Queen Anne's Revenge
Conservation Laboratory Report, April 2004

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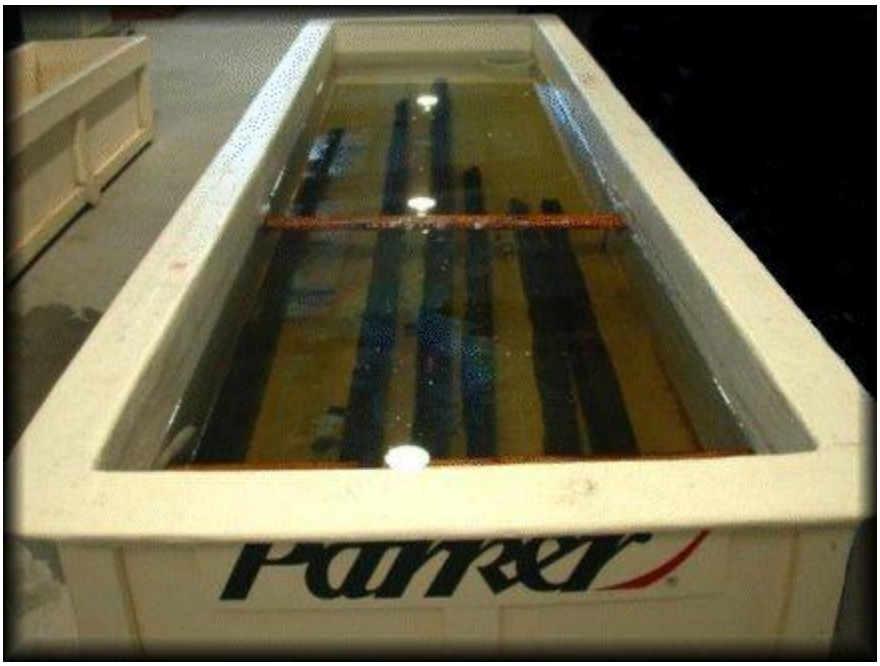
The arrival of a new treatment tank donated by Parker Marine Enterprises and the installation of equipment for purifying water by reverse osmosis continue the steady pace of progress at the conservation lab in April. The *QAR* staff also continues correspondence with experts abroad regarding on-going cannon investigations and sought advice from the Head Conservator of Florida's State Bureau of Archaeological Research.



Parker Donation

Large concretions, ship's timbers and the cannons are stored and treated in nine large tanks, each with capacity to hold about 400-500 gallons. Now that the timbers are moving from storage and desalination to a treatment stage with polymer polyethylene glycol (as reported last month) it was realized that another tank would be needed. Due to a limited budget and the cost of polymers chosen to conserve the wooden timbers, conservators must use resources wisely. A new tank was designed to maximize the number of timbers that could be conserved at the same time while providing adequate space for polymer circulation. The *QAR* staff built the new tank, measuring sixteen feet long, four feet wide, and two and half feet high, of wood. Parker Marine Enterprises then graciously donated their time and materials to line it with fiberglass. The ***QAR*** project greatly appreciates donations of this magnitude and recognizes that Parker's assistance has been a tremendous help throughout the years.

