Cleaning and Stabilization Procedures for the Proposed Metal Conservation Facility S.S.I.-Wilmington

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The cleaning and stabilization of ferrous and non-ferrous metal artifacts is a necessary step in the analysis and curation of archaeological collections. The proposed metal conservation facility, SSI-Wilmington, is organized to manage the large quantities of metal artifacts typical of collections from historic archaeological sites. This paper is intended as a guide for laboratory assistants and interested persons to the laboratory's equipment, processes, and procedures. These methods provide for the cleaning and stabilization of metal artifacts as efficiently and inexpensively as possible.

Foremost in the conservation process is the recording of pertinent information concerning the artifact to be cleaned. In addition to the information requested on the standardized record cards (Figure 1), the artifact is traced and any maker's mark, decoration, or other distinctive feature drawn. Details of the artifact subsequently altered or revealed by the cleaning process are added to the drawing as they are noted. All record cards are filed in a supplement section of the catalogue records.

Metal artifacts recovered from historic Native American and Euro-American sites are predominantly of iron. Once recorded, the first step in the conservation of ferrous artifacts is the removal of surface dirt and corrosion products (see Birchenall & Muessner, 1977:39 for identification of corrosion products and the chemical formation processes of iron oxides). Preliminary removal of encrustations is accomplished by hand with a dental pick, small hammer, or by abrasion with a flexible shaft tool. When using a hammer, the strike should be perpendicular to the artifact surface to prevent extensive damage to the artifact. Artifacts not heavily encrusted and those roughly cleaned by hand are further cleaned by abrasion in the sand blaster. These cleaning procedures should remove most substantial formations of dirt and corrision products.

Electrochemical cleaning follows preliminary hand cleaning. The electrolysis unit consists of a power generator (Figure 2) and a stainless steel tank containing a 5% to 10% sodium hydroxide solution. Leads connect the generator with a brass rod from which the artifacts are suspended within the solution by means of wire and alligator clips. The electrical current, in passing from the artifact (cathode) to the walls of the tank (anode), breaks down the solution into hydrogen and oxygen. The reduced hydrogen ion in turn effects the reduction of the surface corrosion products (Kruger 1977). A less expensive set-up uses a plastic trash can for the tank, and a stainless steel plate, suspended in the conducting solution, as the anode.

The number of artifacts treated in the electrolysis unit at any one time is depended on the artifact surface area and the amount of corrosion product remaining on the artifact surface. These factors affect the electrical current resistance encountered, and therefore determine the rate of the reduction process. Generally, upwards of five roughly cleaned artifacts, each with a surface area of less than c.30.5 cm^2 will enable an amphere current output of 4-5 amps./artifact. At this current level, the electrolytic process takes between 3 to 5 hours. Larger artifacts (with surface areas greater than 30.5 cm^2) such as hoes and axes and smaller, heavily encrusted items require both a longer processing time and two or more points of electrical contact (e.g. suspension wires and clips). A number of suspension wires enables an adequate amphere current flow given the increased resistance encountered. The use of a number of suspension wires per artifact, however, reduces the number of artifacts which can be processed simultaneously. The larger artifacts are treated for upwards of 12 hours in the electrolysis unit.

(3) On completion of electrolysis, artifacts are boiled in water. This is part of the stabilization process in which corrosion stimulating chemicals (chlorides) lodged within the porous iron matrix are dissolved. Artifacts recovered from inland areas are generally boiled for a minimum of 1 to 2 hours. Collections from other regions, especially those from coastal regions require substantially longer periods of intensive washing (e.g. a few days to a number of months) (Organ 1966).

A simple test for chlorides in the wash bath involves the addition of silver nitrate solution to a sample of the wash water in which a few drops of dilute nitric acid has been mixed (Organ 1966). The presence of chlorides in the solution tested is indicated by a white precipitate (silver chloride). Intensive washing proceeds until chlorides are not evident in the wash water.

(4) Upon air drying, the artifact surface is sometimes noted to be covered with black and/or white residues. These are believed to be impurities brought to the surface by the electrolysis and washing processes. Commonly noted beneath these residue layers are patches of dark gray or black deposits of a very stable corrosion product believed to be graphite (Birchenall & Muessner 1977:44). The final cleaning process involves removal of these residues by sand blasting. The abrasion provided by the sand blaster exposes the raw metal of the artifact.

