Side Effects of Sucrose: Retreating a Civil War Era Keg Torpedo

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Introduction: The conservation of wooden objects from an underwater environment can present unique challenges to conservators, even after treatment. This case study presents an example of the challenges that arose while retreating a keg torpedo that had been bulked with sucrose then stored in a non-climate controlled environment for 12 years.

History: Civil War

Shells fired on Fort Sumter 12 April 1861 ignited tensions between Northern and Southern American states into full scale war. Confederates lacking craftsmen and resources turned to more creative means of slowing Union gunboats. The need lead to founding the Confederate States Torpedo Bureau in October 1862. This agency developed many young mining specialist, one of whom was Brigadier General Gabriel J. Rains. Rains developed torpedoes used both in terrestrial and aqueous environments but his most prolific is known as a keg torpedo, the name deriving from recycled barrels to create the torpedo's body.

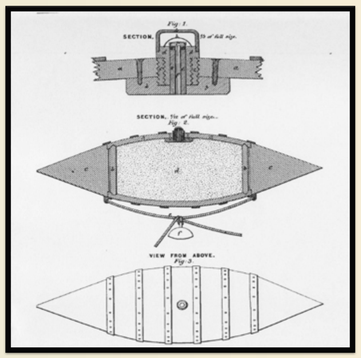


Illustration of a common keg torpedo. These devices consist of a repurposed barrel tarred on inside and out for waterproofing, cones for flotation and streamlining, and a friction fuse intended to ignite with the slightest pressure.
Source:

History: The Object

August 28, 1996 Jim Bell discovered one of the keg torpedo's cones sticking out of the Savannah River's muddy banks. Burial conditions created an anaerobic environment preserving the wood and copper alloy fuses but iron hoops holding the barrel together rusted away. Property of the state of Georgia, East Carolina University's Maritime Conservation lab was enlisted to conserve the artifact during a semester-long course in the Spring of 1997. After treatment, the keg torpedo was on long term loan to the Savannah History Museum where it was alternately on display and in storage.

The disarticulated keg torpedo pieces after arriving at the East Carolina University's Maritime Conservation Lab 1997

Condition and Analysis

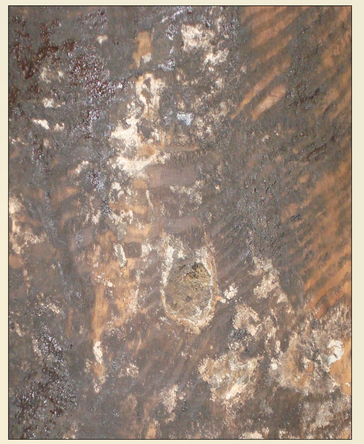
Over time the fuses developed a black patina. The keg torpedo was eventually brought back to ECU so the blackened fuses could be cleaned, but conservators noticed other more problematic issues for the artifact. In the 12 years since initial treatment, the staves had developed slight mold growth and a hard white concretion had formed on the conical reinforcing pieces. It was postulated that this substance could be an unstable product of the initial sucrose treatment. FTIR analysis showed a similar signature to that of glucose and fructose. The concretion was not only aesthetically unappealing but, since it was likely composed of hydrophilic sugars, harmful to the artifact . It had to be removed.

Methodology: Fuses

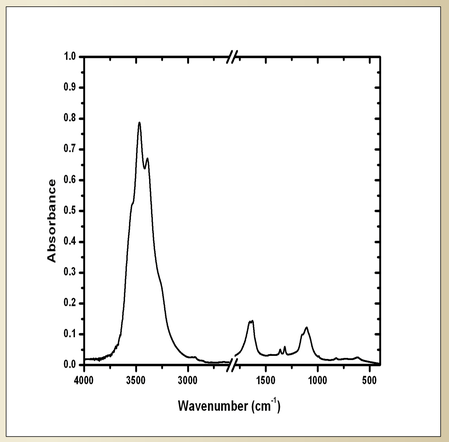
Two copper-alloy fuses required retreatment focusing specifically on a black patina and surface pitting that formed during the twelve years between treatments. Pitting could not be treated but black patina was removed by chemical cleaning. Twenty percent aqueous Citric Acid was applied with cotton swabs followed by application of deionized water to slow the chemical reaction. Mechanical cleaning was necessary on tougher concretions remaining, which were removed with a scalpel. Following cleaning, fuses were coated with Renaissance Microcrystalline Wax applied with a paintbrush.

Before and After Treatment
Comparison of Fuse Exterior 2010

Before and After Treatment
Comparison of Fuse Interior 2010



Concretion Detail from Cone



FTIR Results for Concretion Sample

Methodology: Cones

The concretion on the cones proved water soluble. Large cracks in the object made it too fragile for re-immersion, so sponges and de-ionized water were used to soften and gently remove the residue. Excess moisture was blotted with Kimwipes and the then the cones were air dried.

Before Treatment 1997

Before Treatment 2010

After Treatment 2010

Results/Further Study

Sucrose has long been a popular bulking agent for waterlogged wood because it is cheap, nontoxic, and generally considered reversible. Recent research, however, has shown sucrose treatments can break down rapidly in certain environments, such as those with high humidity. This case study supports these claims and potentially predicts problems for other sucrose bulked wooden objects as well.

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