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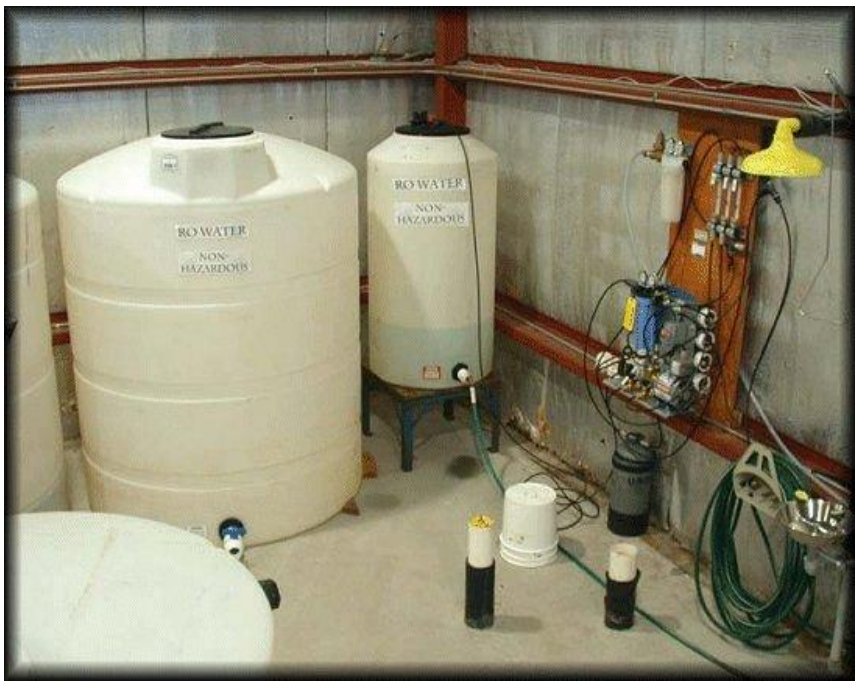
Desalination - the importance of pure water.



Archaeological objects recovered from marine environments contain large amounts of chlorides and other soluble salts as a result of long-term exposure to seawater. In order to prevent corrosion and other types of damage to the artifacts, these salts are removed during conservation in a process called desalination. Desalination of non-metal objects, such as ceramics, stone, glass, wood, and organic material, is accomplished by soaking in baths of clean water, starting with tap water and moving on to water purified by reverse-osmosis (RO water). Over time, the salts present in the objects move out into the desalination baths, leaving the artifacts as free of salts as possible.

Metal objects, particularly those made of iron, are very susceptible to corrosion promoted by the presence of chloride. Chlorides can be removed from metal objects by electrolysis. During electrolysis at the *QAR* Lab, the artifacts are kept immersed in a 2.5% solution of sodium carbonate (made up initially in tap water and then in RO water), which functions both as the electrolyte and a corrosion inhibitor, due to its elevated pH. As the electrolysis treatment progresses, chlorides are drawn away from the metal object and into the electrolyte solution. By measuring the amount of salts in samples taken from the various desalination solutions on a weekly basis, progress in desalination is monitored. Chloride ion concentrations (in parts per million (ppm)) in metal desalination solutions are measured with a millivolt meter and a chloride specific electrode. The levels of soluble salts generally in non-metal desalination solutions are measured with a conductivity meter (units being micro Siemens per centimeter). Measurements are recorded in a table and graphed. Salts will continue to diffuse out of the objects as long as the concentration in the solution is less than in the object. When salt levels stop rising in a solution, the water is changed so that the diffusion gradient between the object and the solution is maintained.

For much of the desalination process tap water (with chloride levels in Greenville of about 40ppm) can be used. As chloride concentrations in seawater are about 19,000ppm and levels in objects can be as high as 4,000ppm (as found in cannon by conservators in Australia) there will be a sufficient diffusion gradient between the object and tap water to facilitate extraction of salts from the object. We are now approaching the end of the desalination stage for most of the objects, as indicated by chloride concentrations in most desalination solutions of less than 100ppm. To complete desalination we must now change from tap water to purified water (with

chloride concentrations of c. 1ppm). To change the solutions in the cannon tanks we will need a lot of purified water - at least 400 gallons per tank!

A unit to purify tap water by Reverse osmosis (RO) was installed by US Filters this month at the laboratory in Greenville and will enable us to complete the final stages of desalination of *QAR* artifacts.

