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The Center for Maritime Archaeology and Conservation (CMAC) is based at Texas A&M University in College Station, Texas. Working in partnership with the Anthropology Department's Nautical Archaeology Program, the non-profit Institute of Nautical Archaeology, and other research institutions, CMAC strives to be in the forefront of maritime archaeological research around the world. The opinions expressed in CMAC News & Reports are those of the authors and do not necessarily reflect the views of CMAC or Texas A&M University.

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Please send correspondence to:

Center for Maritime Archaeology & Conservation
4352 TAMU
College Station, TX 77843-4352
United States

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On the Back Cover: Stephen DeCasian stands next to the beeswax replica of his ancient naval ram casting project.

From the Director:

Welcome to another edition of CMAC News and Reports! While the new discoveries in maritime archaeology and conservation are always exciting, these discoveries can lead to research projects that span decades. As these decades pass and new technologies are introduced, a re-evaluation of legacy assemblages can lead to exciting new revelations. This issue of CMAC News and Reports contains two such studies, on two of the most famous projects carried out by CMAC faculty, the 14th-century BCE Uluburun shipwreck and the 17th-century CE sunken city of Port Royal, Jamaica.

For the Uluburun shipwreck, NAP Ph.D. candidate Rachel Matheny is using statistical analyses to look for patterns in the shape of one of the transport jar types being carried by the ship to try and elucidate typologies and trends not seen in traditional analyses. For Port Royal, NAP Ph.D. student Bethany Becktell is leading the charge to re-inventory the Port Royal collection in a modern museum database program. Not only is this helping us identify new patterns in the assemblage, it is also providing many of our students valuable experience working with a large, complex museum collection.

It is not all legacy collections in this issue though; NAP M.S. alumnus Peyton Harrison writes about his study of some of the recreational items found among the many thousands of artifacts from the C.S.S. *Georgia* (1864 CE) that were conserved at the Conservation Research Laboratory. These types of objects provide a powerful common link to the humanity in those that came before us. Finally, NAP Ph.D. student Stephen DeCasien stuns with his massive work of passion, a full-sized lost-wax replica of a Greek trireme battering ram, based on archaeological research. Watching the ram take shape in the Conservation Research Laboratory has been a real treat for all of us, and we are excited to see the final bronze result of all of his hard work.

As always, if you find yourself impressed with our research, you can directly support the students, faculty, and staff of CMAC at give.am/shipwreck.

Christopher Dostal
dostalc@tamu.edu
(979) 845 - 5242

CMAC
4352 TAMU
College Station, TX 77843-4352
United States

Ancient Naval Ram Casting Project (2021 - Present)

Stephen DeCasien
Nautical Archaeology Program, Texas A&M University

More than 31 naval rams exist in the archaeological record, many of which are three-bladed waterline rams. The first archaeologically attested three-bladed waterline ram was discovered off the coast of Athlit, Israel in the 1980s (Figure 1). The Athlit ram was the first to be studied by archaeologists and historians. The bronze ram and its intact bow timbers revealed that the ram served as an integral part of warship construction and a complex naval weapons system. It also suggested that rams were cast in bronze to the highest standards using the direct lost-wax casting method.

31 rams have been discovered since the Athlit ram. Each subsequent discovery has helped scholars gain deeper insight into naval warfare from the Classical to the early Roman Imperial periods. Of those 31 rams, 26 were recovered at the Egadi Islands near western Sicily. RPM Nautical Foundation in cooperation with the Sicilian government and the Soprintendenza del Mare are at the head of these recovery efforts. Other notable discoveries include the Acqualadroni, Bremerhaven, Follonica, and Piraeus rams, along with a supposed Mithridatic ram that was found in the Black Sea (Figure 2). Proembolia, or 'subsidiary,' rams such as the Belgammel, Canellopoulos, Turin, and an unpublished Imperial Roman era proembolion have also been found.

Figure 1: Athlit ram at the National Maritime Museum in Haifa, Israel. Photo by Dr. Shelley Wachsmann.

Figure 2: Piraeus ram at the Piraeus Archaeological Museum in Piraeus, Greece. Photo by the author.

While it is known that the ancient craftsmen used the lost-wax casting method to produce large bronze objects, such as the famous Riace Warriors, the intricate details of this process as it relates to ram production is debatable. I am currently in the final stages of conducting an experimental project in recreating a trireme-sized ram using a three-step process: (1) false bow construction, (2) beeswax model creation, and (3) lost-wax casting. The purpose of this experimental reconstruction is to better understand the time, manpower, and materials needed to create ancient rams. By knowing the production process of rams, it is possible to better understand the economic, social, and political apparatuses of ancient navies.

The first step of the project was to construct a trireme-sized ramming bow to serve as the beeswax model's core. The bow was based on a culmination of archaeologically attested ramming bows such as those found inside the Acqualadroni, Athlit, and Egadi rams. The bow consisted of six major timbers: the ramming timber, port and starboard wales, keel, chock, and stem. These six pieces of wood in combination reflect a bow that may have been constructed as part of a frontal ramming vessel after 413 BCE. The entire bow was built using Douglas fir, a pine that is native to the northwestern United States. This type of timber was chosen due to its similarity to Mediterranean pine species, availability, and affordability. In total, the bow was made from eight 4x4s and one 2x4 of Douglas fir that were cut and planed to the specifications and dimensions needed to create the false ramming bow (Figure 3).

The second step of the project involved the use of beeswax to fashion a model of a trireme-sized ram onto the false bow (Figure 4). Around 40 pounds of beeswax was used to make the final beeswax model. Based on relevant academic scholarship and personal experience working with beeswax, the following measures were taken to create the beeswax ram model.

1. The bow was coated in pine tar to slightly oversize the model to compensate for shrinkage during casting and to create a working surface for the beeswax.
2. The cold beeswax blocks were broken-down and separated for each specific section of the ram model.
3. The beeswax was melted into blocks, sheets, and semi-hot "half-blocks" using pre-made molds and some small sheets were worked by hand.
4. The beeswax was hard-pressed and sculpted directly onto the bow while it was still warm.
5. Each section was sculpted to a desired thickness and smoothed together.
6. Once the central core was finished, the fins were added and fixed to the rest of the beeswax model.
7. The fins were built in two methods using both freehand sculpting and pre-made molds.
8. After the addition of the fins, the fins and fin cavities were shaped and smoothed.
9. Once the beeswax ram was completed, decorative additions were made, such as an inscription on the cowl.

Based on the initial stages of the project, it is safe to assume that in antiquity a trireme-sized naval ram required an average of 30 to 50 pounds of beeswax to create a model. It would take as

Figure 3: Fully constructed false trireme ramming bow. Photo by the author.

many as three to four skilled craftsmen to build one beeswax model in a span of one to four working days, depending on its size and complexity. The process of working the beeswax likely consisted of a combination of pre-made slabs and semi-hot wax pieces worked together followed by the addition of the fins in a similar manner. The last step of the project is to cast the beeswax model which is scheduled to occur in Fall 2022. Currently, the beeswax model has been removed from the false bow and delivered to the local foundry. The foundry will follow the lost-wax casting method to produce the bronze ram. The finished ram will then be set on the bow for final placement and recording. ■

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Figure 4: Various construction stages of the beeswax ram model. Photo by the author.

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