The clean artifact is then hand buffed with a metal brush. This produces a lustrous artifact surface while removing sand and dust acquired from the previous cleaning step. Handling of the artifact in these final stages of the conservation process is kept to a minimum. Gloves are utilized to prevent deposition of corrosion-stimulants inherent in the oils of the skin.

The artifacts are heated to 325° in a Sears portable roasting oven for a minimum of one hour. This heating serves to evaporate residual moisture contained within the iron matrix, thereby eliminating a major catalyst in the iron oxidation process. A note of caution: iron artifacts should not be placed within a hot oven since gas pockets within the artifact might expand quickly, fragmenting the artifact.

From the oven, artifacts are hot-dipped in clear Rust-Oleum. The artifact is thus encased in a moisture and air-resistant coating. The flexible nature of the dried Rust-Oleum coat resists chipping and cracking, unlike paraffin or other coating substances. After the Rust-Oleum dries, artifacts are scribed with accession numbers. Inked numbers are protected with Krylon acrylic spray. For additional protection in storage, artifacts are wrapped in Saran Wrap and carefully boxed.

Exceptions to this standard conservation procedure for iron artifacts are made for very fragile items or for large quantities of artifacts which possess limited analytical utility. Highly corroded artifacts are primarily comprised of the corrosion products which have virtually replaced the less stable iron. Normal cleaning and stabilization of such items could result in disintegration of the artifact. Fragile artifacts are therefore excluded from cleaning by sand blasting and electrolysis. These items are washed, heat treated, and then coated with Rust-Oleum or actylic spray.

When presented with a large sample of an artifact class of limited analytical utility, such as nails, representative specimens may be cleaned and treated according to the standard procedures outlined. The remainder of the artifacts, if to be conserved, are cleaned by sand blasting, washed, heat treated, and coated with Rust-Oleum. The exclusion of the electrolysis process enables a substantial savings in the total processing time while not altering the analytical potential of the individual artifact.

Non-ferrous metal artifacts receive a variety of treatments other than the conservation process outlined for iron. Methods of cleaning and stabilizing copper, brass, latten, silver, pewter, and lead artifacts follow the processes discussed by Plenderleith (1965), Plenderleith and Warner (1971), and Noel Hume (1975).

Brass, latten, and copper items are placed in a hot 3% solution of citric acid for five to ten minutes. After this period, three to five drops of hydrogen peroxide are added to the citric acid solution. After an additional few minutes, the artifact should be removed from the solution before the raw metal is attacked. While wet, corrision products (copper carbonates, cuprous oxides, and chlorides) (Noel Hume 1975:280) are removed with a brush. The artifacts are then washed, dried, and covered with acrylic spray.

Silver artifacts are occasionally cleaned of their dark surface tarnish. The tarnish is softened by soaking in a solution of water and ammonia, to which is added a little dish detergent for five to ten hours. Once softened, the tarnish can be rubbed or brushed off. The artifacts are then washed, dried, and coated with acrylic spray.

Pewter and lead are brushed to remove the white carbonate residue from the artifact surface. The items are then coated with acrylic spray. At best, this process is felt to only retard the corrosion process.

Organic materials such as wood, bone, and fabrics require conservation when part of a metal artifact. If possible, the organic material is removed from the metal, submersed in acetone, dried, and then coated with an acetone-duco cement solution. After cementing the organic material back onto the cleaned metal part of the artifact, the artifact is sprayed with acrylic. If the organic material is not removable from the metal component of the artifact, then it is washed, heat treated, and coated with Rust-Oleum along with the metal portion of the artifact. With this latter method, it is necessary to protect the organic material from the abrasive action of the sand blaster and from the electrolytic solution. If substantial portions of the organic material will be destroyed by cleaning, latex casts are made of those parts so that restoration can be performed if desired.

Numerous methods are available for conserving metal artifacts (Organ 1977:107-143). The methods proposed for the SSI-Wilmington Laboratory are not suitable for all types of metals, classes of artifacts, or research requirements. Equipment limitations restrict the processing of larger artifacts. Limitations on the technical expertise of laboratory personnel and equipment restrict the ability to stabilize non-ferrous metals. The objectives of corrosion scientists, conservators, and art conservators differ from those of the archaeologist. One conservation method does not satisfy all demands. The conservation methods outlined in this paper enable the expeditious cleaning and stabilization of a large quantity of iron artifacts. The results satisfy the archaeologist's analytical and curational requirements while remaining within the realm of economic feasibility.

