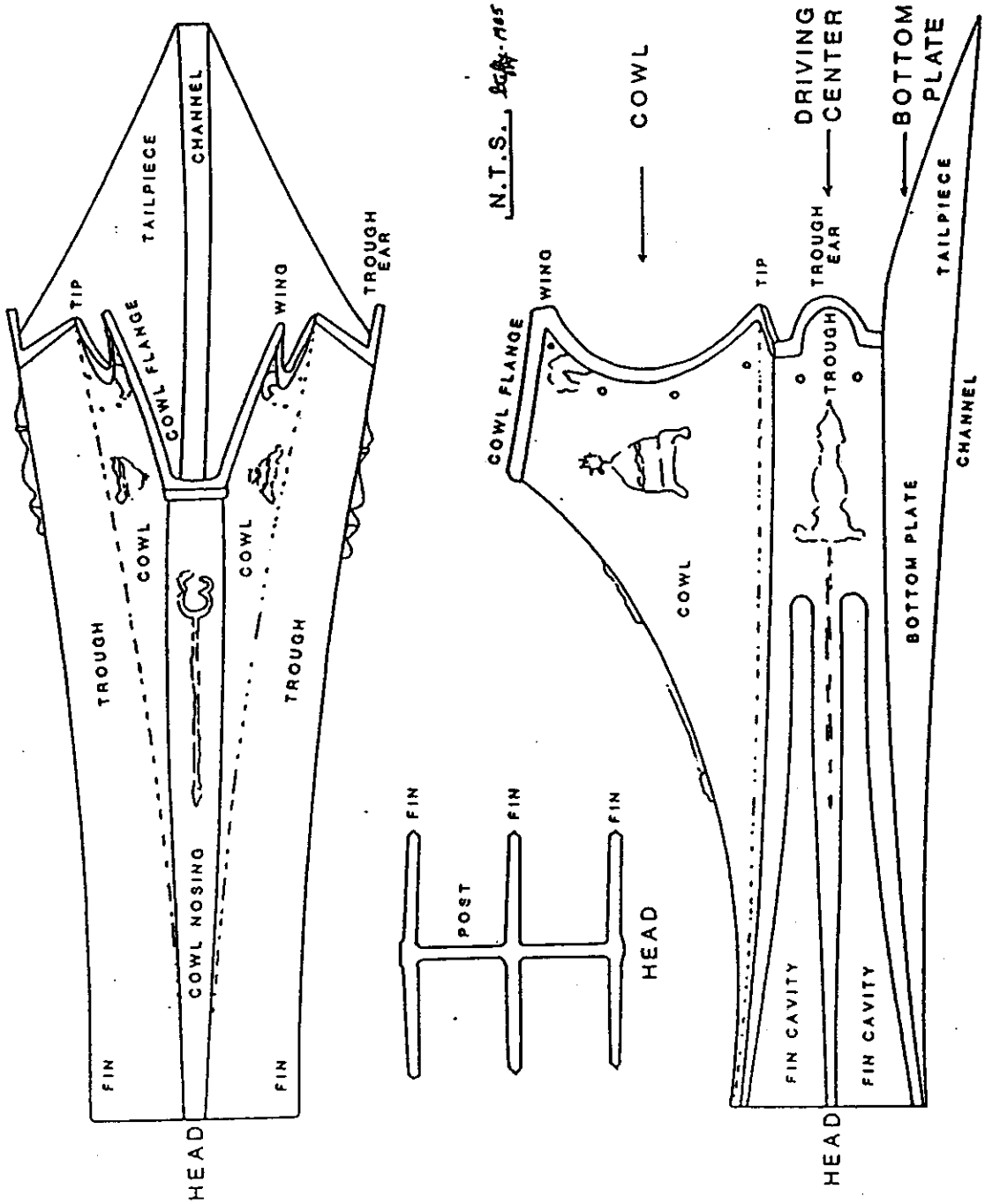

Fig. 19. Identification of Athlit ram parts. (Drawing courtesy of J.R. Steffy)

end of the cowl flange, is 0.95 m, while it has a maximum width of 0.76 m. The thickness of the metal varies throughout the ram from 0.7 to 1.0 cm.

We will first look at the ram's main body or driving center. The driving center contained the main horizontal timbers of the warship's bow and was the focus of a ramming blow. It consists of the ramming head along with troughs on either side which accepted a pair of the ship's wales. The driving center measures 1.7 m in length and at its after end is 0.30 m high and 0.76 m wide. The interior of the driving center is hollow and is 1.6 m deep.

The ramming head consists of three horizontal fins bisected by a vertical post (fig. 19). It has a maximum width of 44.2 cm and a maximum height of 41.1 cm. The head thus has an area of just over 0.18 m^2. Each of the three fins is solid metal for the forwardmost 30 cm, ending with tips which are 2.0 cm thick.[91]

Located directly above the driving center is the cowl. The cowl is 0.54 m high and flares out from behind the ramming head. It served to protect the lower section of the ship's stem, along with other upper bow timbers. The cowl also bears the majority of the ram's decoration cast onto its surface. The ornamentation will be discussed in more detail below.

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[91] Steffy (supra n. 76) 11-12.

Located below the main ram body is the bottom plate. This plate protected the lower bow timbers just as the cowl protected the upper bow timbers. The bottom plate is 2.26 m long and has a maximum width of 0.68 m at the after end of the tailpiece. The tailpiece is the aftermost section of the bottom plate, and it protected the forward end of the ship's keel. Running along the interior of the tailpiece is a central channel, which accepted the ship's keel. This channel is 6.5 cm wide at its after end and averages 1.2 cm in depth.[92]

The Athlit ram was fastened to the warship's bow with a series of bronze bolts. Two bolts were located along the after edge of either trough on the driving center, although only one bolt survives. This bolt has a head that is 2.5 cm in diameter and a shaft 1.5 cm in diameter. It had been driven through a hole measuring 1.6 cm in diameter. Four additional bolts of the same size as those used in the troughs were placed on either side of the cowl along its after edge.

There were also four nails or bolts along the bottom plate, although each of the holes for these bolts has concreted shut. Two bolts were located along the central channel, while two were found on the starboard side of the tailpiece. Similar bolts probably existed originally on the port side of the tailpiece, but the area in which one would expect to find these

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[92] Steffy (supra n. 76) 13.

bolts was repaired in antiquity, and there is now no evidence of any bolts in this area. There are also six holes in each of the hollows between the ram's fins. The exact function of these holes is not clear, although it is possible that they were also nail holes.[93]

Overall, the Athlit ram is well preserved. It is dull green in color, but appears stable with respect to bronze disease.[94] It does, however, show signs of both damage and repairs made in antiquity. For example, the lower part of the port decorative handle along with part of the port cowl wing are missing. Various bronze patches were used to repair the ram. One such patch appears on the port side of the cowl near the helmet decoration. A crack extending from this same patch had also been welded shut in antiquity. Similar patches and welds were found on the port side of the tailpiece in the area of the suspected bolts.[95]

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[93] The holes found in the hollows of the fins are probably associated with the casting mould, though they may then have been reused when securing the ram to the bow timbers: Steffy (supra n. 76) 12-14, 32.

[94] The ram does show some signs of bronze disease, but it is not considered a serious problem at this time: J. R. Steffy, "The Athlit Ram: A Preliminary Investigation of Its Structure," *MM* 69 (1983) 234.

Bronze disease develops when the copper corrosion products of a bronze object react with water and oxygen. The resulting products include copper chloride and hydrochloric acid. The production of hydrochloric acid produces a self-sustaining process. The condition is characterized by the presence of small, loose, pale green crystals. If the object is left untreated extreme damage, including disintegration, can occur: J. M. Cronyn, *The Elements of Archaeological Conservation* (London 1990) 226-27.

[95] Steffy (supra n. 76) 15.

The discovery of the Athlit ram was of special importance not only because it expanded the meager data set on naval rams, but also due to what was preserved within the ram's bronze casing. A total of sixteen separate timbers were found within the ram (figs. 20 and 21). Unfortunately, these timbers give just a brief glimpse of warship bow construction, acting only to pique the curiosity of naval scholars.[96]

One must look at the timbers as component parts of a single structure in order to appreciate their role. All sixteen timbers acted in concert with one another to deliver and absorb a ramming blow. The timbers also revealed the existence of a large central "ramming timber", a structural member whose presence in ancient warships had been suspected but unproved until this discovery. As Steffy puts it, the warship's timbers were the real weapon, while the bronze sheathing of the ram was simply the warhead.[97] Another point of interest relating to the timbers is that the Athlit ram appears to have been made specifically for these particular bow timbers. This can be seen from the fact that the bronze casing follows the asymmetry of the timbers to either side of the keel.[98]

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[96] For a more detailed description of the timbers and their proposed constructional sequence, see Steffy (supra n. 62) 59-62 and (supra n. 76) 17-38.

[97] Steffy (supra n. 62) 59.

[98] Steffy (supra n. 76) 38-39.

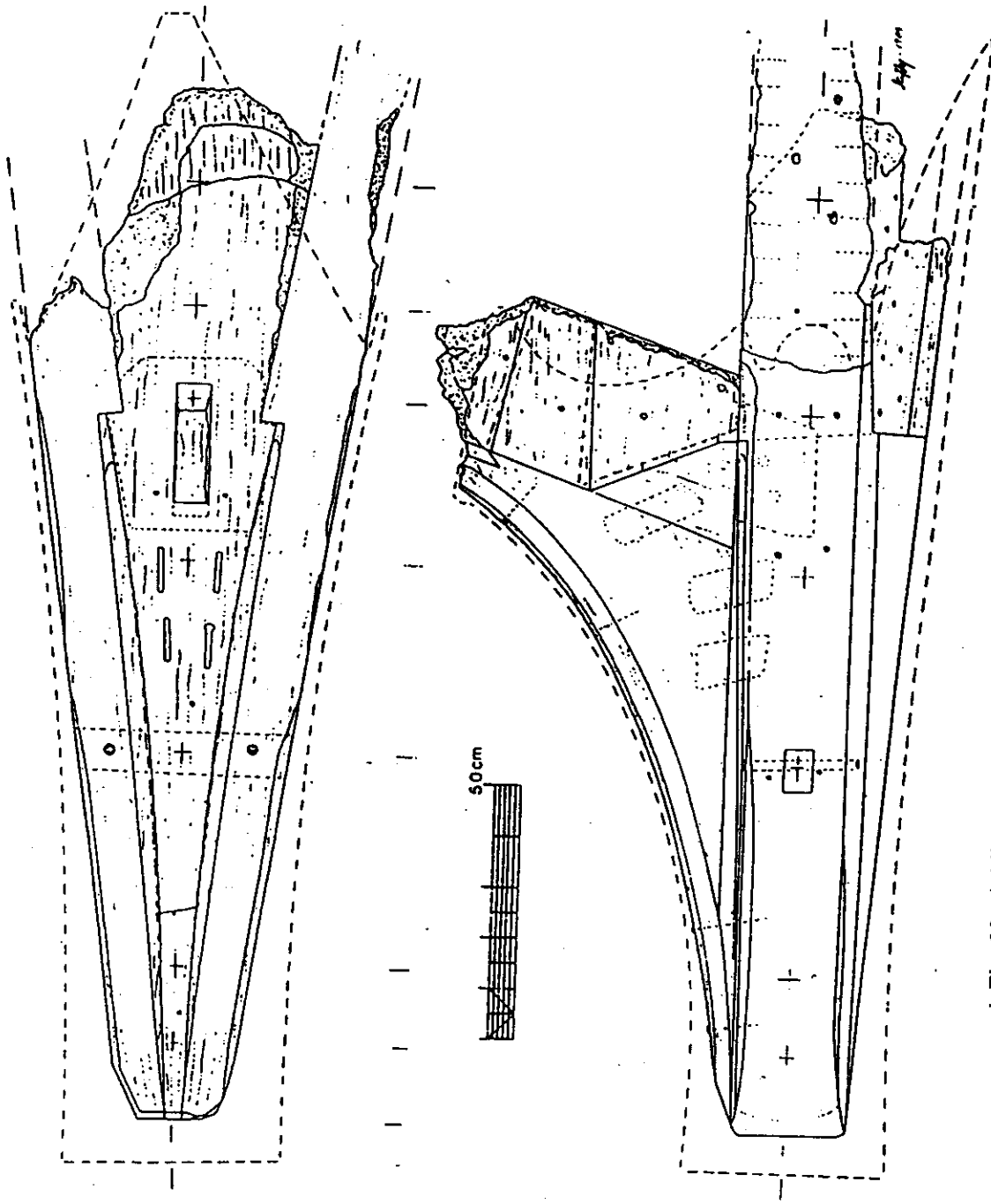

Fig. 20. Athlit ram bow timbers. (Drawing courtesy of J.R. Steffy)

