Canadian Conservation Institute
Institut canadien de conservation

CCI Notes 9/9

Care of Objects Made of Zinc

Introduction

Sculptures were first cast from zinc around 1850. A soft metal with a relatively low melting point, zinc was easy to work with. It was also cheaper than bronze, copper, or silver, but could be painted, plated, or chemically treated to look like the more expensive metals. In spite of these advantages, the use of zinc for sculpture casting was discontinued in the 1920s when problems were identified with its long-term stability: zinc was found to creep or flow under its own weight; it was brittle — making sculptures prone to damage; it corroded quickly under adverse conditions (which was of critical importance for outdoor sculptures); and corrosion was further accelerated by the presence of other metals as platings, fittings, fastenings, or strengthening elements. Zinc was therefore replaced with various lead, tin, and copper alloys that had some of the same desirable working characteristics, but better stability.

Many sculptures and other items made of zinc still appear in museum collections, and zinc castings are often found incorporated into architectural details in building facades and interiors from the late 19th and early 20th centuries. This Note provides information on how to deal with these objects.

Deterioration

Zinc is a relatively light metal that is fairly high in the periodic table of elements, and it reacts vigorously when connected to other metals. Think of a battery: when zinc is connected to copper in the presence of an electrolyte (a fluid that allows ions to flow), the zinc is oxidized and a strong electric current is produced. This is essentially what happens to a zinc sculpture in damp conditions, especially if it is in contact with other metals. The result of this process is corrosion of the zinc. Acid rain, chemicals leached from bird droppings, and many other sources of contamination speed up the reaction and increase the corrosion.

When outdoors, zinc develops a thick, white patina composed mainly of zinc carbonates. In areas of low pollution, this patina is relatively stable and solid (as zinc carbonates partially isolate the metal from the atmosphere) and corrosion is quite slow. However, in the presence of acid rain the zinc carbonates are continually dissolved and the metal eventually wears away. Also, zinc that is permanently damp produces a bulky, non-adherent white powder and corrodes rapidly.

Under normal indoor conditions, polished zinc develops a light grey patina of zinc oxide that is quite stable. However, these polished zinc objects are very susceptible to damage from human fingerprints. The moisture on the fingers contains chlorides that react strongly with the zinc to form zinc chloride, which is hygroscopic. The zinc chloride then attracts water from the atmosphere, and the zinc corrodes. As corrosion proceeds, fingerprints become etched in the polished metal surface.

Most zinc sculptures are hollow (this was the easiest and most economical method of production), and are susceptible to the same problems as any hollow sculpture. To create a hollow sculpture, a liquid is poured into a mould which is then upended and rotated to allow the liquid to coat the entire inner surface. This produces a sculpture with an interior cavity and walls of variable thickness. Some parts, particularly wide, flat areas, can be very thin and quite fragile. In addition, the process of sloshing the liquid around inside the mould can cause the formation of air bubbles, which also weaken the walls.

Even when well constructed, zinc sculptures are structurally vulnerable. Zinc is a weak metal with a pronounced granular structure. These grains do not cohere very effectively, and they can distort and flow over each other when stress is applied (and it is impossible to avoid stress, as even the force of gravity is a major stress on a large metal sculpture). The

deleterious effects of stress are compounded by any weaknesses in the casting or deterioration due to corrosion. Also, the constant cycles of heating and cooling in outdoor locations (both diurnally and annually) cause zinc to expand and contract, which can further stress large sculptures at key points.

Identification

There are a number of ways to determine whether or not a museum object is made of zinc.

Literature search

It is sometimes possible to find information about a specific item in catalogues or other descriptions. If so, look for any specifications of material or construction technique.

Appearance

Zinc can often be identified by its appearance. Colour is a good indicator. Zinc is bluish-white and thus easily distinguished from the yellow or pink colours typical of bronze, brass, and copper. The colour can also be checked against a known sample. The presence of cracks and distortions in the surface is indicative of zinc, as damage of this kind is less likely to appear on more stable casting materials. If there is any bare metal visible (in cracks or elsewhere), it may be possible to see the granular structure mentioned above. Zinc plating, sometimes applied to objects made of other metals, is usually evident by the characteristic "spangle" effect caused by the molten zinc crystallizing on the surface.