On-going Cannon Investigations

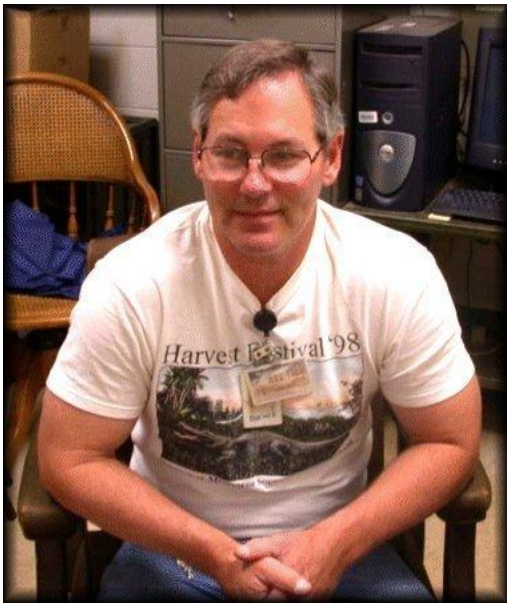
QAR archaeologists corresponded with experts in eighteenth century European armament, as research into the origins and dates of the cannons continues. Accurate recording of measurements and marks are vital for this research. Cannon 2 and 3 have been identified as six-pounders.

Cannon 2 is the only cannon recovered unmarked and not loaded. Cannon 3 exhibits crudely chiseled numbers "1 7 3" running lengthwise just forward of the vent. Archaeologists investigating the origins of these two six-pounders have been in correspondence with Max Guerout, a French archaeologist. Guerout is the vice president and organizer of "Le Groupe de Recherche en Archeologie Navale" (GRAN). One of his areas of expertise and research has been ships used in the French slave trade.

Cannon 19 has marks on each trunnion. The left trunnion is marked with the numbers "713". The right trunnion appears to bear the letters "IEC", possibly foundry marks of Jasper Ehrencreutz whose family operated the Ehrendal Cannon Works,1689- 1750. Research is still ongoing and we have contacted The Head of Sweden's Armament Museum Research Department, Thomas Roth, for information that may help in determining the origin of this cannon. Details of cannon research will be published once complete.

Conservator Consultation

Conservators puzzled on the identification of artifact QAR060.000 when first removing it from concretion until David Moore, *QAR* Archaeologist, identified the artifact as a lifting jack.



He also suggested consulting Jamie Levy, Head Conservator of Florida's State Bureau of Archaeological Research. Levy had conserved a similar jack, from the 1715 Spanish Plate Fleet wrecks off the Florida coast, about 20 years ago. We obtained a number of excellent drawings of the original appearance of a jack but the construction of the internal gearing mechanisms remained a mystery.

In our February 2003 report we described the process of removing QAR060.000 from concretion. It is currently undergoing desalination by electrolysis but concretion still surrounds the gearing mechanism. Removing more of the concretion would speed up the desalination as well reveal how the object was constructed. However before proceeding to do this we needed more information about these types of objects.

This month Wendy Welsh, our Conservation Laboratory Manager, had a chance to travel to Florida and consult with Jamie Levy about our jack as well as viewed several he has conserved over the years.

Although these jacks are similar to wagon jacks of the same period, they are considered to be jacks designed for use on ships. They would have been used upright and the curved end of the track allowed the user to lift from the bottom as well as move cargo. The 1715 Plate Fleet jack is larger than QAR060.000, but the construction of the gearbox or cranequin, would be similar and would give us a guide on what to expect to find inside our jack.

Jamie Levy was an excellent host and provided great insight concerning this artifact. His knowledge of 18th century artifacts and methods to conserve them was greatly appreciated and his help will be useful in the future.

We hope to arrange to X-ray QAR060.000 again soon. Now that much of the external concretion is removed another X-ray may reveal more detail of the gearing mechanism. A good X-ray image would help guide us if we decide to remove more of the internal concretion to reveal more of the mechanism as well as facilitate chloride removal from inside the object. If all possible salt is not removed there is a risk that after treatment the dry object could begin to corrode from the inside out and eventually the artifact would be lost.

Next month: ECU Graduate Assistants finish up for the semester and the last task in constructing our conservation laboratory is completed.