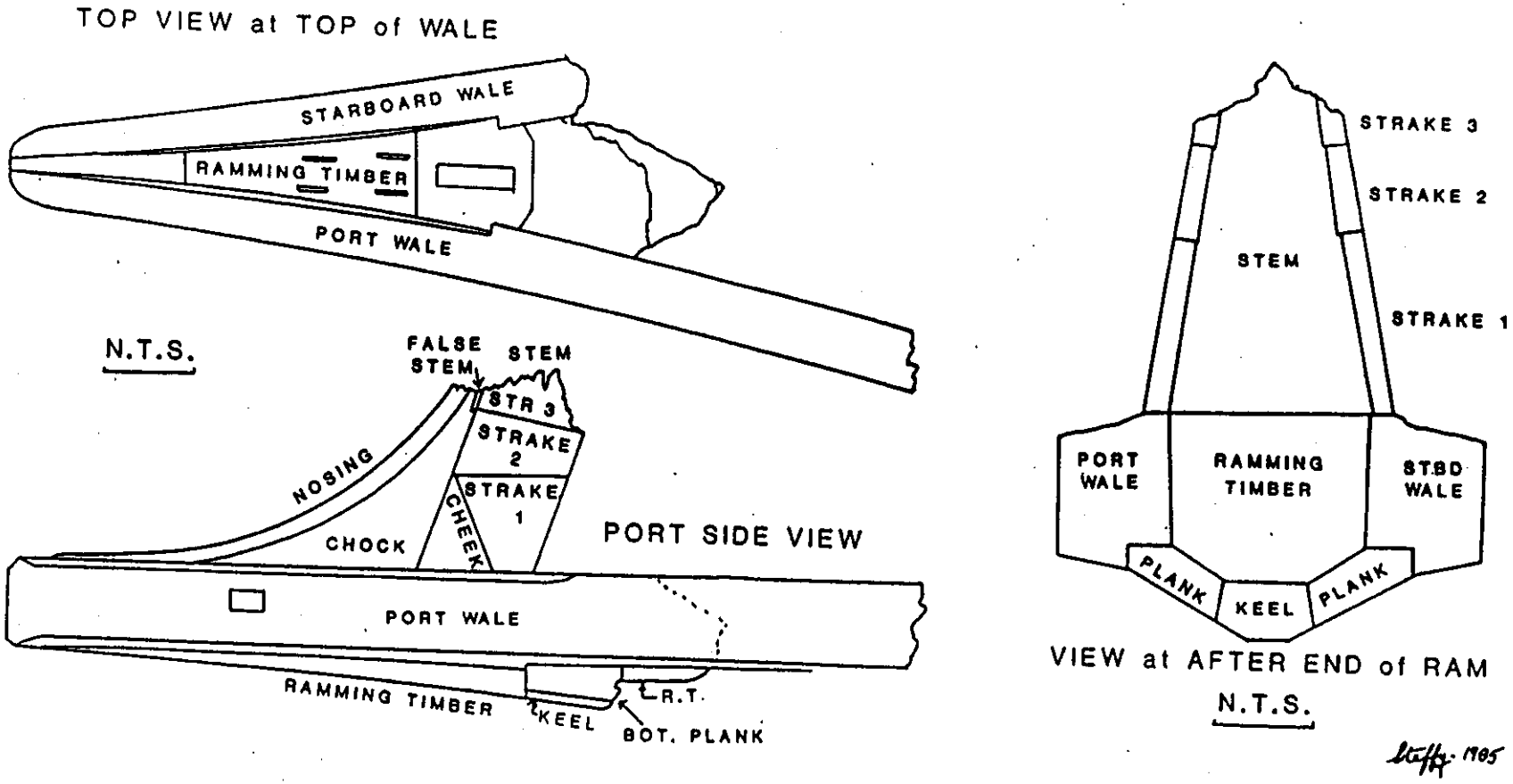

Fig. 21. Identification of Athlit ram bow timbers. (Drawing courtesy of J.R. Steffy)

Prominent elements in the Athlit ram's ornamentation are four different symbols cast into its surface, three of which occur on both sides of the ram. These symbols include a bird's head, a helmet with an eight-pointed star, a herald's staff, and a decorative handle device.

The bird's head appears in the upper corner of the cowl on either side (fig. 18). Given the bird's form, it is generally thought to represent an eagle, and one can find similar-shaped bird's heads on Ptolemaic period coins.[99] Also located on either side of the cowl is a wreathed helmet topped by an eight-pointed star (fig. 18). This combination of symbols represents a felt helmet liner which is also referred to as the *pileus* of the Dioskouri. The Dioskouri are the mythical twins Castor and Pollux, who were considered patrons of sailors.[100] The *pileus* appears in eastern Mediterranean iconography around 204 B.C. and is used up through the first half of the first century B.C.[101]

The third symbol that appears on the cowl is found on the upper cowl nosing. Here one sees a *kerykeion* or herald's staff (fig. 18). This is the

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[99] Some had called this bird a griffin, but the lack of ears and horns argues against this hypothesis: Steffy (supra n. 94) 235; L. Basch, "The Athlit Ram: A Preliminary Introduction and Report," *MM* 68 (1982) 5; H. Frost, "When and Whence Came the Stories of the Kerykeion and the Caduceus? Decorations on the Athlit Ram," *MM* 69 (1983) 249; W. M. Murray, "The Provenience and Date: The Evidence of the Symbols," in L. Casson and J. R. Steffy, eds., *The Athlit Ram* (College Station 1991) 54-5.

[100] Linder and Ramon (supra n. 88) 63.

[101] Murray (supra n. 99) 54-56.

only symbol which appears only once on the ram. The symbol of the herald's staff was used throughout the Mediterranean. However, it is only found in combination with the other symbols used on the ram on a series of Ptolemaic coins minted on Cyprus between 204-181 B.C.[102]

The fourth symbol is found on either side of the main ram body. Located directly behind the three fins is a decorative handle device (fig. 18). In conjunction with the fins, this symbol appears to form a trident, although in his study of the Athlit ram symbols Murray concluded otherwise. He cites several reasons why he believes this symbol not to be a trident: there are no barbs on the fins (tines), the handle or socket device is set too close to the fins, and the fins are too elongated for a correctly proportioned trident. Instead of a trident, Murray calls this symbol a fulmen or thunderbolt, which is also commonly found on Ptolemaic period coins.[103] One would question how precise the artists intended to make the proportions and details of these symbols. While the socket device is similar to the Ptolemaic thunderbolt, Murray may be biased towards this classification due to other Ptolemaic period parallels for the other symbols.

The symbols provided the majority of evidence for dating the Athlit ram, although the ram's general form is important as well. Three-finned

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[102] Murray (supra n. 99) 61-62.

[103] Murray (supra n. 99) 56-57.

rams are seen from the end of the fifth century B.C. through the first century A.D. Taken together, all of the evidence points to a date in the Hellenistic period (323-30 B.C.). More specifically, the symbols occur together in the Ptolemaic period around the first half of the second century B.C., but possibly the late third century B.C.[104]

There is also the question of the size or classification of the ship to which the Athlit ram was attached. Since the ram's size is not conveniently labeled, one must turn to other sources. A hypothetical classification of the ship was based primarily upon information obtained from Octavian's campsite memorial in Greece.[105] Octavian erected this particular monument on the site where his tent was pitched overlooking the Battle of Actium in 31 B.C. The monument is special because it was decorated with the rams from at least twenty-three enemy ships captured during the battle, although unexcavated areas of the monument undoubtedly held several more rams.[106]

Although the rams no longer remain, the stone sockets in which the rams were placed do survive. From literary sources, we know that

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[104] Murray has gone even further in saying that the ram was manufactured on Cyprus by Ptolemy V Epiphanes or his successor Ptolemy VI Philometor: supra n. 99, 63 and 66 and "Classification of the Athlit Ship: A Preliminary Report," in L. Casson and J. R. Steffy, eds., *The Athlit Ram* (College Station 1991) 74.

[105] For a detailed description of this site, see W. M. Murray and Ph. M. Petsas, *Octavian's Campsite Memorial for the Actium War, TAPS* vol. 79.4 (Philadelphia 1989) and "The Spoils of Actium," *Archaeology* 41.4 (1988) 29-35.

[106] Murray (supra n. 104) 72-73.

Octavian's forces captured ships from several different classes, ranging from "ones" all the way to "tens."[107] One can thus take the largest socket on the monument to represent a "ten" and extrapolate for the sizes of the lower class vessels. Even though no sockets survive that are small enough for the Athlit ram, Murray has hypothesized that the Athlit ram probably belonged to either a "four" or a "five" class warship, although he leans towards its being a "four".[108]

Bremerhaven Ram

The first public knowledge of the Bremerhaven ram came in 1987 when it appeared in the catalog of a Swiss antiquities dealer.[109] That same year the ram was acquired by the Deutsches Schiffahrtsmuseum in Bremerhaven, Germany, where it is currently on display. The original site of the ram's discovery is not known at this time. It is possible that the ram came from Egypt, since the dealer from which the ram was purchased has

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[107] Strabo 7.7.6.

[108] Murray also used the trireme reconstruction *Olympias II's* ram as a guide to classifying the Athlit ram. The overall shape of the *Olympias II's* ram was based on the Athlit ram. However, the trireme ram weighed only 200 kg and was made from five pieces which were welded together. Though the ram was not manufactured as it would have been in antiquity, its dimensions do seem appropriate for a trireme's bow and may offer some insight into the problems of classification: Murray (supra n. 104) 74-75, n. 10; Morrison and Coates (supra n. 49) 221.

[109] Galerie Nefer, *Catalog* 5 (Zurich 1987) 25.

close ties with that country (fig. 17).[110] One can hope that the site of the ram's discovery will be revealed at a later date.[111] From the little information currently available, one would lean towards an eastern Mediterranean origin for the Bremerhaven ram.

The ram is in overall good condition. It exhibits some exfoliation, but there is no significant loss of metal. The ram also appears stable with no outward signs of bronze disease, hence no conservation measures have been conducted on the ram to date.[112] There is some variation in the ram's color, ranging from a light green all the way to dark brown.

The ram had been underwater for some period of time since its initial loss, because there are small remnants of marine encrustation along its interior walls. Any other encrustation was probably removed before the ram was sold, since there are no signs of encrustation in the photographs found in the dealer's catalog. There are presently no wood remains, although it is unknown if any wood remains were associated with the ram at the time of its discovery.

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[110] Personal communication, Dr. Detlev Ellmers, Deutsches Schiffahrtsmuseum, Bremerhaven, September 1994.

[111] A representative of the Galerie Nefer thought that the ram may have been found off the Levantine coast, i.e. Syria, Lebanon, or Israel, though this was only a supposition: Personal communication, F. Nussberger, Galerie Nefer, November 1994.

[112] Personal communication, Dr. D. Ellmers, November 1994.

Like the Athlit ram, the Bremerhaven ram is three-finned and consists of three main structural features (fig. 22). There is the main ram body or driving center, which includes the ramming head, a cowl, and a tailpiece.[113] The ram is considerably smaller than the Athlit ram, with a maximum length of 43.8 cm along the main ram body, and a maximum height of 61.8 cm. The Bremerhaven ram weighs only 53 kg.[114]

The ram was originally cast as one piece, although it currently consists of two pieces, showing evidence of a major repair made in antiquity. This and other repairs will be discussed in more detail below. The ram does shows signs of wear and/or damage, particularly around the ramming head. Unlike the Athlit ram and the Fitzwilliam ram discussed below, the Bremerhaven ram is very symmetrical with respect to the port and starboard sides.

The ram's body has a maximum length of 43.8 cm, while it reaches its maximum height at the ramming head. The driving center is hollow to accept the warship's bow timbers. The main body is 35 cm deep as measured from the end of the driving center. Like the Athlit ram, the main ram body has troughs on either side to accept a pair of wales. These troughs are 7.04 cm wide and 21.8 cm high at their after end.

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[113] I call the lower functional area simply a tailpiece and not a bottom plate because of its size and shape.

[114] Murray (supra n. 104) 75.

