

The Care and Preservation of Historical Brass and Bronze

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INTRODUCTION

Historical brass and bronze can be maintained for years of use and enjoyment provided that some basic care and attention is given to its preservation. The conservation staff at The Henry Ford has compiled the information in this fact sheet to help individuals care for their objects and collections. The first step in the care of collections is to understand and minimize or eliminate conditions that can cause damage. The second step is to follow basic guidelines for care, handling and cleaning.

NOTE: This Information Sheet will present a brief overview of the care of brass and bronze objects, stressing appropriate storage and handling as the best means of preservation. It does not address the serious problem of preserving archaeological metals excavated from land or marine sites. People who collect un-conserved archaeological artifacts should be aware that they might be unstable if they do not receive appropriate conservation treatment. It is not within the scope of this document to address all the problems associated with outdoor bronze sculptures. This information sheet may provide some useful information for the care of these objects, but we encourage consultation with a professional conservator on such complicated artifacts.

IDENTIFYING BRASS AND BRONZE ARTIFACTS

Brass and bronze are alloys of copper. (Two or more metals are combined to form an alloy. Alloys generally have a different appearance or working properties that is dependent on their percent composition.) There are other alloys of copper include gunmetal (red brass), bell metal, and German silver, also called Nickel silver and "paktong".

Brass is an alloy of mainly copper and the addition of zinc. It may be cast into solid shapes, rolled into thin sheets, spun into vessel shapes or drawn wire. Many decorative objects, housewares, furniture hardware and inlays, and tools are made of or contain brass. Brass is often found in scientific instruments, scale models and historical apparatuses. In its natural state it is typically light yellow-gold in appearance.

Bronze is combination of principally copper with tin as an additive, while there are other metal elements that can be added for a sought-after property. Historic cast bronze is usually 90% copper, 6% tin and 4% zinc, (sometimes called tin brass). It has been widely used since antiquity for weapons, sculpture and decorative objects. Bronzes are traditionally patinated and usually appear anywhere from light green to dark brown.



Patinas are sometimes described as any controlled corrosion that imparts an aesthetically pleasing color and/or texture to the artifact. Patinas may be applied with chemicals or may have accumulated over time naturally; in either case, owners should be aware of the potential value of these finishes and the need to preserve their patinated appearance. (The confusing part may come in differentiating pale green patina from potentially harmful corrosion; this will be addressed below).

A third category of artifact that should be included in any discussion of brass and bronze, is "bronzed" and plated finishes. Sometimes called "French Bronze" in the Nineteenth century, paint or varnish containing bronze pigments were applied to cast iron or soft white metal. These painted finishes may develop copper oxidation but should not be polished. Another method of bronzing involved applying a very thin copper plating to a metal surface; this kind of finish does not hold up to polishing either. Colored lacquers were sometimes applied to scientific instruments and should be considered as carefully as you would an original patina on a bronze artifact. Please consult a conservation professional before attempting to conserve these unique artifacts.

TYPES OF DAMAGE

Corrosion, poor handling, and inappropriate storage are the major causes of damage to metal artifacts. Copper alloys are relatively stable, corrosion-resistant materials if they are properly cared for. Active or "problem" corrosion causes a loss of metal from the object and is closely associated with an inappropriate storage or a display environment which is heavily polluted or subjected to evaporating salt water. Mishandling, however, can result in serious loss of value if denting, breakage, bending or cracking occurs. Salts, oils and moisture can cause corrosion to develop, "staining" copper alloys, so if you handle metal artifacts with bare hands you risk damaging them.

CORROSION

SAFE CORROSION - Uncoated copper alloy artifacts that have been kept clean and dry will usually develop stable surfaces. Stable surfaces may appear reddish, black to brown, or green to blue. The brownish and black colors may result from natural, nondestructive oxidation of the copper, which is sometimes misnamed "tarnish". Thick crusts may accumulate, but dense corrosion that does not progress may protect the object if it is left intact. Purposely applied, "patinas", which may be any variety of colors, usually act as a protection to the metal.

