Corrosion Of Metal Objects: Part I

by Diane Day, CPF

Most metal objects are made from alloys, a combination of two or more metals, and usually have different appearances or working properties from the individual metals. Common causes for damage, in general, are inappropriate handling, display, and storage, as well as chlorides, oils, and moisture.

The roll of pollutants in the damage to metals is not well defined. Environmental pollutants have varied affects on metals. Consider the corrosion found on pennies: all pennies start out alike, but their distribution varies.

Low humidity can slow down corrosion, so metals should be displayed or stored in a dry environment. Metal objects should be inspected regularly for loose powder, flaking, or other changes in appearance. Try to eliminate sources of acids, chlorides, and sulfur. Handle metals with gloves, because skin is a source for acids, salts, and moisture. Fingerprints will show on metals and may become engraved in the surface due to the acids and salts in perspiration. Dust and dirt on metal objects hold moisture and may encourage corrosion even when the humidity is not high, so be sure to dust regularly.

Waxes, paints, and lacquers are common coatings. Some objects may have been coated at the time of manufacture or had a coating applied later to protect it from corrosion. Coatings can have numerous drawbacks. It is easy to miss a spot or put a coating on in an uneven thickness. Coatings can be scratched, thus exposing the bare metal. Rapidly changing temperatures can cause coatings to crack as metal expands and contracts.

Polishing silver and brass entails removal of metal from the surface and causes erosion of design elements. Commercial cleaners are strong, containing acids or ammonia to eat through the corrosive layers. Residues can be hard to remove and will continue to react with the metal. Another problem with using chemical polishes is that the metal may not be what you thought it was. (It may be plated or not solid. It may have an original coating. It may be an alloy that responds badly to the polish.)

Copper/Copper Alloys: Brass & Bronze

Brass is about 70% copper and 30% zinc. Historical (old) bronze is usually 90% copper, 6% tin and 4% zinc. Bronzes usually have a patina from light green to dark brown. A problem can arise if you can't tell the difference between a patina and potentially harmful corrosion. There are items that have "bronzed" or plated finishes. Paint or varnish containing bronze pigments was applied to cast iron in the 19th century. Copper oxidation may form on these items but they should not be polished. Oriental bronzes have a high lead content and lead corrosion can occur before the copper content shows signs of corrosion. Objects made with mixed metals like bronze and iron can be very problematic.

Safe Corrosion: Copper alloys that are kept clean and dry usually develop stable surfaces. Crusts may form that do not progress and may actually protect the item if left intact. Patinas also usually act as a barrier to corrosion.

Problem Corrosion: Salts in the air or left behind from poor cleaning or handling can cause "bronze disease," the rapid development of light green powdery eruptions. This occurs when the humidity is high. A powdery layer can form over the surface. These layers may form due to pollutants like chloride particles and acetic acids, which produce a green layer. Ammonia in a gaseous form produces a bluer corrosive layer. Any alloy containing copper can develop "bronze disease" if chlorides and water are present. It can form quickly and transform copper into a powder.

Cleaning improves the appearance of copper items and removes materials that can begin the corrosive process, such as grease, dust, metal polish residues, and fingerprints. Polishing, however, is an abrasive process that removes tarnish and some of the surface metal. A newly cleaned item is particularly sensitive to fingerprints that transmit moisture, salts and oils. Cleaners that require the object to be "dipped" may contain acids that act too quickly and remove more metal than simple polishing, exposing

reactive metal to the air and results in further oxidation. Some objects may have a coating to protect them from corrosion. Do not use abrasive cleaners on coated objects.

Iron

Iron is found in various alloys. These ferrous metals include wrought iron, cast iron, and steel. Iron is a very reactive metal. It has a natural tendency to rust and therefore requires a protective coating. All surfaces must be thoroughly cleaned before applying any coating. No coating is impervious to moisture and a poorly applied coating can lead to more corrosion.

Safe Corrosion: Stable rust that does not progress may actually form a protective coating if left intact. Stable surfaces may appear blue-black to brown and do not have scaling, flaking, or pitting.

Problem Corrosion: Rust particles around the object or depressions in the surface with orange spots in the center are signs of active corrosion. Sweating or weeping— yellow, brown or orange droplets on the surface—result from a concentration of salts in a humid environment. When the humidity goes down these droplets dry out and form crusts or blisters on the iron object. Rust can quickly turn iron into powder. Rust is a difficult problem to solve. Treatment of rust can be very complex and costly, so prevention is the key. Corrosion is slow to form in a clean, dry environment. However, dust and dirt hold moisture and may induce corrosion even when the humidity is low. Heavily corroded pieces require the attention of a conservator. ■

Next month, Part II: Pewter, Lead, Silver, etc.