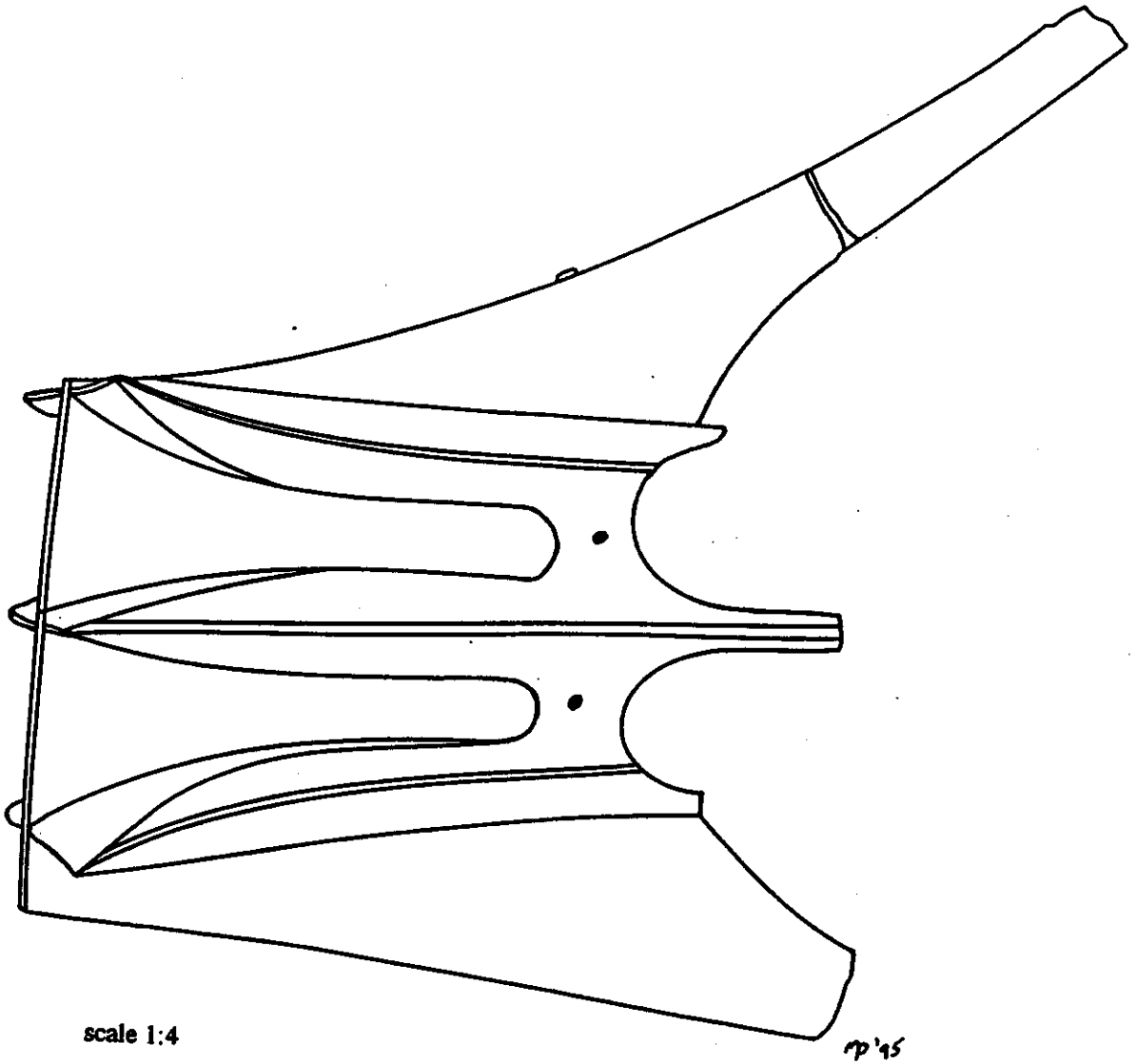

Fig. 22. Bremerhaven ram, Deutsches Schiffahrtsmuseum, Bremerhaven, Germany. (Drawing by M. Pridemore)

The ramming head (fig. 23) has a maximum width of 26.6 cm and a maximum height of 30.6 cm, for a total ram head area of 0.08 m^2. One can see that the ramming head is flared with the uppermost fin turned up, while the lowermost fin is turned down. The fins have a maximum width of 5.9 cm, and each fin also has a raised central ridge running along its entire length. Damage to the ramming head includes a casting flaw, possibly caused by an air bubble during casting, on the port middle fin, and the loss of the entire corner of the lower starboard fin.

Above the ram's driving center is the cowl, which unlike that of the Athlit ram is unadorned. The cowl extends back from just aft of the ramming head. It is 68.9 cm long, approximately 27 cm high, and protected the lower section of the ship's stem. The aftermost tip of the cowl is 8.3 cm wide, but it is damaged. The metal of the cowl varies in thickness from 0.50 to 0.85 cm.

Below the driving center is the tailpiece. The tailpiece is approximately 13 cm high, 48 cm long, and 10.48 cm wide at its after end. The metal of the tailpiece also varies in thickness from 0.50 to 0.90 cm. The tailpiece tapers towards the ramming head, unlike the cowl which tapers towards the after end. Even given its small size, the shape and angle of the ram's tailpiece suggest it was attached to and protected the forward end of the

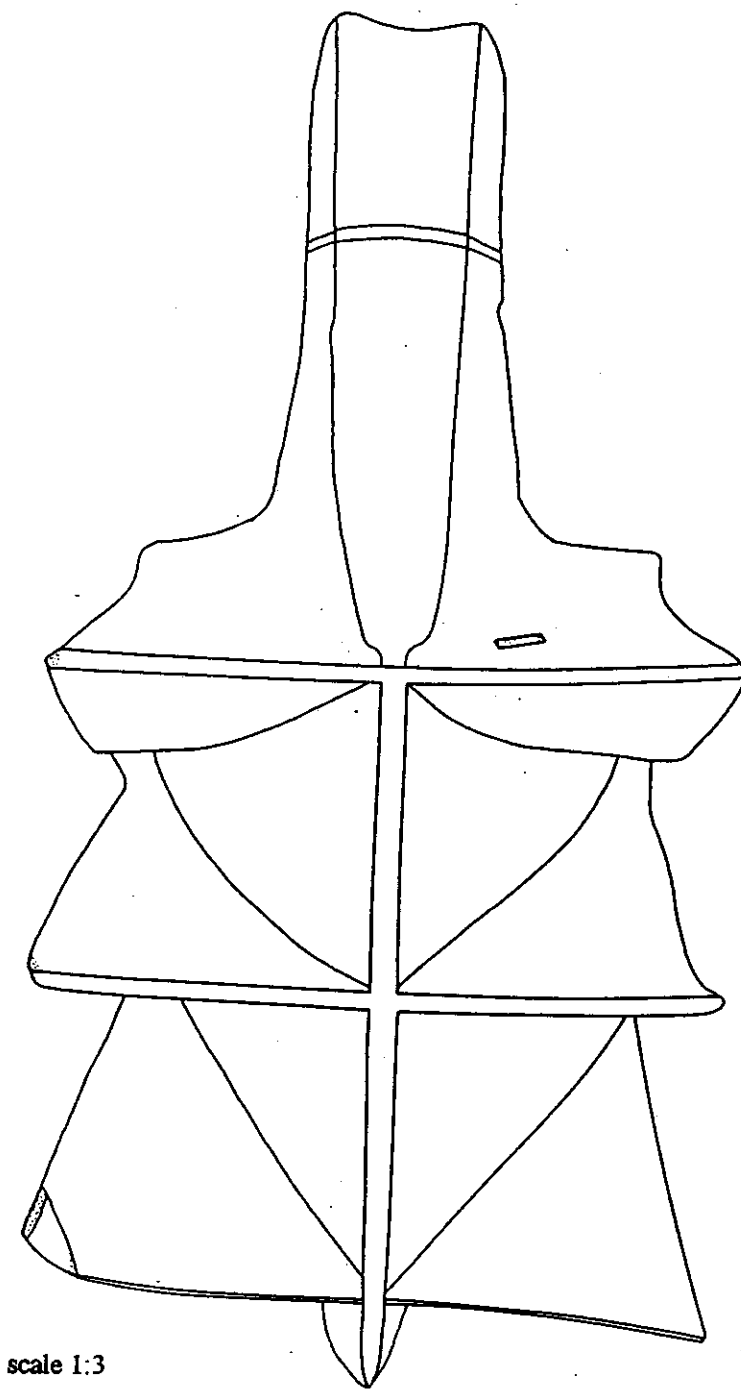

Fig. 23. Ramming head of Bremerhaven ram, Deutsches Schiffahrtsmuseum, Bremerhaven, Germany. (Drawing by M. Pridemore)

warship's keel, thus making the Bremerhaven ram a primary waterline ram and not a *proembolion.*

The ram was attached with bronze rivets. Only five rivets were used, one of which partially survives. There were two rivets located along the after edge on either side of the main ram body. These pairs of holes are symmetrically placed. All four holes have concreted shut, but appear to have been approximately 0.82 cm in diameter originally.

The fifth rivet is located along the upper surface of the ram's cowl, and is the one rivet still present. The rivet's head measures 1.49 cm in diameter, while the rivet's shank is 0.81 cm in diameter. Comparison of the one surviving rivet to the other four rivet holes suggests that all five rivets were similar in size. The small number and size of the rivets suggests that the Bremerhaven ram was primarily held to the warship by the internal timbers of the warship's bow.

The Bremerhaven ram shows clear signs of at least two repairs. The first repair is located on the upper surface of the main ram body, directly behind the forward end of the ramming head on the port side. A rectangular hole here measuring 0.81 cm wide, 1.33 cm long, and approximately 0.4 cm deep, may mark the site of a casting flaw, possibly caused by an air bubble

during the ram's casting.[115] Whatever the case, a rectangular hole was carefully cut so that it could be easily filled with a bronze plug. The location of the flaw on the upper face of the ramming head would have made it highly visible. Thus, it is not surprising that steps were taken to remove it.

The second repair is found on the ram's cowl. At some point in the ram's life, the uppermost 21.4 cm-long section of the cowl completely broke off, but was then welded back in place. The weld is rough on the interior but flush on the exterior, probably for aesthetic reasons. It is difficult to see why this particular section of cowling broke. The single fastening in the cowl is well below the damaged segment, so that there was nothing specifically securing the upper section. It is possible that the damage occurred before the ram was even mounted.

Unlike the Athlit ram, the Bremerhaven ram does not have any detailed ornamentation. The one exception is the basic trident design found on either side of the ram's main body (fig. 24).[116] The lack of ornamentation

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[115] Upon first examining the Bremerhaven ram, I thought this rectangular hole might be where a metal sample had been taken. However, Dr. D. Ellmers informed me that the museum had taken no such sample: Personal communication, Dr. D. Ellmers, November 1994.

[116] It is interesting that Murray believes the Bremerhaven ram to have a trident design, while at the same time believing that the Athlit ram does not. The reason he gives for believing that the Athlit ram does not have a trident design is the lack of barbs on the tips of the fins and the proportions of the fins, yet the Bremerhaven ram suffers these same "faults": Murray (supra n. 99) 56-57.

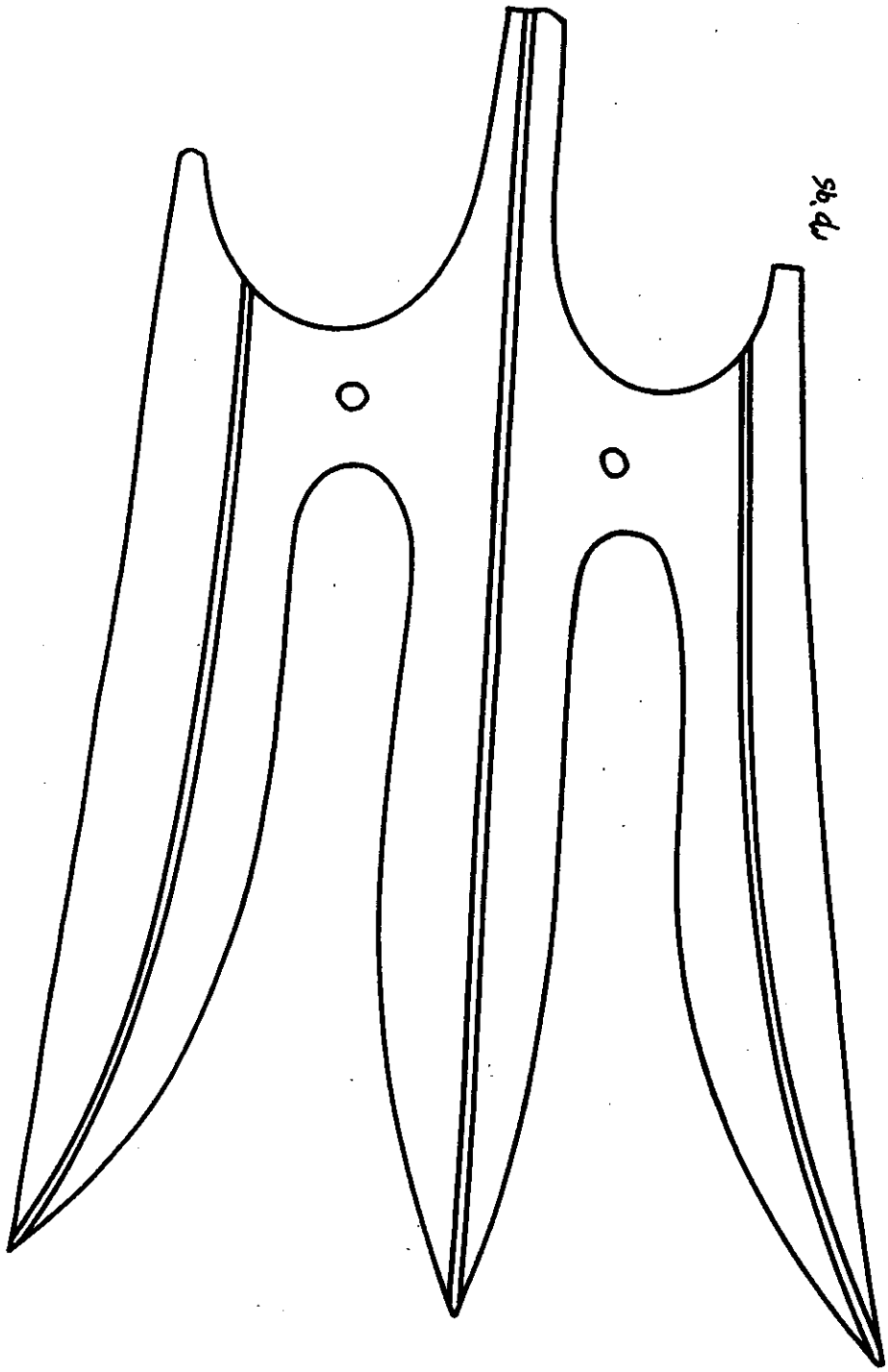

Fig. 24. Bremerhaven ram's trident ornamentation (not shown to scale), Deutsches Schiffahrtsmuseum, Bremerhaven, Germany. (Drawing by M. Pridemore)

makes dating the Bremerhaven ram a bit more difficult, forcing one to rely only upon the ram's general design.