Weight

Zinc is heavier than aluminum and lighter than other white metals such as pewter, Britannia metal, and nickel silver. Although relative weight is difficult to estimate without standards of comparison, together with other clues it may help to narrow down possibilities.

Chemical test

A chemical test such as EM QUANT Zinc Ion Specific Test Strips can be used to identify zinc. Apply the test paper to a clean metal surface and watch the colour. Pink indicates a positive result, i.e. the metal is zinc.

Warning: This test requires the use of strong sodium hydroxide (NaOH); it is recommended only if suitable facilities are available and the user is experienced in chemical techniques.

Care Guidelines

Zinc objects must be handled carefully as they can be very fragile, especially if they have been exposed outdoors for extended periods. Always support large objects well to avoid damage due to gravitational creep. Do not lift them by their extremities, as it is rarely possible to gauge how thick the metal is or how much deterioration may have taken place. To avoid damage from fingerprints, wear white cotton gloves when handling polished zinc.

Proper cleaning of zinc objects depends upon their finish and condition. Indoor artifacts that are coated with an intact and stable paint, lacquer, or other finish can be cleaned gently with a cloth dampened with water. Visible metal surfaces with a stable patina need no further treatment aside from light dusting. Surfaces with an uneven patination, small areas of corrosion, or fingerprints can be polished with a metal wadding polish, such as Duraglit metals polish, working in a circular pattern. (Note: Be sure to check the effect of polishing on an unobtrusive spot before treating the whole object.) After polishing, allow the surface to patinate naturally in air, and do not handle it.

Outdoor zinc artifacts with a stable, whitish patina require only light cleaning with a brush. In areas where salt is present, use a gentle wash with water at low pressure followed by thorough drying. If there is any loose, white corrosion, the object should be referred to a metals conservator for treatment.

Outdoor zinc objects with deteriorating paint pose special problems. Zinc is attacked by the strong alkalis found in most paint removers, and is also easily damaged by the scraping techniques or abrasive blasting required for mechanical removal of the paint. If the objects are to be repainted, it is essential to use paint specifically for zinc or galvanized surfaces; if oil-based or alky paints are used, the zinc will cause soap formation in the oils and result in poor adhesion. It is therefore best to consult a conservator specializing in sculptures to deal with objects in this condition.

Special care must also be taken when removing finishes from building decorative elements. Although these are often made of relatively robust materials such as formed steel, they may have zinc castings incorporated for decorative effect. Stamp zinc sheet may also have been used. Aggressive cleaning methods such as abrasive or ice blast cleaning, which may be safe for the stronger materials, can damage the softer zinc elements.

Zinc objects that have suffered cracks or losses require structural repair. Zinc can be soft-soldered very easily, but it is not advisable to do this without adequate experience and proper equipment because:

- damage that requires this type of repair work is often an indication of a problem in the interior of the casting, and heating discrete areas as a prelude to soldering can lead to additional harm
- it is difficult to remove all traces of acidic flux, and any that remain can continue to attack the metal long after the repair work is finished
- any patination, either applied to the sculpture on manufacture or acquired later, will be damaged by heating
- heating zinc above the temperature used for soft-soldering causes it to vaporize easily, and these vapours can be harmful

To avoid these problems, structural repairs of zinc objects should be referred to a conservator specializing in sculptures. In many cases, reinforcements and adhesives (which allow more control and are to a certain extent removable) are preferable to soldering techniques.

Suppliers

Note: The following information is provided only to assist the reader. Inclusion of a company in this list does not in any way imply endorsement by the Canadian Conservation Institute.

Zinc test strips:
VWR International
2360 Argentia Road
Mississauga ON L5N 5Z7
Canada
tel.: 1-800-932-5000
fax: 1-800-765-3316
www.vwr.com

Wadding polish:
hardware stores

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