

# Curator's Choice

## *Electrolysis PSA*

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Iron is one of the more problematic materials for archaeologists and curators. After being preserved beneath the ground for hundred of years, it becomes very unstable once removed and quickly begins to deteriorate. Conservators use techniques to reveal and preserve iron artifacts that can be labor intensive, need specialized chemicals and equipment, and expensive. Everyone would like an inexpensive, quick method of preservation but it doesn't currently exist. Unfortunately, the internet has promoted a method, Electrolysis, as a magic treatment without understanding how it works or the damage that it can inflict.

**E**lectrolytic reduction (ER) is a type of electrolysis using an electrolytic cell which converts electrical energy into chemical energy to drive a non-spontaneous redox reaction. The artifact serves as the positively charged cathode and the negatively charged chloride ions migrate away from the artifact into the solution or toward the anode. When excess energy is applied to the electrolytic cell, the water in the solution will decompose and produce hydrogen gas. ER can be used in very specific applications for desalinating iron as well as an aid in corrosion removal. It is NOT a recommended technique for most archaeological artifacts as chemical reactions can be difficult to control and artifacts can be easily damaged. ER does not differentiate between the bulky outer corrosion products and the dense corrosion layers that make up the object's original surface. Without close controls, it is easy to strip artifacts so that only the core metal remains while destroying surface detail.

**T**he example provided by this archaeologically recovered horseshoe illustrates the damage and loss of information that can occur when an artifact is subjected to electrolysis. Upon visual inspection the object is robust (Figure 1), but x-radiography shows a different story. The object is more heavily degraded than it initially appeared. The original surface of the object is suspended in the corrosion products and visible only in outline (Figure 2).

The rope-like structure of the wrought iron is an indicator of the deterioration. While the metal core is present in some areas of the object, one quarter of the horseshoe has been completely replaced by corrosion product (Figure 3). Any treatment would be more damaging to the artifact than preserving the corrosion product that is providing protection to the remaining metal. This horseshoe was exposed to ER to illustrate the extent of loss and damage this process can incur.

**W**ithout the x-ray images, archaeologists would have lost all the original dimensional and surface information. The x-ray also indicates to conservators that this object is not a good candidate for an expensive treatment process. X-radiography is a very good, inexpensive means to survey metal collections. It can provide accurate identifications, provide diagnostic measurements, and record preservation conditions. The MAC Lab is an excellent resource for x-radiography services, but you can also build relationships with local doctors, dentists, security offices (i.e., courthouses), large animal veterinarians, etc. to help image your artifacts. Accurate recording of artifacts is a superior option to destroying data with inappropriate preservation methods.



Figure 1. Horseshoe before treatment.

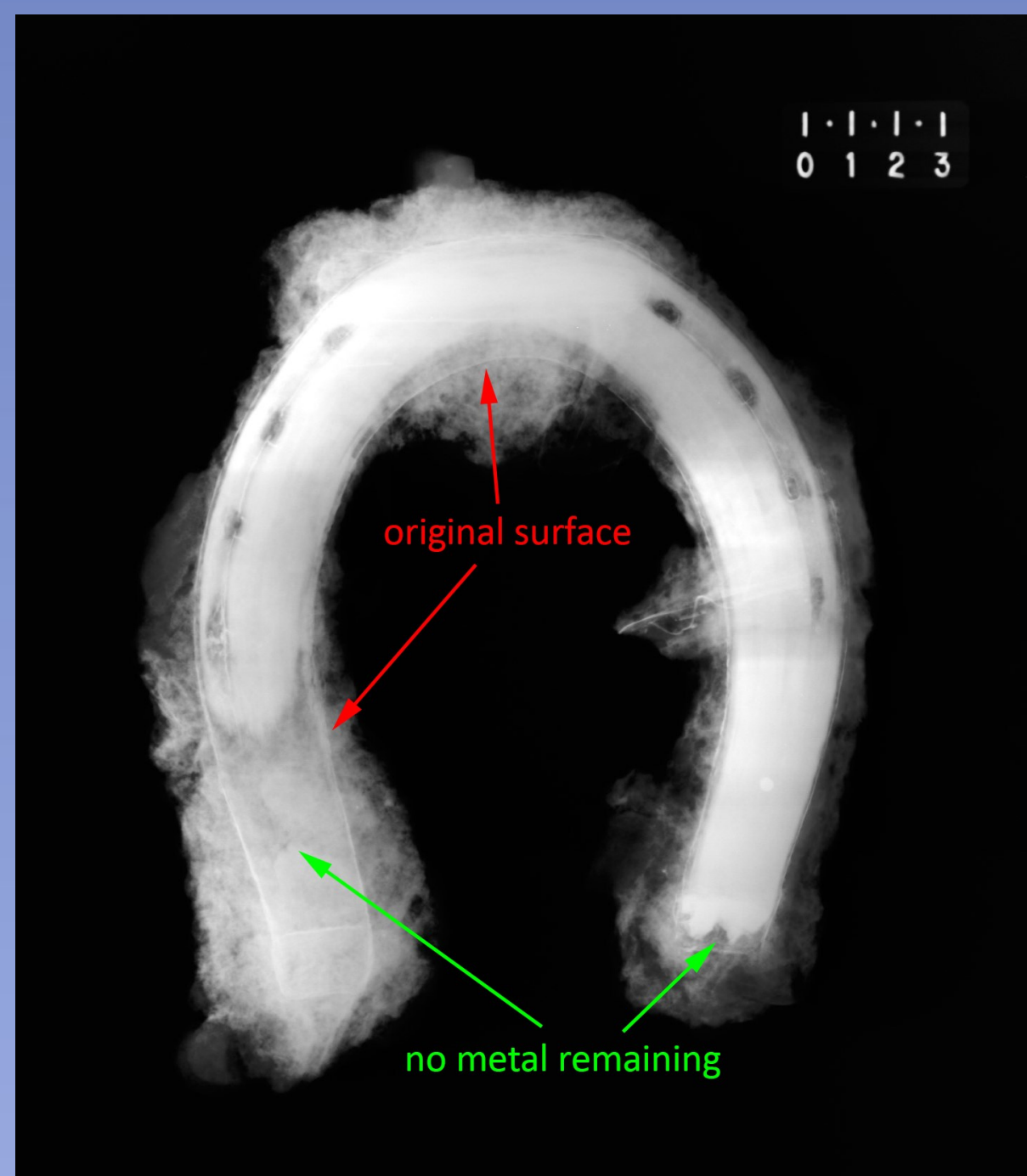


Figure 2. X-ray of horseshoe showing outline of original surface and material loss.



Figure 3. After electrolytic reduction which destroyed all original surfaces and exposes metal core.



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