Three-finned rams are seen in the iconography from the fifth century B.C. to the first century A.D. However, a coin found at Arados in Syria (fig. 25) may offer some assistance in narrowing down the date of the Bremerhaven ram. The coin is unusual in that one side is dominated by a free standing ram. The overall shape of the ram, particularly the cowl and tailpiece, is very similar to that of the Bremerhaven ram. Both rams also have a horizontal projection at the after end of their main ram body representing the trident's central shaft. The coin dates to 174/3 B.C. and may give an approximate point of comparison for dating the Bremerhaven ram.

There are also two marble statues which may offer some help in dating the Bremerhaven ram. One is located on Rhodes, while the other is found at Cyrene in Libya.[117] Each piece depicts a three-finned waterline ram whose main body and tailpiece are similar in shape and size to those of the Bremerhaven ram.[118] Both monuments date to the first century B.C. From the above evidence, a date for the Bremerhaven ram from the second half of the second century B.C. to the first century B.C. seems quite plausible.

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[117] The Cyrene monument is the same one which has a three-finned secondary ram, see n. 81.

[118] The marble ram at Rhodes measures 53 cm in length: Basch (supra n. 4) 191, figs. 816-17.

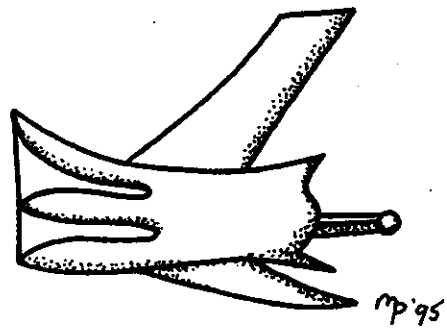

Fig. 25. Ram on coin from Arados, Syria (c. 174/3 B.C.). (After Basch, 1987, fig. 818)

Murray has suggested that the Bremerhaven ram was attached to the bow of a warship smaller than a trireme.[119] This hypothesis was reached in a manner similar to that used to classify the Athlit ram, namely by comparing its cross-sectional shape against the sockets found on Octavian's monument. Clearly, the size of the Bremerhaven ram shows that it could not have been attached to a very large vessel, although the exact class of the warship is difficult to determine at this point.

Fitzwilliam Ram

The third ram to be examined is the Fitzwilliam ram (figs. 26-8). This piece acquired its name when it was loaned to the Fitzwilliam Museum in Cambridge, England in 1968.[120] This particular ram was then removed from the Fitzwilliam Museum by the ram's owner in 1991.[121] In order to avoid any confusion, for the purposes of this thesis the name "Fitzwilliam" will be retained, since it has already been cited in the literature as such. However, at some point in the future, depending upon the ram's final

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[119] Murray (supra n. 104) 75.

[120] Personal communication, Dr. Penelope Wilson, Fitzwilliam Museum, February 1994.

[121] The owner of the "Fitzwilliam" ram has requested that I act as an intermediary for any third-party inquiries into this ram. I can be contacted at my permanent address, which can be found in my *vita* at the end of this thesis.

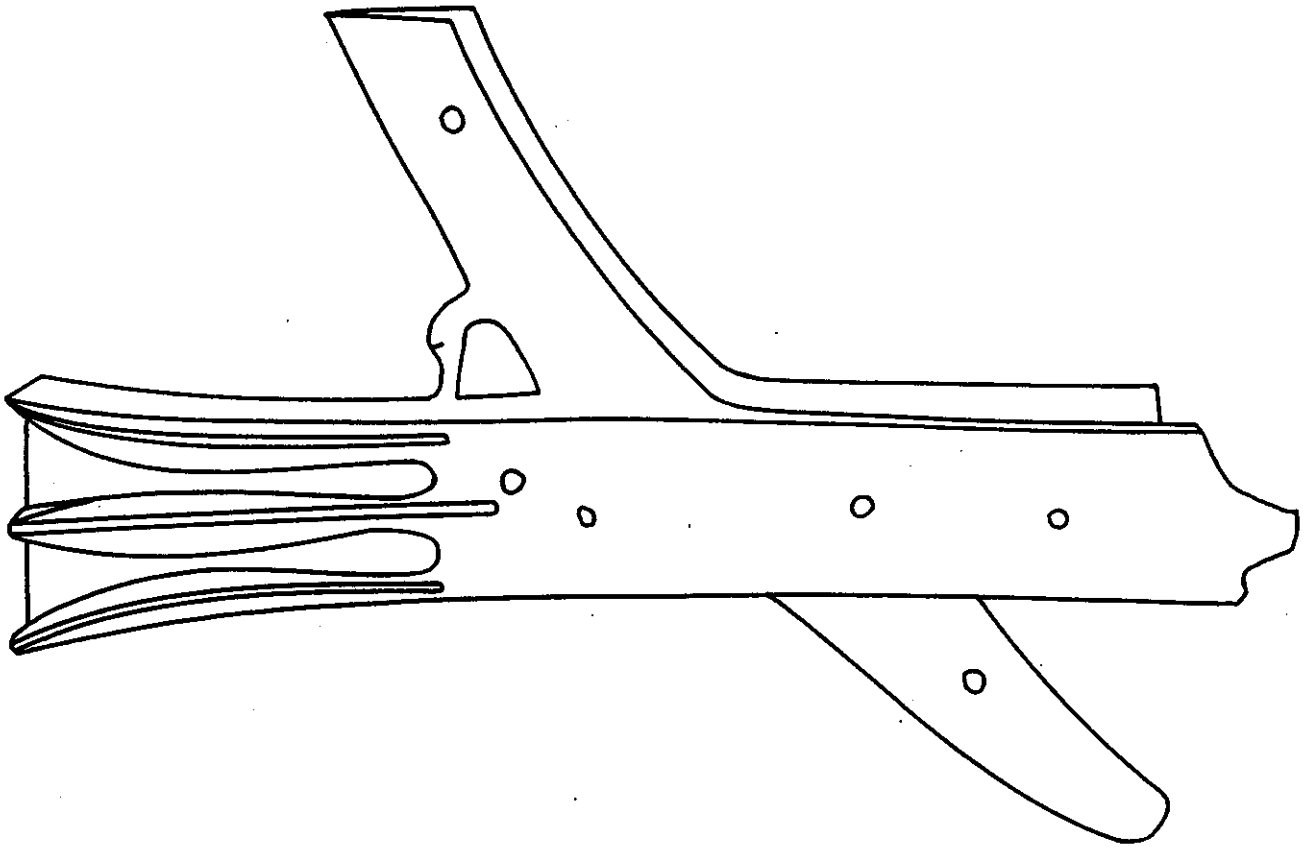

Fig. 26. Fitzwilliam ram, port side. (Drawing by M. Pridemore)

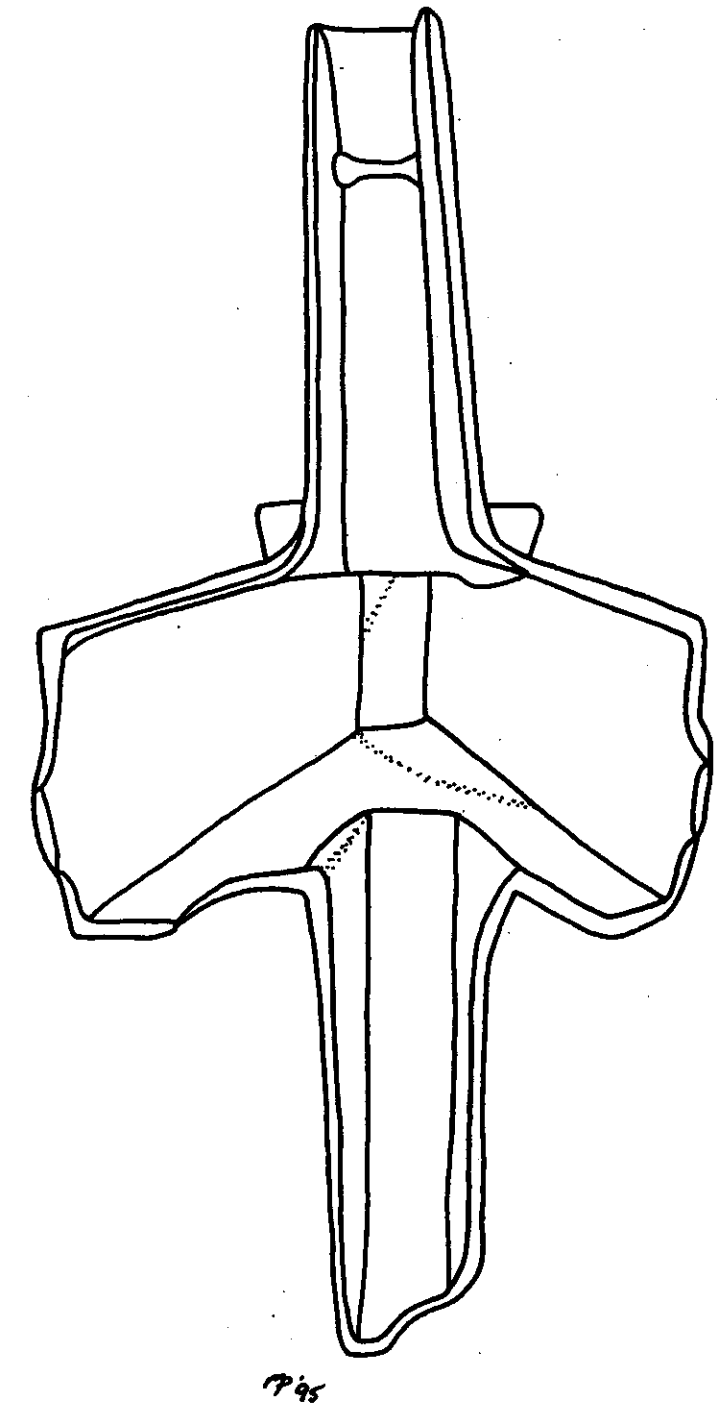

Fig. 27. Fitzwilliam ram, aft view. (Drawing by M. Pridemore)

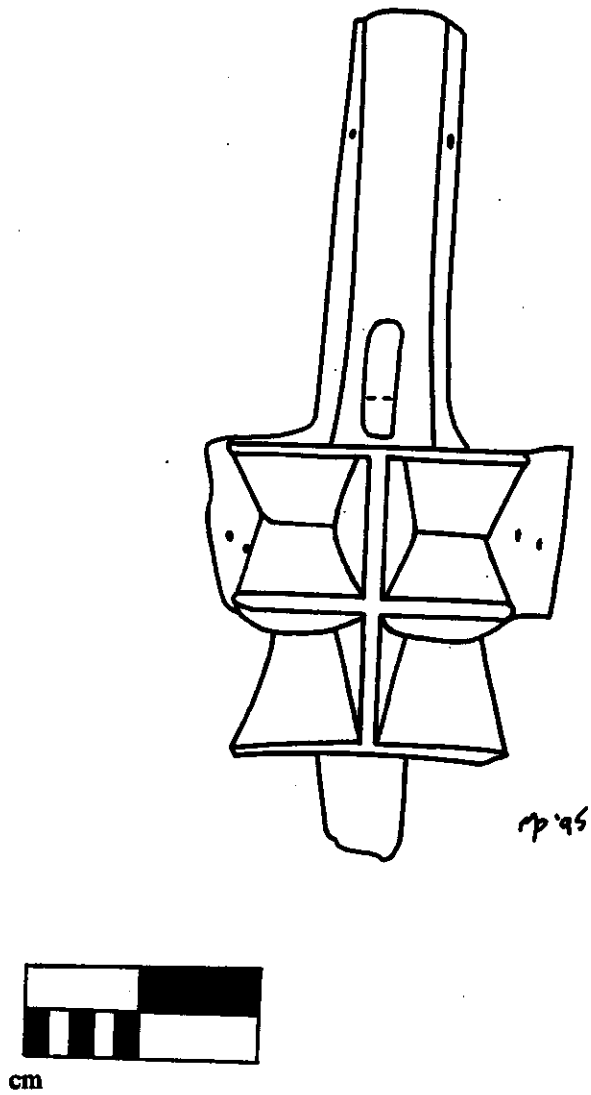

Fig. 28. Ramming head of Fitzwilliam ram. (Drawing by M. Pridemore)

destination, a new and lasting designation may be in order to avoid any further confusion.