PROBLEM CORROSION - If you notice the development of small spots of light green powder that grow rapidly, your artifact has the symptoms of "bronze disease" and indicates active corrosion. As mentioned above, green surfaces are often seen but may not be cause for alarm if the corrosion layer is continuous and does not flake off easily. Bright or 'waxy" whitish-green powder forming in small areas on the surface, or in

cavities on the metal surface, indicates advanced active corrosion. If left in its current state, this type of corrosion can cause a significant amount of damage to historic copper alloys, as it causes pitting of the surface and a continuous loss of metal. This condition is sometimes noticed when green powder falls from an undisturbed object. It is caused by the presence of salts in the air, or by deposits left behind from inappropriate cleaning or handling and progresses when the air is humid. High levels of ammonia pollution in the air will cause bluish deposits of corrosion.

In rare cases, "patinas" contain corrosive ingredients that may contribute to corrosion. Corrosion will progress on copper alloys in the presence of high Relative Humidity (RH), normally above 70%. As for most metals, the critical RH may be LOWER in polluted atmospheres (like Metro-Detroit). Dust and grime left to accumulate on metal artifacts can hold moisture to the surface and may induce corrosion even where the humidity is not that high. Varnished or lacquer brass and bronze can usually withstand corrosion if the coating is not broken. Where there are losses in the coating, corrosion will progress, usually seen as dark streaking where unprotected areas have oxidized.

ABRASION & DENTING

Objects with thin walls or fine ornamental detailing may be damaged by rough handling. Raised areas and handles are especially susceptible to denting and joint failure. (See Handling, below). If historic brassware is being used in the home, their owners should accept a certain amount of wear and tear from handling and more frequent cleaning and polishing. Repairs to valuable metal artifacts, which may involve braising or raising and reshaping dents, should be done by a qualified metal smith familiar with historical techniques or by an art conservator.

STORAGE

Since artifacts made in part or entirely from copper alloys are so varied, it is not possible to cover all aspects of treatment in this document. The first line of defense is to provide a good storage environment. Maintain an even, low humidity where metal objects are kept; ideally below 55% Relative Humidity (RH). Rapidly fluctuating temperatures will cause coatings to fail as the metal expands and contracts; this problem is most acute in the case of artifacts composed of sheet metal.

If you are concerned about brass components on furniture, clocks or other objects made of wood, you may wish to refer to the Conservation Information Sheets on these subjects; in some cases, you should consider the best storage conditions for the whole artifact, not just the metal components.

In most homes, an even environment is difficult to ensure, but, basements in Michigan area are damp in the summer and therefore should not be used for the storage of metal artifacts.

Temperature and Humidity sensors are readily available for those who wish to check conditions near their collections.

Do not allow dust to accumulate on stored objects. You can protect your collection by storing it on shelves padded with inert foam (i.e. "Ethafoam"). You may choose to drape plastic or cloth curtains around storage shelves but do not place metal artifacts in sealed plastic bags; the risk of moisture condensation on the metal outweighs the benefit of dust protection.

HANDLING

Most metal artifacts should not be handled with bare hands. Salts and oils from your skin can etch into uncoated metals and may even cause permanent damage. Fingerprints are often discernible as darkened disfiguring marks on uncoated copper. Handle your valuable collection with gloves. Soft cotton gloves can still carry residual oils and salts, and nitrile gloves are recommended.

Lift objects from their center of gravity. Avoid lifting objects by lip, limbs, handles, spouts or other extended areas; the metal may have developed unseen weaknesses over time and may bend or break unexpectedly. Large and oversize objects may require additional planning and consultation with a professional handler or rigging company.

CARING FOR BRASS AND BRONZE

CLEANING AND POLISHING

If you choose to attempt cleaning your brass or bronze artifacts, and you are sure of the surface appearance you wish to achieve, some of the following suggestions may help:

Cleaning - Stable or painted surfaces should be kept dust free. Vacuum-clean all stable artifacts regularly, using the nozzle attachment with a brush. A bristle brush or a toothbrush may help to raise dust from crevices.