MATERIAL: __________

FORM/SHAPE: __________

SITE NO. __________
CAT. NO. __________
PROCESSOR __________
DATE __________

CONDITION BEFORE TREATMENT:
DIMENSIONS:
WEIGHT:
APPEARANCE:
COMMENTS:

CONDITION AFTER TREATMENT:
DIMENSIONS:
WEIGHT:
APPEARANCE:
COMMENTS:

Figure 1 : Artifact Record Card, obverse

TREATMENT:
PRESERVATIVE(S) USED:
SOLVENTS:
PROCEDURE:

RECOMMENDATIONS: (STORAGE, HANDLING, DISPLAY)

DATE RECEIVED	TREATMENT BEGUN	TREATMENT FINISHED	CHECKED		

Figure 1 : Artifact Record Card, reverse

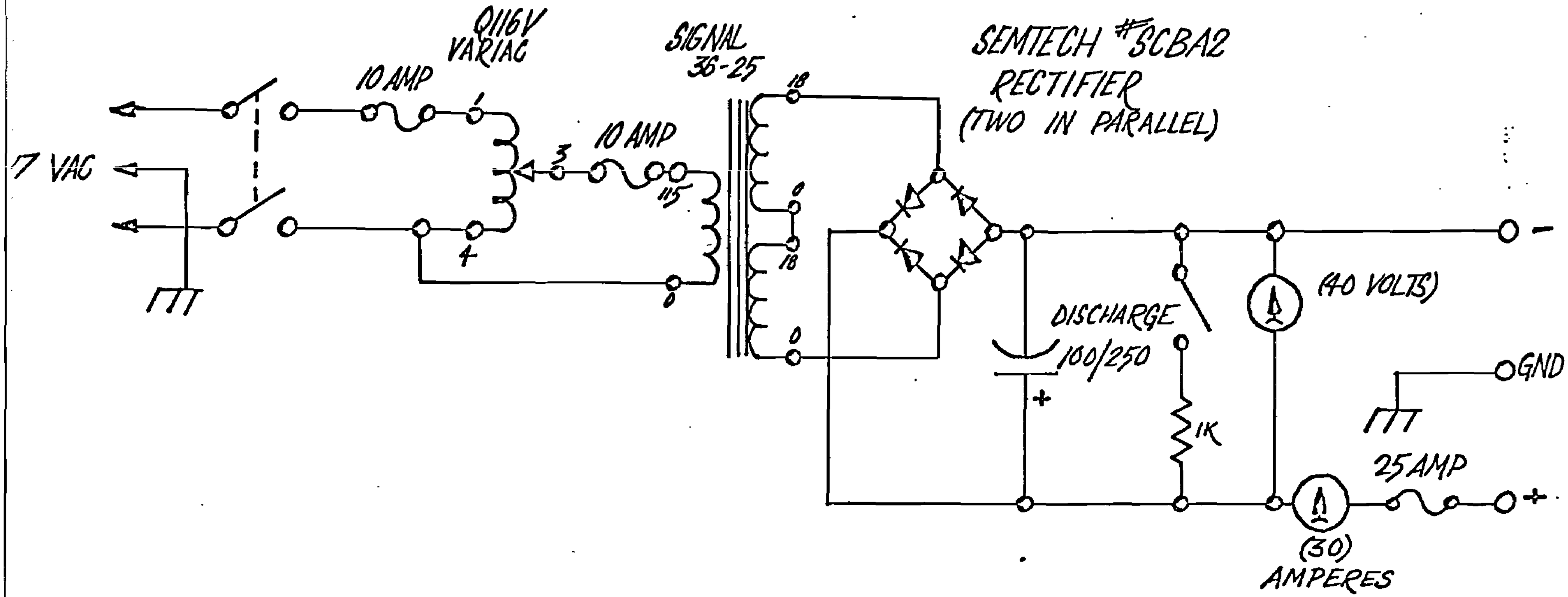

Figure 2 : Design of Electrolysis Power Supply
(Drawing No. A4806, U.of GA Electronics Design and Maintenance Shop ; M.W.Williams, engineer)

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