Though the exact location where the ram was found is unknown at this time, it was definitely found in the Mediterranean.[122] Several accounts put the site somewhere off the North African coast (fig. 17).[123] The ram was found at a depth of approximately eighty feet on a sandy sea floor. Undoubtedly, the sand aided in the ram's preservation. Also located in the area in which the ram was found were numerous amphora fragments, an example of which was recovered. The amphora material will be discussed in more detail below. The site was affected by a strong current, which was partially responsible for the ram's discovery. A corner of the ram had become exposed and subsequently polished by the scouring action of the sand and current. The corner in this way became highly reflective, allowing the ram to be spotted on the seafloor.

The Fitzwilliam ram is in fair condition. It was heavily concreted when found and does show more signs of metal loss and exfoliation than the Bremerhaven ram. After the ram was loaned to the Fitzwilliam Museum, the museum deemed it stable, so no conservation measures were taken.

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[122] Personal communication, Mr. D. Schofield, November 1994.

[123] G. F. Bass, *Archaeology Under Water* (London 1966) 85; R. V. Nicholls, "The Trinity College Collection and Other Recent Loans," *Archaeological Reports* 85 (1970-71) 85; M. -C. de Graeve, *The Ships of the Ancient Near East (c. 2000-500 B.C.)* (Belgium 1981) 133.

Unfortunately, the ram is now showing widespread signs of bronze disease, especially along its interior. However, no significant changes have taken place in the ram's overall appearance in the past thirty years.[124] The Fitzwilliam ram does not show nearly as much color variation as the Bremerhaven ram. For the most part, it is light green in color.

No wood remains were found within the ram at the time of its discovery. There were, however, several small pieces of encrustation removed from the ram's interior which did carry the impressions of wood grain. Although these few fragments were too small to provide any accurate wood identification, their presence clearly shows that there were some wood remains within the ram when it went to the sea floor.

Like the Athlit and Bremerhaven rams, the Fitzwilliam ram is three-finned and consists of the same three basic features: the main ram body, a cowl, and a tailpiece (figs. 26-7). The Fitzwilliam ram is comparable in size to the Bremerhaven ram. It measures 44.1 cm high and has a maximum length of 64 cm. The ram weighs only 19.7 kg, a value which is undoubtedly due to the metal loss, which in turn is related to the bronze disease. The thickness of the metal also varies considerably over the ram due to the metal loss.

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[124] Personal communication, D. Schofield, November 1994.

Looking first at the driving center, one sees that it exhibits some pronounced asymmetry. For example, the main ram body is 64 cm long on the port side, but only 60.5 cm long on the starboard side. The entire driving center exhibits an hour-glass shape. It is widest at the ramming head, reaches a minimum width just aft of the cowl and tailpiece, and then widens again towards the ram's after end.

The ramming head has a maximum width of 12.16 cm and a maximum height of 13.1 cm (fig. 28), giving an area of 0.02 m^2. One will note that even though the Bremerhaven and Fitzwilliam rams are comparable in overall dimensions, the sizes of their ramming heads are considerably different. This point will be taken up in the concluding section. The fins are each approximately 0.72 cm thick at their ends, and as with the Bremerhaven ram, the fins of the Fitzwilliam ram are splayed. There is also a small casting flaw located on the uppermost fin on the port side, which has left a hole measuring 0.45 cm in diameter.

As with the previous examples, the driving center contains troughs on either side to accept a pair of wales. Measured at their after ends, the port side trough is 9.20 cm high, while the starboard trough is 9.40 cm high. The trough widths also differ, with each trough being wider on the bottom than the top. On the port side, the trough is 2.95 cm wide along its lower

end and only 1.70 cm wide at the top, while on the starboard side the trough is 2.15 cm wide along the bottom and 1.90 cm wide at the top.

Both the cowl and tailpiece form a relatively narrow channel with slightly outsloping sides along their entire length. The channel in the cowl would have accepted the ship's stem. It is 9.50 cm deep at its base, and only 6.20 cm deep at the cowl's tip. The cowl's height measured to its forward tip is 19.80 cm, while the cowl's width is 4.98 cm wide at the top and 7.22 cm wide at its base. The curve of the cowl is continued in the curvature of the tailpiece. The tailpiece is 14.70 cm high and 4.55 cm wide at its after end. However, the tailpiece is missing a section at its tip.

As with the two rams discussed above, the Fitzwilliam ram was attached to a ship with rivets. A total of nine rivets were used, three of which partially survive. The main ram body has seven rivets: four on the port side and three on the starboard. On the port side, the forwardmost rivet hole measures 0.74 cm in diameter, while the next rivet hole has concreted shut. The after two rivet holes on the port side are still open. The next-to-last rivet hole is 1.15 cm in diameter, while the aftermost hole measures 0.72 cm in diameter, although it has also partially concreted shut. The forwardmost of the three rivets on the starboard side is located directly behind the center fin and appears as if it is part of the trident design. The

head of this rivet is intact and measures 1.5 cm in diameter. The remaining two rivet holes on the starboard side have concreted shut.

Another of the surviving rivets is found on the cowl, while the third is on the tailpiece. The head of the rivet on the cowl measures 1.18 cm in diameter, while its shaft is 0.53 cm in diameter. The rivet's shaft has, however, lost a significant amount of metal. The tailpiece rivet's head no longer survives, but the full length of the shaft was still preserved within the tailpiece channel. Unfortunately, at some time since Nicholls' 1970 article on the Fitzwilliam ram, the remains of the lower rivet shaft have broken off from the tailpiece. The rivet hole is 1.4 cm in diameter, and the remains of the rivet shaft measure 0.60 cm in diameter.

It is interesting that the two surviving rivet shafts, the one found on the cowl and the other on the tailpiece, are made from different metals. The upper rivet is of bronze, while the lower rivet is of iron. This difference probably is due to the replacement of one of the rivets (probably the lower one), since there is no clear advantage for using rivets of different materials in different areas of the ram.

The Fitzwilliam ram does contain some ornamentation (fig. 29).[125] There is the trident design on either side of the main ram body, but there is

[125] A circular feature is noted on the after end on the port wale trough in the drawings found in Nicholls' article (fig. 30). However, this mark represents corrosion or a flaw in the metal and not decoration.

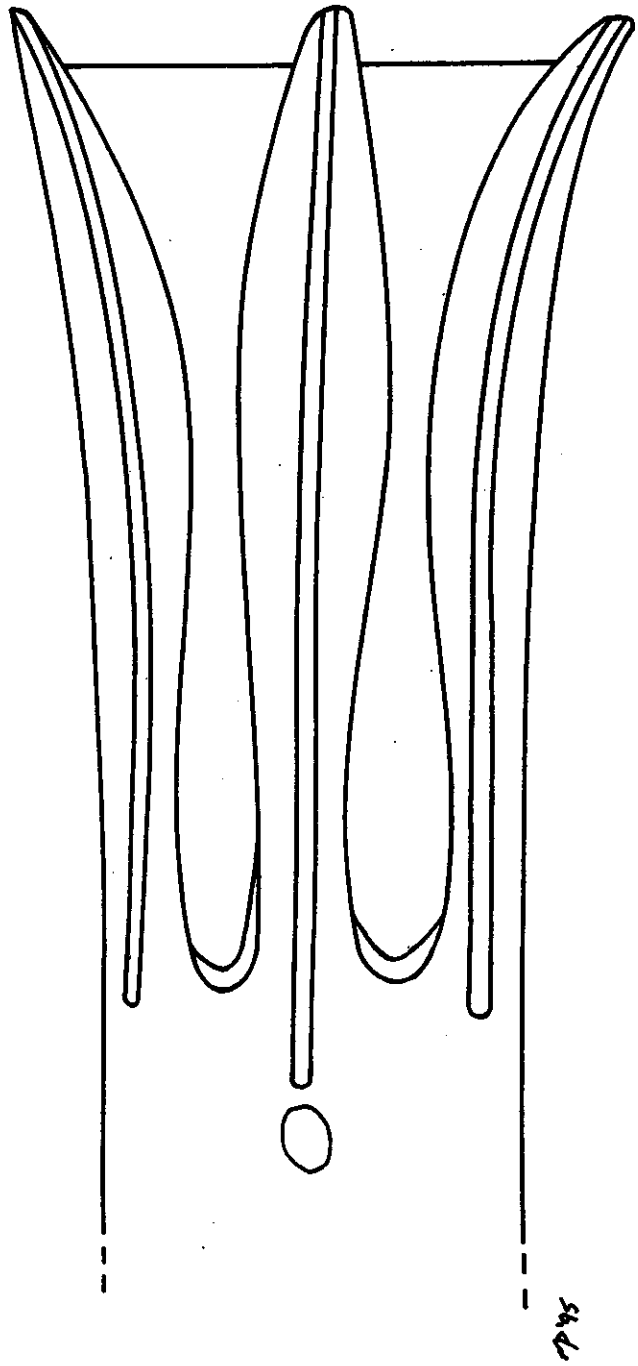

Fig. 29. Fitzwilliam ram's trident ornamentation (not shown to scale).
(Drawing by M. Pridemore)

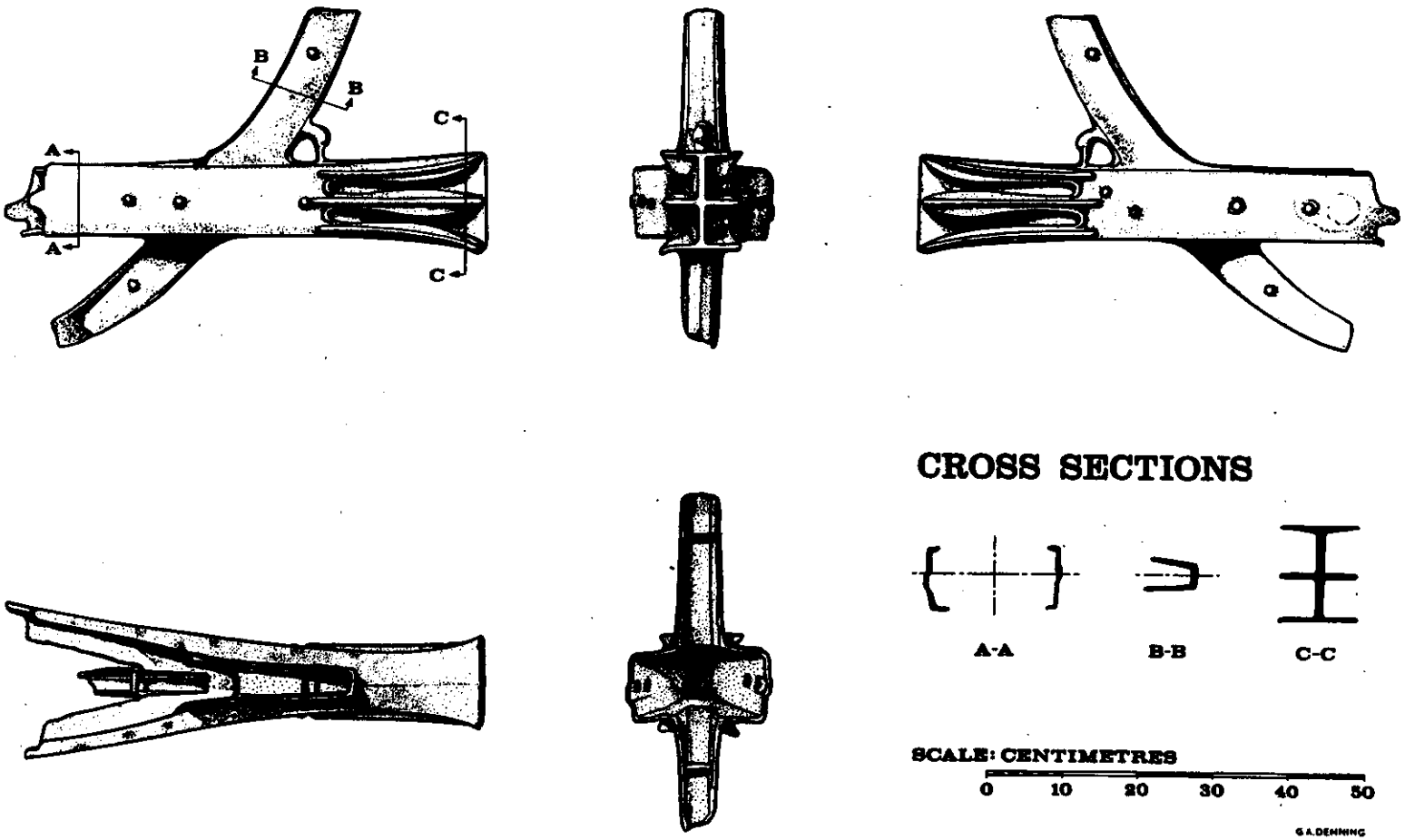

Fig. 30. Fitzwilliam ram. (Drawing courtesy of Fitzwilliam Museum, Cambridge, England)

also a three-dimensional bird's head, possibly that of a swan, atop the driving center. The bird's head is depicted very realistically, with even the bird's eyes represented, by two small horizontal lines. The bird's head acts as a buttress between the main ram body and the cowl. Nicholls proposed that this feature may have served as an attachment point for a rope.[126] However, there are no obvious signs of any wear on or around this feature.