Sometimes surface grime can be removed satisfactorily with soap and water. We recommend a plain soap such as "Triton X-100" or "Vulpex"; both are conservation approved, in a 3% solution in water. Any wet cleaning should employ deionized or distilled water only, and rinsing is a necessary to remove the dirt and soap dilution. If the dirt that you want to remove is very greasy, "Vulpex" may be used in mineral spirits, in a 3% solution: rinse with straight mineral spirits. It is especially important to remove old polish residues, which appear usually as dark green, gray or white deposits in cracks.

Calcareous (lime or hard water) deposits may respond to a 10 % solution of regular "Calgon" (sodium hexametaphosphate) in distilled or deionized water. Allow the

solution to soak into the crust and then remove by scrubbing with stiff brushes. Then rinse thoroughly in distilled water.

Degreasing - The presence of degraded oils and grime may promote corrosion. You can degrease most uncoated metal artifacts with mineral spirits. (Please consult the manufacturer or Safety Data Sheet (SDS) for complete safety requirements and use appropriate personal protective equipment.) Wipe it over the surface in a small, inconspicuous area first to test for discoloration. After the solvent has evaporated, check for any undesirable effects (usually caused by residual dust or an old finish). Continue the cleaning process, using cloths that have been dampened with mineral spirits to lift the grime. You may find that sharpened bamboo skewers, nylon bristle "parts brushes", craft stencil brushes or even toothbrushes help you to get into crevices and join areas. If mineral spirits does not seem to remove the grime, a conservation-recommended surfactant, "Vulpex" may be used in a 1% solution in mineral spirits. Be very certain to rinse with clean mineral spirits to remove residual detergent. This method is not recommended for old copper with richly patinated surface accumulations.

Corrosion removal - Very heavily corroded objects, like those unearthed or found in water, artifacts with original painted surfaces or those damaged by salts may require the assistance of a trained conservator. By attempting to remove thick corrosion mechanically with steel wool or other scrapers, you may end up scratching or abrading the metal surface.

Polishing - Some, but not all, brass was traditionally polished to a bright finish, and altering original surfaces may reduce the historical value of an object. As mentioned above, some dark, stable surfaces may be considered "patinas". Collectors should be aware of any special finishes, especially lacquers and patinas, which may determine the correct color the metal should be, the degree to which it should be cleaned and/or the degree to which it should be polished. If you come across any special coating after you have cleaned off the simple dirt, you may wish to consult with a conservator before proceeding.

If you wish to return a brass or bronze object to its original, polished appearance, it is usually possible with a fair amount of elbow grease and a good polishing compound.

Old lacquers must be removed prior to polishing. If the lacquer is original and in fairly good condition, you may consider investing in a professional treatment to preserve it. Lacquer removal is best done with acetone, preferably by immersion. Acetone is a volatile solvent that should never be used in a poorly ventilated area. (Please consult the manufacturer or SDS for complete safety requirements.)

Polishing with a mild abrasive is the only safe cleaning method conservators can recommend for most historic metal artifacts. Copper and its alloys are relatively soft metals. Commercially available "dips" may contain undesirable components such as

hydrochloric or sulfuric acid, which act too quickly and remove more metal than simple polishing does. Conservators do resort to special dips in certain extreme cases, but for most darkened brass, this method is too aggressive.

Some commercial paste polishes are quite abrasive and may scratch your fine metalwork. Light polishing may be carried out using jeweler's cloth containing rouge (i.e. "Birk Cloth", "Hagerty Glove"). A museum-proven, safe polishing method is as follows:

POLISHING METHOD 1: For most polishing we use ultra-fine (1.2-1.6 microns) calcium carbonate, CHALK, ("whiting") worked into a slurry or runny paste with equal amounts of ethanol (denatured alcohol) and distilled water. The paste is rubbed across the surface working a small area at a time, with cotton balls or clean cotton rags. Detailed areas may be polished with Q-tips in the paste or with cotton wadding on the end of a sharpened bamboo skewer. Depending on the design of your object, it may not be desirable to over clean every crevice, as this decreases the overall contrast of the detailing. It is important to remove all residual polish with distilled water. Drying may be accelerated by adding ethanol to the rinse water, or by giving the object a final wipe with ethanol.

