

Electrolysis Proves Useful In Preserving Metal Relics

By Herbert C. Bump and Frank H. Gilson

The Florida Research and Conservation Laboratory, begun in 1967, is a section of the Florida Department of State's Bureau of Archaeological Research. The lab was set up originally to conserve and stabilize artifacts relating specifically to the history and prehistory of Florida and to serve the conservation needs of the various museums and historical societies in the state.

However, in recent years the lab has expanded its operations and now contracts to do conservation work for the National Park Service, historical societies, organizations and state government agencies throughout the United States, and the Caribbean. The volume of artifactual material processed annually through the lab has tripled in the past two years. Even so, the amount of conservation work still needed is staggering, and many objects of cultural, historical or archaeological importance are being lost each year.

Much of Florida's history lies beneath the sea in the form of shipwrecks. Although it also treats artifacts, the Florida Research and Conservation Lab specializes in the preservation of coastal and submerged artifacts, which pose a special problem. The corrosion processes of iron in aquatic or coastal environments are generally known but the reactions are complex and subject to many interacting variables. It is usually possible, however, to determine what conservation alternatives are warranted for any artifact through visual inspection and knowledge of its previous environment.

On old shipwreck material and items from coastal environments the most prevalent iron corrosion products are ferrous sulfide, magnetite, ferrous hydroxide and iron chloride. Once iron has been contaminated by exposure to a submerged or coastal environment the corrosion process will continue, and even accelerate. If the iron artifact is exposed to the air, the ferrous compounds can oxidize to a ferric state where they

occupy a greater volume and scale off the surface. This process can disfigure a piece and eventually destroy it.

The greatest damage, however is caused by iron chlorides. Iron, especially cast iron, is highly porous. Sea water penetrates the artifact and carries corrosive chlorides (salts) deep within the metal. If the artifact is later exposed to the air, the water will evaporate, leaving the salts behind. Allowing a metal artifact to dry without removing the salts will cause damage and eventual destruction of the artifact.

Many artifacts throughout the United States have suffered from continuing corrosion through the years and will eventually be worthless unless conservation measures are taken, but most are still worth the effort required for preservation. Detecting corrosion problems before they get out of hand is a relatively simple procedure. One may begin by looking at the artifact for the following visible conditions:

1. Is the iron leaking a bluish-purple stain on its surface or on its coating? (Photo 1)
2. On a hot dry day does the iron show small beads of liquid on its surface? (Photo 2)
3. Is the iron cracked? Cracks will usually appear along sharp edges first. (Photo 3)

The photos illustrate dramatic conditions. If any of the conditions can be seen with the unaided eye, the artifact should be considered for treatment. The badly damaged cannon in Photo 4 illustrates what will occur if nothing is done.

Electrolysis is the commonest method of extracting corrosive salts from ferrous and other metal artifacts. This oxidation-reduction process uses an artifact as a cathode, an anode, an electrolytic medium and a DC power source. The process involves negatively charging the salt ions inside the metal so that they are attracted toward the positively charged anode and



Photo 1



Photo 2

thereby extracted from the metal.

Commonly, the artifact and anode are submerged in a tank of liquid electrolyte. However, the industrial sector has long used a "dry" electrolytic technique to protect reinforcement rods in poured concrete structures – an instance where submersion in electrolyte is not possible. In this technique, a conductive mastic, which serves as the anode, is painted directly onto the concrete. The reinforcement rod becomes the cathode while the natural dampness in the concrete acts as the electrolyte. This particular technique is especially useful in the preservation of historic reinforced concrete structures located along Florida's coastline.

Another electrolytic technique used by the research and Conservation Laboratory is underwater cathodic protection. This technique is used to protect submerged iron artifacts such as cannons or metal hull ships. Using the same principle as that used to protect outboard motors or offshore drilling rigs from salt corrosion, zinc "sacrificial" anodes are attached to the iron artifacts. In this case the seawater itself acts as the electrolyte.

Underwater cathodic protection is used to preserve historic iron shipwrecks that may be salvaged entire at some future date. It may be used in the preservation of submerged displays such as the reproduction of an 18th century shipwreck at Pennekamp Coral Reef State Park at Key Largo, Florida. It may also be used for the preservation of submerged national shrines that are to remain *in situ* but are beginning to show signs of deterioration.

Electrolysis is an effective preservation tool; however, no amount of technique can overcome lack of interest in the field. Even after artifacts needing preservation are identified, preserved and stabilized, some care must be taken in performing preventive maintenance. It is most disheartening to the conservator visiting a historic site to find the valuable artifact that he so carefully preserved six months before, deteriorating through lack of simple maintenance.

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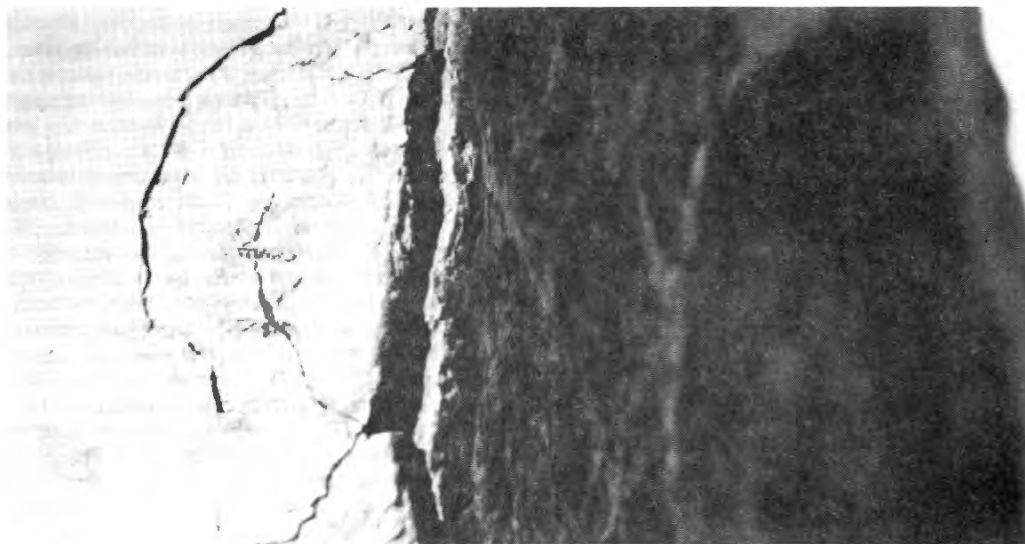


Photo 3



Photo 4