Birds-head devices have been used as ornamentation on ships for millennia, developing in two main directions. On the one hand there has been a movement towards stylization and a total abstraction of the bird form, while the other trend has seen the development of naturalistic bird forms.[127] In the Geometric period of Greece (900-700 B.C.), bird representations on ships favored stylized, even abstract forms. In the seventh century B.C., a new stylistic trend came about, where the heads became extremely curved, beginning to form volutes (fig. 32A). This particular style was common on Archaic period (700-480 B.C.) ships.

In the Roman period naturalistic forms came into style for bird-head devices. Most of these birds had long, graceful necks, and were most

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[126] Nicholls (supra n. 123) 85.

Support for Nicholls' claim may be found on a wreck recently discovered off the northeast coast of Sicily. Nine examples of a bronze cleat shaped like a bird's head (fig. 31), which is very similar in shape to the Fitzwilliam's bird head, were found on the wreck: A. Freschi, "An Ancient Warship in the Waters off Capo Rasocolmo, Sicily," in M. Bound, ed., *Archaeology of Ships of War* (Oxford 1995) 10-11.

[127] Wachsmann (supra n. 23) 210.

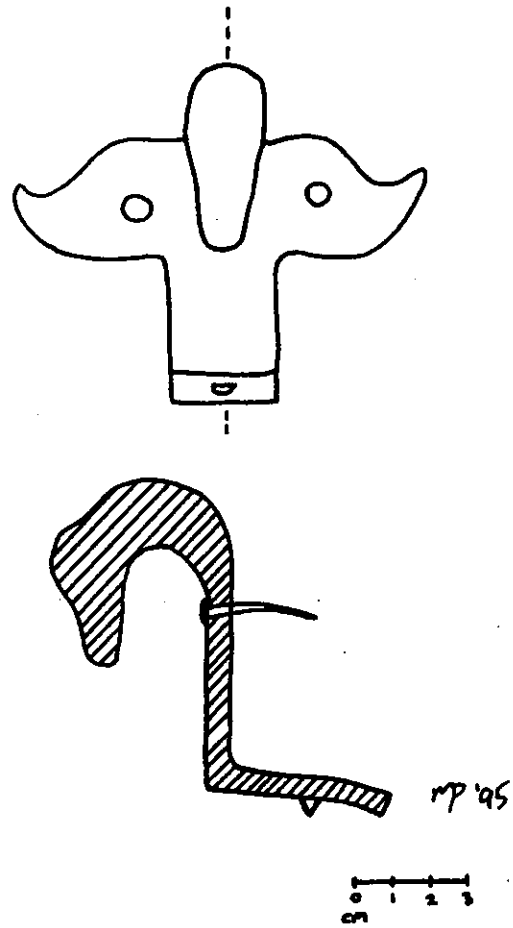
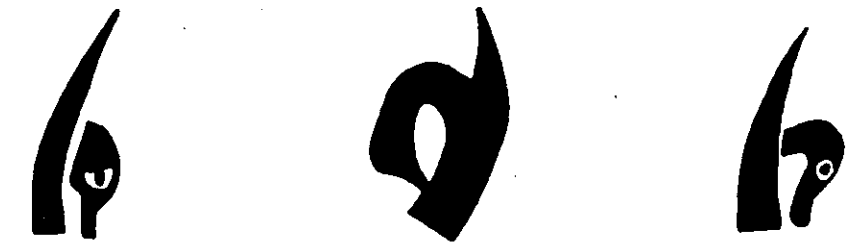
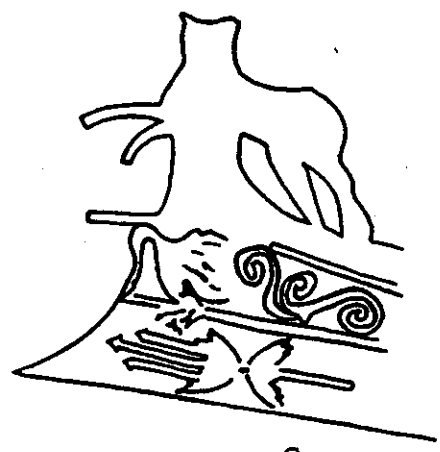


Fig. 31. Bird head cleat (2nd half 1st century B.C.). (After Freschi, 1995, fig. 2)



A

B



C

Fig. 32. Birds-head ornaments.

A. Archaic period (700-480 B.C.). (After Wachsmann, 1989, pl. 117)
B. Roman period (1st century B.C.-3rd century A.D.). (After Wachsmann, 1989, pl. 121)
C. Warship from mosaic at Constantine, Algeria (c. 50-30 B.C.). (After Basch, 1983, fig. 12)

probably swans. This form is found especially from the first century B.C. through the third century A.D., but almost exclusively on merchantmen (fig. 32B).[128] There is, however, a mosaic at Constantine in Algeria which depicts four ships, three of which are warships. One of these warships has a naturalistic swan as a bow decoration (fig. 32C). The mosaic dates to between 50-30 B.C.[129]

The Fitzwilliam ram is unusual in that it was attached to a convex surface, as reflected by its curved cowl and tailpiece. This feature has led some scholars to believe that this ram was attached to a warship that possessed a curved bow, a feature usually associated with merchant vessels.[130]

Basch has even stated that the Fitzwilliam ram represents a type of waterline ram that could be attached to an existing round-ended bow. Thus, a ship that may not have initially been intended to be a warship could be transformed into one with the addition of a ram. In support of this argument Basch sites a passage from Caesar's *de Bello Alexandrino* where

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[128] S. Wachsmann, *Seagoing Ships and Seamanship in the Late Bronze Age Levant*, Ph.D. dissertation, Hebrew University (Haifa 1989) 149-52.

[129] L. Basch, "When Is a Ram Not a Ram? The Case of the Punic Ship," *MM* 69 (1983) 139-40.

[130] Parallels to Etruscan ships are cited for a ram attached to a curved bow (fig. 33): Hagy (supra n. 26) 226-7; Morrison (supra n. 11) 158. Yet, these Etruscan ships may simply be merchantmen being used as troop transports, and the projections just forefoots and/or cutwaters: G. S. Kirk, "Ships on Geometric Vases," BSA 44 (1949) 121, n. 31.

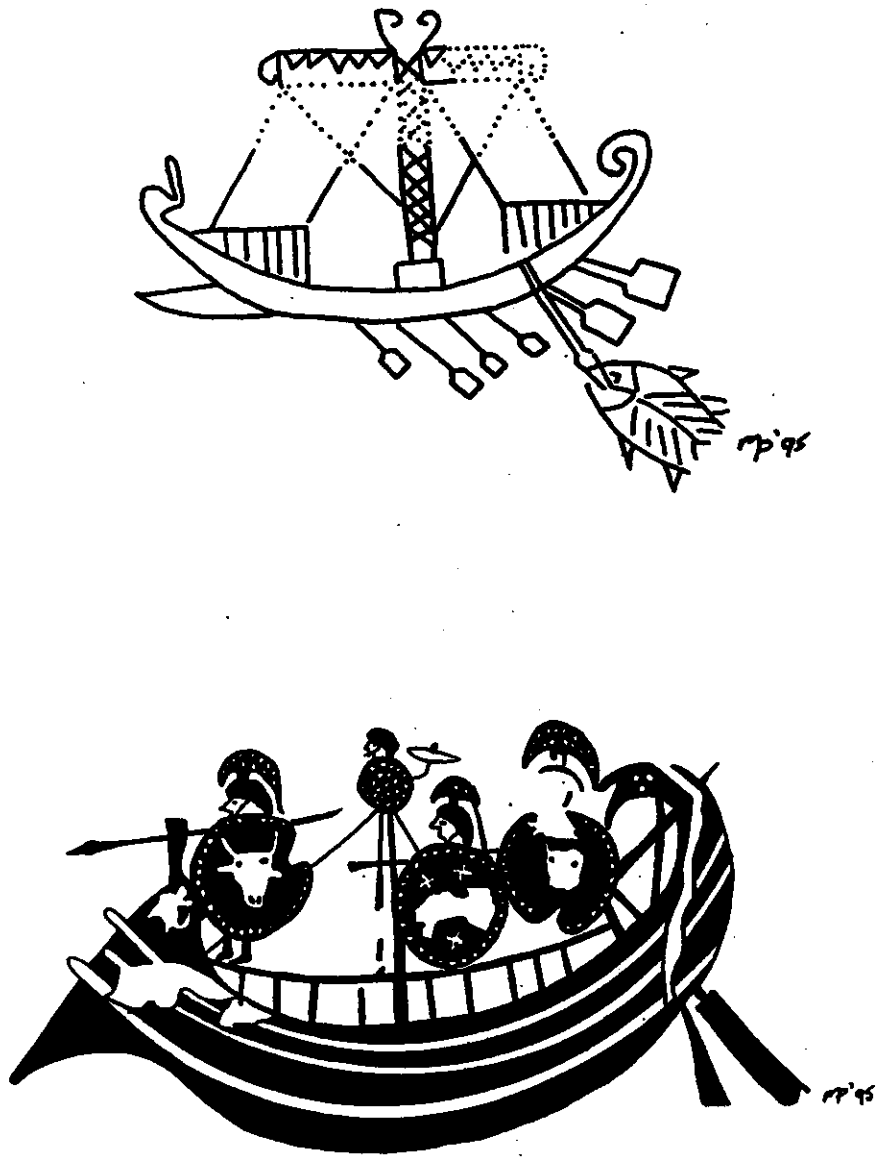

Fig. 33. Etruscan ships (mid-7th century B.C.). (After Basch, 1987, figs. 865 and 482)

rams were quickly mounted on merchant ships in order to bolster the size of Caesar's war fleet.[131]

There are several problems with this hypothesis. First, Basch does not take into consideration the fact that the Fitzwilliam ram's main body is hollow to accept a pair of extended wales. If the vessel did not already have projecting wales, a pair of wales would need to be somehow extended to accommodate the ram. A ram needed these internal timbers in order to distribute the force of a ramming blow to the warship's hull. If a ram, such as the Fitzwilliam ram, was attached to a rounded hull without any internal support timbers, the majority of the force generated by a ramming blow would be absorbed by the ship's stem. Such a blow would likely snap the stem or at least severely damage it. Basch's reconstruction (fig. 34) is also flawed in that the upper section of stem extends well beyond the ramming head. Thus, when executing a ramming blow, the vessel's stem would make contact with the enemy vessel before the waterline ram could.

At different times in the literature, the Fitzwilliam ram has been classified as both a primary and a secondary ram. More recently, opinions lean towards it being a primary ram.[132] These opinions appear to be based

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[131] Basch (supra n. 6) 213; Caesar *Bell. Alex.* 44.3.

[132] Murray has changed his opinion over the years. He originally called the Fitzwilliam ram a *proembolion*, but recently has classified it as a primary ram: Murray and Petsas (supra n. 105) 103, n. 33; Murray (supra n. 99) 51, n. 1; Hagy (supra n. 26) 226-27; Morrison (supra n. 11) 158.

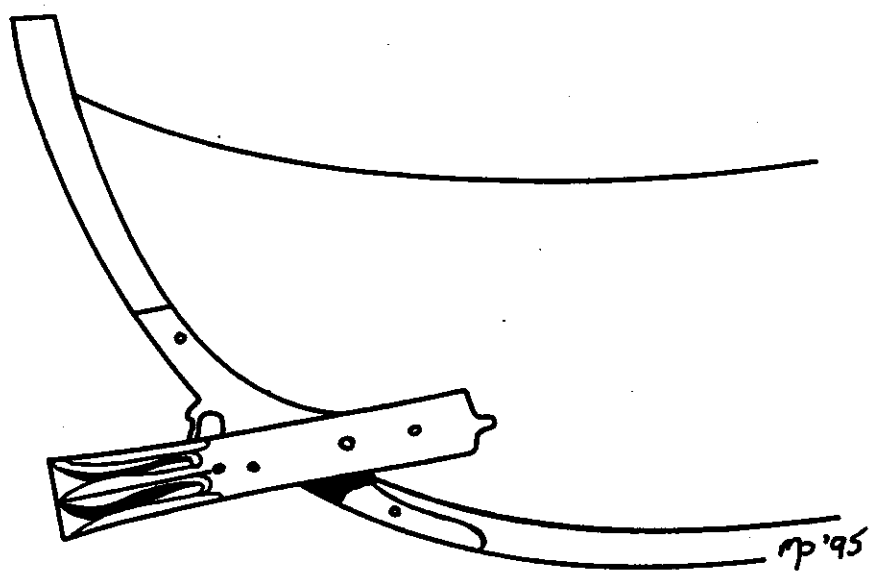

Fig. 34. Basch's reconstruction of Fitzwilliam ram. (After Basch, 1987, fig. 867)

primarily upon the ram's size and that it is three-finned. However, a clear example of a three-finned *proembolion* is provided by the already-mentioned Cyrene monument.