POLISHING METHOD 2: Some artifacts may not respond to the special treatment outlined above because the oxidation layers are too thick. For an admittedly more abrasive method, we recommend "Autosol" for general purpose polishing. Test for the degree of polish you wish to achieve on a small inconspicuous part of the object. Buff on the polish with a clean rag. The surface must be rinsed with mineral spirits after polishing to remove any polish residues. This polish can be recommended because it contains less ammonia than most other commercial brands. Ammonia can cause long term damage to valuable copper alloy objects.

COATING

Polishing exposes fresh, reactive metal to the atmosphere and, therefore, to further oxidation. You may wish to coat objects that will not be used. We apply a lacquer coating to valuable silver and brass for their protection. This also mitigates the need for frequent polishing, which inevitably wears away the metal surface if done frequently.

Lacquering: Lacquering involves the use of solvents such as acetone to clean the metal properly. On large areas of metal, a spray-applied lacquer achieves the most even and durable finish. Spray lacquering is a task best left to qualified individuals with the training and equipment necessary to do a good job. Poorly applied lacquers can actually cause more severe corrosion if small areas are left exposed.

If there are small areas or pieces of an artifact that need to be coated, you may achieve satisfactory results by brushing on a lacquer. We recommend "Incralac" lacquer, which

is formulated for use on copper and copper alloys. It is soluble in the solvents xylene and toluene and must be used in a well-ventilated area. (Please request a SDS and instructions when you order this product). The metal must first be scrupulously clean, and you should always wear gloves to handle the artifact after it has been polished. Just prior to applying the lacquer, the artifact should be given a final degreasing with acetone. Lacquer gives a shiny luster to the metal.

Waxing: For most collectible brass and bronze artifacts, the best coating we can recommend is wax. Wax provides a flexible coating that is easily applied and that can be renewed. It can be used on top of original patinas and lacquers that you do not wish to disturb if they are cleaned first. The Henry Ford uses "Renaissance" wax, or other "microcrystalline" waxes in most cases, because it is inert and will not yellow over time. It is applied to a degreased surface with a clean cloth and buffed out with a rag or bristle brushes (shoe polish brushes are great for this purpose).

For better adhesion, you may wish to dilute the wax in mineral spirits or lacquer thinner. Brush the wax on, let the solvent evaporate and then buff with a rag or soft-shoe polishing brush. An alternative on objects made entirely of metal is to heat the degreased surface gently and briefly with a hair dryer before applying the wax. (Do not try this if heat-sensitive materials such as wood and ivory are nearby.)

Again, wax is not an appropriate coating for all metal surfaces, especially where it is impossible to cover the whole object, or where the slightly glossy finish would be inappropriate.

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Preparation, Art Handling, Collections Care Information Network (PACCIN)

<http://www.paccin.org/>

Find a Conservator

The American Institute for Conservation

<https://www.culturalheritage.org/about-conservation/find-a-conservator>

SUPPLIERS

Talas

New York, NY 10012

212-219-0770

<https://www.talasonline.com/>

Renaissance Wax, Triton X-100, Vulpex, Incralac,

Chalk (Ultra Fine Calcium Carbonate)

World Wide Foams

<https://worldwidefoam.com/>

Zotefoams, Irradiated XLPE Foams, Ethafoams

Eastwood Company

<https://www.eastwood.com/>

Autosol Metal Polish

Grainger Inc.

www.grainger.com

3M Nonabrasive Pads

Local Hardware Stores and Paint Supplier

Acetone, Ethanol (Denatured Alcohol substitute), Mineral Spirits, Xylene, Toluene

Local Pharmacy and Drug Supply Stores

Cotton balls, unwoven cotton rolls, Q-tips, cotton pads



Note: The in-house conservation staff at The Henry Ford has developed these Preservation Fact Sheets to assist in caring for your historical materials. These fact sheets provide basic information on the care, cleaning, and handling of a particular type of artifact, referral information to other conservation organizations, and a bibliography of authoritative works. Individuals may also arrange for a private consultation with a conservator. For more information, please contact the Benson Ford Research Center at research.center@thehenryford.com.

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