

**3 December 2005**

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## **TREATMENT REPORT**

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### **Cleaning**

- The salts were identified as chlorides using Quantofix chloride test strips. Chlorides were mechanically excavated using sharp wooden tipped tools.
- The soil deposits were mechanically reduced with sharp wooden tipped tools. This was followed by surface cleaning with ethanol and acetone. Cleaning revealed more remnants of wood impressions in the corrosion on both sides of the sword. On the blade, the wood impressions appear to run vertically, and likely correspond to wood graining.
- The extensive layer of a hard white accretion/concretion on one side of the sword was found to be harder than the underlying metal. The concretion was often so closely bound to the metal that it was extremely difficult to remove the concretion entirely without removing metal. Furthermore, the accretion appeared to be providing some structural support to the sword, and therefore should not be completely removed. Therefore, the upper layers of the accretion were mechanically reduced using a Dremel tool with rubber-tipped bits and bristle brush bits. This cleaning revealed an uneven, lamellar metal surface consistent with a chloride-laden archaeological iron object.
- Areas of active rust were mechanically excavated with scalpel blades. Corrosion inhibitors were not used in this case as none of those currently available provides adequate long-term protection against future corrosion.
- The copper alloy washer was cleaned with ethanol.

### **Consolidation/Stabilization**

- Exfoliating, flaking and powdery metal areas were consolidated with the conservation grade acrylic resin, Acryloid B72 in acetone.
- Though the areas of wood impressions show some corrosion, they were not excavated as they are an important feature of the object. The edges of the impressions were consolidated with Acryloid B72 in acetone.
- The small crack on the hilt was stabilized with Japanese tissue paper impregnated with Acryloid B72 in acetone.

## **Storage**

As mentioned in the proposal, this treatment could not entirely remove the causes of deterioration, i.e., the salts. The most important measure for the long-term preservation of the sword is its storage in a dry, stable environment that is regularly monitored. The conservation literature shows that iron corrosion can be triggered at relative humidity (RH) levels as low as 20%; therefore, it is extremely important to maintain as low an RH possible. The sword should also only be handled with gloves.

The sword is currently packed in an archival Coroplast tray that has been padded with Volara foam. An RH indicating strip is included with the object. (It should be noted that these indicating strips are not extremely accurate, and can be off by up to 10%. These strips should be changed every five years.) The sword should be stored in a polyethylene or polypropylene container with a tight fitting lid. Most of the Tupperware currently available on the market should be adequate for storage. The box should also be covered in polyethylene (plastic) sheeting or bags and tied. The conservation literature shows that these measures are important in reducing the amount of water vapor that could otherwise reach the object.

A large amount of silica gel should also be stored with the object. The amount of silica gel required to reduce the relative humidity depends on the volume inside the box, i.e., the larger the volume, the greater the amount of silica gel. The silica gel included with the sword should be re-conditioned every two months. The crystals should be poured into a baking tin and placed in an oven at 350 degrees for 10 hours to completely dry out the silica gel. A face mask and gloves should be worn when working with silica gel. The crystals can then be placed in a sealed plastic bag perforated with several small holes, and placed back inside the storage container. Note that it will take approximately 2 days for the box to return to the proper RH.

## **Further Research**

It is recommended that the sword be x-rayed, to identify the amount of metal still preserved, as well as details of manufacturing techniques.