In the first in-depth article published on the Fitzwilliam ram, Nicholls suggested that the piece was a secondary ram.[133] The key elements to this conclusion were the curved cowl and tailpiece. Warships in antiquity did not have a rounded convex bow for the attachment of a waterline projection like the Fitzwilliam ram. However, in the Hellenistic period (323-30 B.C.), the bow ornament of some warships take the form off a convex curve. Representations from this period also show wales at the base of these ornaments for attachment of secondary rams (fig. 35). Unfortunately, there are no representations showing a secondary ram located as high as the lower part of the bow ornament itself.

Due to its size, the Fitzwilliam ram has even been considered to be ornamentation from a "pleasure" craft and not a functional ram at all.[134] However, if the Fitzwilliam ram is a *proembolion* and not a primary ram, it could very well have been functional for it possesses the necessary features.

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[133] Nicholls (supra n. 123) 85.

[134] A. Göttlicher, *Materialien für ein Corpus der Schiffsmodelle im Altertum* (Mainz 1978) 83.

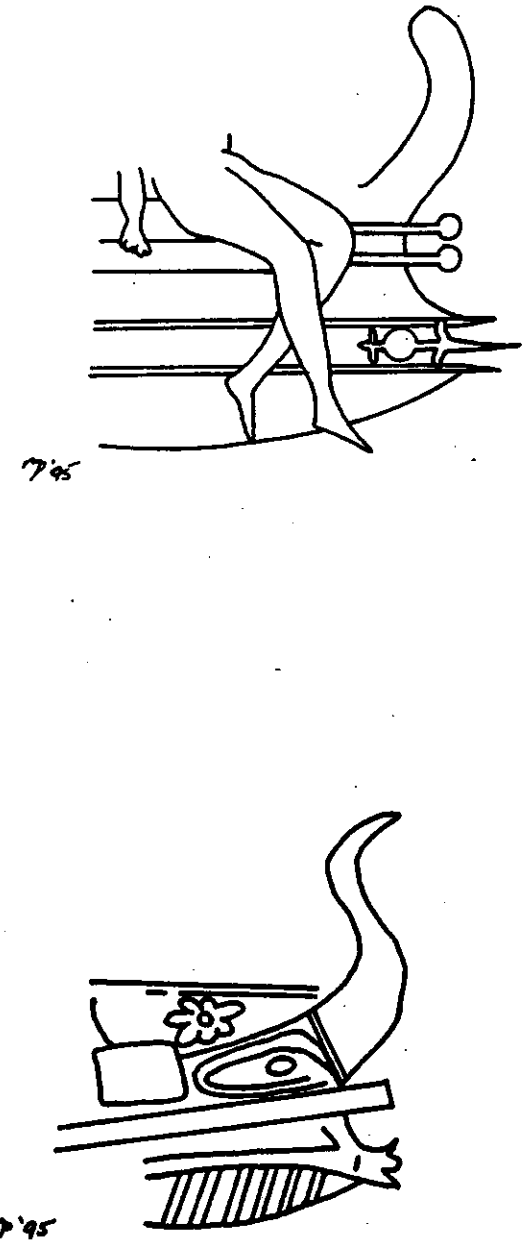

Fig. 35. Placement of wales on Hellenistic warships.
(After Basch, 1987, figs. 812C and 808E)

It has the side wale troughs for attaching the ram to the ship, as well as a cowl and tailpiece to protect the ship's stem.[135]

In discussing the Fitzwilliam ram, Frost wrote that the main ram body would have supported the bulk of the ram's weight. Such a conclusion is not surprising considering the small number of attachments on the cowl and tailpiece. Frost then adds that the attachment of this ram to a warship's hull would not have been very effective because the ram could be knocked sideways.[136] This last point should not be considered a problem exclusive to the Fitzwilliam ram, since all rams probably faced similar problems. A warship and its ram(s) were built to transfer the force of a ramming blow along their length and not transversely. Therefore, any blow from the side to either a ship's ram or hull would have caused considerable damage.[137]

As mentioned above, numerous amphora fragments were found in the same area in which the ram was recovered. No probing was conducted to see how deep or extensive the amphora field extended into the sand, although a large number were clearly visible atop the seafloor. A piece

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[135] There are cases where naval rams were used as decorative elements. In the middle of the sixth century B.C. in Greece, rams were mounted on wagons taking part in theater troupe processions, a practice which was later taken up by the Romans: M. Bieber, *The History of the Greek and Roman Theater* (Princeton 1961) 19.

[136] Frost (supra n. 42) 227.

[137] Morrison and Coates (supra n. 49) 222.

from one of these amphoras was recovered at the same time as the ram (fig. 36).

The amphora neck is preserved to a length of just over 35 cm. The exterior diameter of the collar is 14.5 cm, while the exterior diameter at the base of the neck is 17 cm. The walls of the neck are 1.7 cm thick. The piece is red-beige in color, with flecks of mica in the paste. Wheel-ridging extends over the entire length of the neck. Each of the amphora's two handles is approximately 3.0 cm wide. The handles at their upper ends blend into the flared lip of the collar. The piece is relatively free of encrustation, although one side clearly shows more encrustation, undoubtedly because this was the exposed face. However, the encrustation was light enough that it was possible to note that there were no markings or stamps.

Nicholls wrote that the amphoras at the site were Late Roman.[138] This initial statement appears to be correct because there are close parallels from the Late Roman period. This amphora type is frequently found along the North African coast, particularly in Egypt (fig. 37). It was made from a distinct Nilotic clay, is characterized by a soft, fairly rough and sandy mica fabric, and is buff in color. This type of amphora probably held wine and

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[138] Nicholls (supra n. 123) 86.
Correspondence between the ram's owner and George Bass back in 1964 suggested that the amphora may be Byzantine, yet no Byzantine parallels could be found for the amphora neck in question: Personal communication, D. Schofield, November 1994.

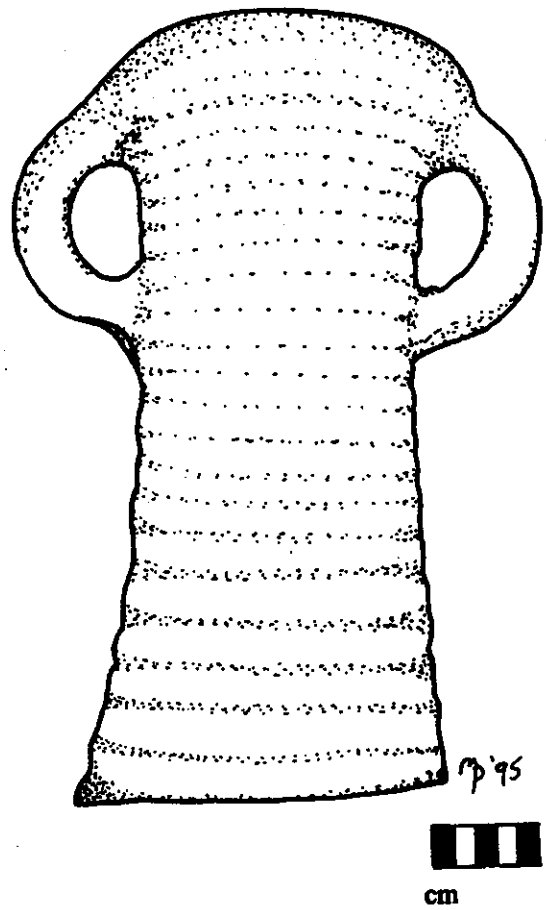

Fig. 36. Amphora neck recovered near Fitzwilliam ram. (Drawing by M. Pridemore)

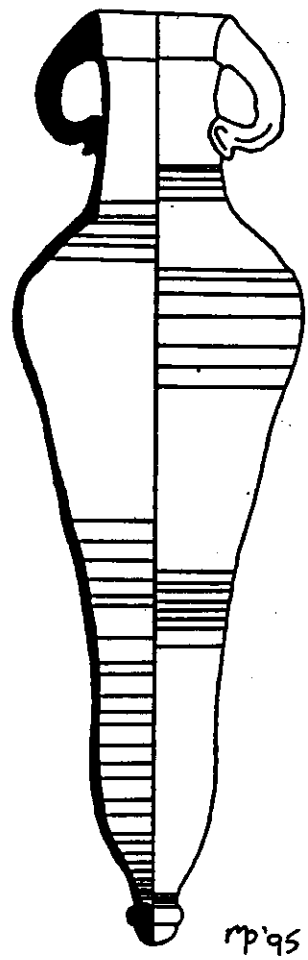

Fig. 37. Late Roman amphora from Alexandria, Egypt (late 4th-6th century A.D.). (After Peacock and Williams, 1986, fig. 124)

dates from the late fourth century A.D. to the middle of the sixth century A.D. Several amphora of this type have been found at Alexandria, and also at Carthage and Ostia.[139] Several fragments have also turned up at Benghazi, Libya.[140] The large number of amphoras on the seabed near to where the ram was found, and their late date, suggest the ram and amphoras came from two separate wrecks. There is also the point that ancient warships tended to travel light for speed and maneuverability, and thus would not have usually carried such a large number of storage jars, although they could and were used as military transport vessels.

As with the Bremerhaven ram, there is little to go on in terms of trying to date the Fitzwilliam ram. The amphora material is clearly of later date, so it is no help in this matter. Morrison dated the Fitzwilliam ram to the third to first century B.C., probably based upon its being three-finned.[141] Yet, the naturalistic bird's head and possibly the curved cowl and tailpiece tend to favor a date of the first century B.C. or first century A.D.

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[139] D. P. S. Peacock and D. F. Williams, *Amphorae and the Roman Economy: An Introductory Guide* (London and New York 1986) 205-07.

[140] J. A. Riley, "The Coarse Pottery from Bernice," in J. A. Lloyd, ed., *Excavations at Sidi Khrebish Benghazi (Bernice)*, vol. II (Tripoli 1977) 208.

[141] Morrison (supra n. 11) 158.

Turin Ram

The fourth example to be discussed is the Turin ram (fig. 38). This ram was found in the harbor at Genoa, Italy (fig. 17), and then placed in the Armory at Turin, Italy. The Turin ram is actually longer than both the Fitzwilliam and Bremerhaven rams, measuring just over 0.55 m in length and 0.22 m in height. This bronze sheathing could have fitted over the end of a rectangular composite timber consisting of the joined ends of a pair of wales. The ram was attached to internal timbers with rivets or nails, only the holes for which still survive. The limited fastenings again demonstrate that the majority of the ram's support was provided by an internal wooden armature.

As one can see from Fig. 38, the Turin ram is shaped like a boar's head.[142] Torr dated this ram to approximately 50 B.C., though he cites no evidence for this date.[143] Zoomorphic *proembolia* are seen anywhere from the third century B.C. up through the first century A.D. Any further narrowing of the date would be difficult with the information currently available.

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[142] Murray wrote that the Turin ram represents a ram's head. However, given the lack of horns, and the prominent lower canines, a boar's head is more plausible: Murray and Petsas (supra n. 105) 103, n. 33.

[143] Torr (supra n. 70) 139.

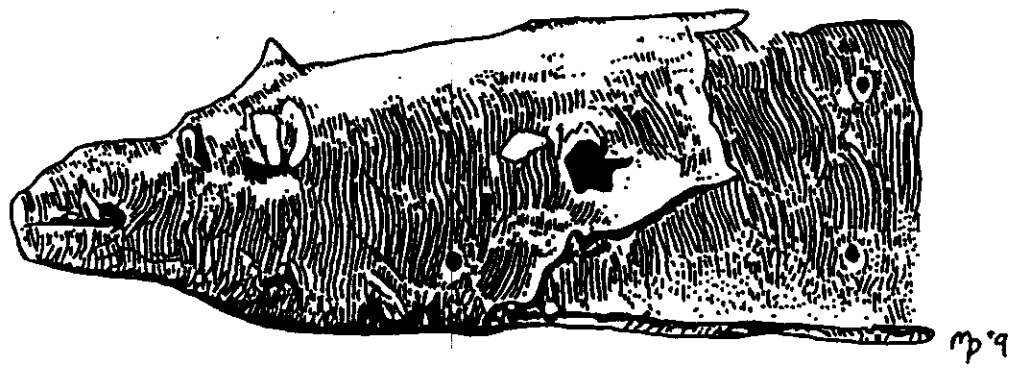

Fig. 38. Turin ram. (After Torr, 1964, fig. 43)

Canellopoulos Ram

The fifth and final example is currently on display in the Paul and Alexandra Canellopoulos Museum in Athens, Greece (fig. 39).[144] This ram was reportedly found by Mr. Canellopoulos somewhere in the Corinthian Gulf earlier this century (fig. 17). The ram is approximately 40 cm long and 25 cm high, making it the smallest of the five extant examples. The ram's width varies between 10-15 cm, though it increases towards the forward end. This piece is also made from bronze, and the metal is only a few millimeters thick. There are no wood remains, and it is unknown if any wood was present when the piece was originally recovered. Given its size and shape, this piece has been called a *proembolion.*[145]

The piece is zoomorphic and has been rendered to show various details of the creature. The eyes and large nostrils are simply represented by holes in the metal. There are also pronounced indications of skin folds cast into the metal's surface, suggesting the creature might possibly represent some type of swine. The creature has a long open mouth which runs the length of the head and contains three distinct types of teeth. The elongated jaw is

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[144] I would like to thank my friend and colleague David Stewart for his help, and for the invaluable photographs he took of the Canellopoulos ram for me while he was in Athens.

[145] Murray and Petsas (supra n. 105) 103, n. 33.

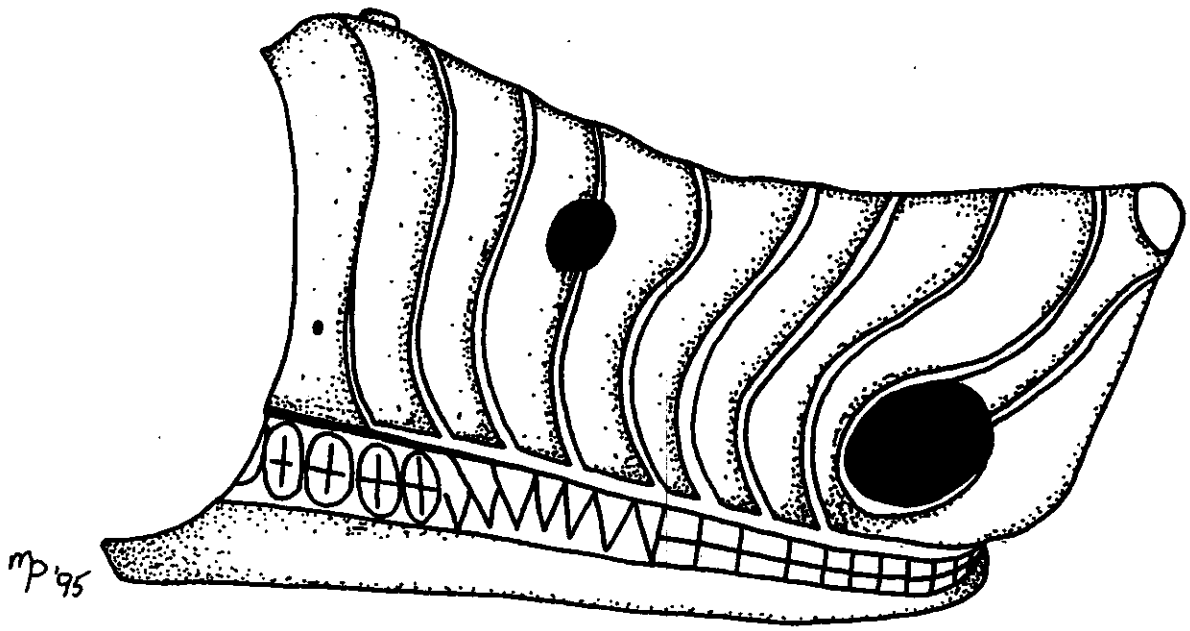

Fig. 39. Canellopoulos ram. (Drawing by M. Pridemore)

more characteristic of a crocodile than a boar, so the identification of the creature is somewhat ambiguous.

The ram was attached to a ship's bow with large bronze rivets. There were only three rivets in all, one of which survives. All three rivets were located along the after edge of the ram, one on either side and the third on top. The interior of the ram contains two slots, one running down either side, which could have accepted a pair of wales to support the piece.

The only published description of the Canellopoulos ram appears in a guide to the Canellopoulos Museum. The entire passage is reproduced here. The guide states that,

> some of the nails which attached this bronze sheath, moulded in the form of a sea monster snout, to a wooden core are still preserved. The snout is oblong, with numerous transverse wrinkles even on the nostrils, and underneath there is a row of three sorts of teeth. The clarity and simplicity of the decorative elements, combined with a certain naturalistic tendency, point to a dating in the early Classical period.[146]

The Canellopoulos ram is thus very similar to the Turin ram, the most striking similarity being the zoomorphic appearance of both pieces. There is little to go on in terms of trying to date the Canellopoulos ram. Although Brouskari suggests the early Classical period based upon stylistic factors,

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[146] M. Brouskari, *The Paul and Alexandra Canellopoulos Museum* (Athens 1985) 46.

zoomorphic *proembolia* are not seen in the iconographic record until the third century B.C., hardly the early Classical period.

There is a possible parallel for this style of creature on a marble relief found at Praeneste and now in the Vatican Museum. The relief dates to the second half of the first century B.C. and depicts a Roman galley, possibly a quadrireme or larger class of warship.[147] Of interest here is the "figure-head" (fig. 40). One sees a large four-legged creature situated on the ship's bow. The creature has a large ovoid head with an elongated jaw with its teeth bared. The entire creature has been rendered to show scales. The exact identification of the creature is unclear, although it is clearly a reptile. Its long tail and overall appearance suggest a crocodile. If the ship on the Praeneste relief represents one of Antony's ships captured at Actium in 31 B.C., the identification of a crocodile would gain some support, given that such creatures are found along the Nile, and Antony's close association with this region.[148]

The wales of the ship are on the same level as the creature's head, which projects beyond the vessel's stem. On the relief they appear to terminate at the creature's back. The placement of the creature with respect to the wales may show how the structure was supported. Thus, this relief

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[147] Casson (supra n. 2) xxiii.

[148] Basch (supra n. 4) 824.

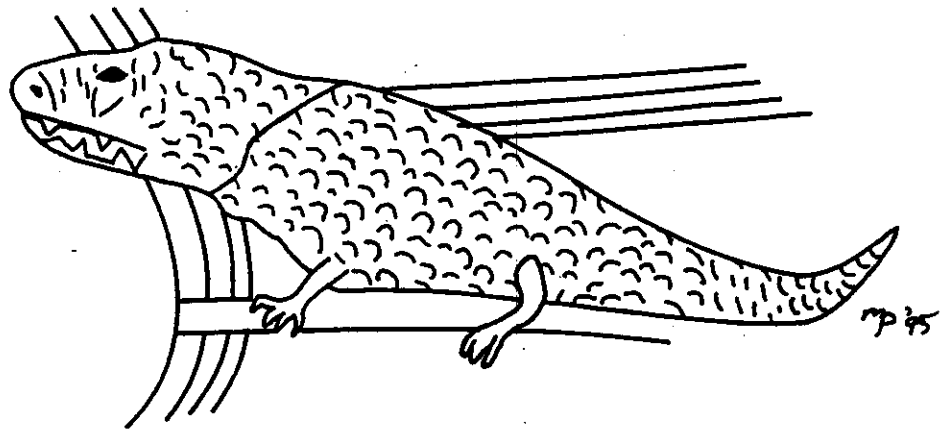

Fig. 40. Bow ornament on marble relief from Praeneste. (After Basch, 1987, fig. 916)

may represent a vessel equipped with a feature similar to the Canellopoulos ram, and thus provide it with a date closer to the first century B.C.

An important factor to keep in mind is the very thin metal from which this piece is made. The lightness of the casting is not ideal for ramming. A blow of any significant force would more than likely crush the creature's snout. (The same could be said for the Turin ram.) There are also the large holes in the forward end of the Canellopoulos "ram". Again, these features are not very conducive for a solid, impact resistant structure. One would thus question the functionality of both the Canellopoulos and Turin "rams". They may still have been mounted at the end of a pair of extended wales on the stem of a warship, but they do not appear to be constructed in such a manner as to make them viable weapons. Both objects were more likely decorative pieces.

CONCLUSIONS

One has seen that the naval ram went through several distinct developmental stages in over a millennium of use. The earliest waterline rams were pointed. Over time this design was replaced by the blunt-ended ram, which in turn was superseded by the three-finned ram. Each successive design was an improvement in the efficiency with which the ram delivered a ramming blow, decreasing the chances of a ramming ship becoming entangled in the hull of an enemy vessel. As ship designs and construction techniques changed, the waterline ram was phased out of use. In the medieval period the waterline ram had completely vanished and was replaced by the boarding ram.

Secondary rams went through a similar developmental process, responding to changes in the design of primary rams. The first *proembolia* complemented a waterline ram by limiting primary ram penetration. In their second incarnation, *proembolia* were used to damage an enemy ship's outrigger, although they could still function in their original capacity to limit primary ram penetration. All three waterline ram designs were used as designs for secondary rams, showing that *proembolia* paralleled the development of primary rams.

Only the Bremerhaven and Athlit rams are clearly examples of primary waterline rams. This can be seen from the design and angles of their bottom

plates. The Fitzwilliam ram is more likely a *proembolion* given its size, particularly the size of its ramming head. Even though the Fitzwilliam ram is comparable in overall dimensions to the Bremerhaven ram, the Bremerhaven ram's ramming head is four times larger than the Fitzwilliam ram's. The larger surface area would be more suited to a primary ram than a secondary ram. In the case of future ram finds, the size of the ramming head in relation to the size of its body may help distinguish primary and secondary rams.

There is also the matter of the curved cowl and tailpiece. Although the curvature of these features is not definitive proof for the Fitzwilliam being a secondary ram, the ram's tailpiece may still hold an answer to this question. The small dimensions of the channel within the tailpiece suggest it would be much more suited to accepting a ship's upper stem than the forward end of its keel.

The Canellopoulos ram, and possibly the Turin ram as well, are probably not functional secondary rams due to the way in which they were designed and constructed. In the strictest sense, for a structure to be a *proembolion* it must be a functioning weapon and not just bow ornamentation. This is not to say that all zoomorphic bow projections were not *proembolia* and simply decorative. Each piece must be judged on the basis of its own particular dimensions and design. However, in the case of

the Canellopoulos ram, the thickness of the metal, along with the large holes in the structure, show that it could not possibly have withstood any impact, and hence it cannot be a secondary ram.

Only a limited number of designs are represented in the group of known rams, certainly in part due to a total sample size that is very small. All of these rams, excluding the recent find off Sicily whose design remains unclear, are either three-finned or zoomorphic. It is not entirely clear why these designs, representing a relatively small portion of the total period of ram use, would be favored in the archaeological record, although the size of fleets in the Hellenistic period may be a key factor in this question. The increased number of ships from the period meant there were more ships to enter the archaeological record, creating a biased sample.

The three-finned rams all share certain elements. Each consists of a main ram body and a bottom plate. The main body transferred the majority of the forces in delivering and absorbing a ramming blow. The ram's interiors were hollow and contained troughs along either side to accept a pair of the warship's wales. Except for the Fitzwilliam ram, the bottom plates acted to protect the forward end of the warship's keel.

All of the extant rams show that there was a limited number of fastenings used to attach the ram to a warship's bow. The Bremerhaven ram, for example, was secured with just five small bolts. These rams were

held in place primarily by the internal timbers and not by the fastenings. The timbers which played the largest role in this regard were the warship's wales, although in the larger rams the ramming timber also helped support the ram. A ship's wales gave internal support to a ram and also aided in transferring and absorbing the forces generated by a ramming blow to the warship's hull. If this task was not properly engineered, severe damage would occur to the warship's hull.

Both the Athlit and Bremerhaven rams show signs of multiple repairs. These repairs show that efforts were made to keep a ram in service instead of scrapping it. Large amounts of time, money, materials, and skill were required to cast a ram, especially the larger rams. Thus, it is not surprising that repairs were made wherever possible.

Naval ram research has a great deal of potential for future work. The biggest need is expansion of the data set, especially considering that two of the current pieces are questionable as functional rams. With the recent discovery of a ram off Greece and another possibly off Sicily, the number of extant rams is slowly increasing. Hopefully, in the future more attention will be paid to provenience, since this is information that most of the current examples lack.

Some promising work has recently been undertaken in Greece with the Actium Project. The project began in 1993 with the goal of locating the remains of some of the warships and their rams sunk during the Battle of

Actium in 31 B.C. Using side-scanning sonar, the investigators identified twenty-four "contacts" on the sea floor in the area in which the naval battle was thought to have taken place.[149] Hopefully, one of these contacts will turn out to be a ram. Undoubtedly, other rams will be found in the future, allowing even more detailed comparisons to be made. A larger sample might also allow comparisons to be made to see if there were regional or cultural differences in ram designs.

[149] W. M. Murray and E. Hadjidaki, "The Actium Project: A Search for Remains from the Battle of Actium," *Abstracts AIA: 95th Annual Meeting* vol. 17 (1993) 71.

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