

Keeping a Promise to the Past

Lead Alloys

Lead alloy is a term used to describe any metal whose primary component is lead. It has been worked into objects for thousands of years and remains one of the most common minerals still mined. Lead is a popular choice for many objects because it is very soft, has a low melting point and is therefore very malleable. Lead has been used for building components, military hardware, personal and domestic items e.g. flatware, drinking vessels and platters. Lead is usually combined with another metal to give it a slightly harder composition and a more crisp appearance. Lead solder is commonly found on lead for repairs, or on windows to form joints between lead window comes. It is typically 40% lead and 60% tin. Lead can be easily identified because it is a very heavy metal, and often much heavier than expected for the size of the object.



Natural lead is blue-grey in color, but when it is exposed to oxygen it turns dull grey. Lead is very susceptible to oxidation, and in such an environment it begins to tarnish almost immediately. Lead is also known to degrade more rapidly in an acidic environment than one that is neutral or basic. During burial, lead rarely survives intact without some damage. Physically, lead objects are often found very misshapen or smashed due to the softness of the metal. Chemical changes also occur with lead - in an aerated environment the surfaces of lead are quickly oxidized and continue to corrode from the exterior inwards. The surfaces are turned a dull brown-grey color and sometimes advanced corrosion appears like white, soft powder on the surfaces. Lead is easily damaged by organic acids so exposure to acids during burial increases this corrosion.

Types of Lead Alloy Corrosion:

- Lead oxides - A thin layer of protective corrosion usually close to the original surface; usually brown/dull in appearance.
- Lead carbonates - This type of corrosion forms more slowly in reaction to oxygen and Water; found on lead excavated from aerated-damp sites
- Lead-acetates - Usually occurs post-excavation from exposure to pollutants (acetic acid by-products) in display cases/ materials or in storage; the corrosion appears as red dots on the surface of the lead

Pewter

Lead is commonly alloyed with tin to form pewter. Modern day pewter contains less lead than that of the 17th century and earlier. Pewter was created to increase the strength of lead, as typical pewter is 85% tin/15% lead. Pewter can also contain copper, antimony and zinc. Pewter is commonly used for tablewares, as an imitation of silver in the 17th and 18th centuries. It is also used for cast items such as buttons and candlestick.

When pewter is found upon excavation, it is usually more fragile than it appears. During burial the lead is leached from the pewter, leaving behind a thinned matrix of tin with tiny holes throughout where the lead ions once existed. The surfaces are usually dull grey in appearance, with cracks running through the surfaces. Sometimes the pewter will crumble upon touching it. Generally the surface details are visible

but there are lead and tin oxide corrosion products found throughout the matrix, causing internal stress and damage. Pewter is very hard to preserve because it is chemically unstable.

Case Studies in Lead Alloy Conservation

Lead Seal



Conservator's Notes

This lead seal was recovered from St. Mary's City and is a unique artifact for several reasons. The rarity of the find was evident by the markings on the surface of the lead seal. But finding an intact lead object is also very rare. Due to the fragility of lead, markings on the surfaces of lead are usually worn away or damaged beyond recognition. When this artifact was recovered and brought to the conservation laboratory for cleaning, it was very important that the artifact's marking not be jeopardized by the cleaning process. Leads are commonly cleaned in the conservation laboratory to remove obscuring lead-oxide and lead-carbonate corrosion products. Unlike harder metals such as iron and coppers, lead cannot be cleaned mechanically because it can easily be scratched or damaged during this process. Instead, lead

is one of the only metals that is still best cleaned by immersing the artifact in a mild acid solution. This artifact would be different, however, because even immersing the lead in a solution may cause damage to the markings on the seal. Instead the artifact was cleaned using a mild acid and a poultice on the surfaces of the lead. This type of cleaning method involves mixing the dilute acid solution with an inert powder, such as fumed silica, which is then mixed to a paste consistency.

The paste is applied to the surface of the object, but only in the areas where cleaning is warranted. The poultice paste is allowed to dry on the surface, and then carefully brushed away. This method can be applied all over or in spots where the object may be more corroded, or where you may need to better reveal the markings. Afterwards, the surfaces of the lead are rinsed, dried and coated for future handling. The edges of the seal were also exhibiting problems, because they were deteriorated and very brittle. Some flaking of the lead along the edges was apparent and loss was imminent. These areas were strengthened using an acrylic consolidant, applied to specific spots using a brush.

After cleaning the object, the surfaces of the seal were revealed. Damage to the lead is evident, because the mark on the seal is not completely intact and is worn in some areas. The lead surface also shows some signs of pitting from the severity of the corrosion. This important artifact was cleaned for further identification and is now on exhibit at St. Mary's City. It remains fragile and will be monitored for future changes to ensure its long term preservation.

Curator's Notes

This object is unique in the archaeological collections held by Historic St. Mary's City. It bears the heraldic crest of the Lords Baltimore, the Calvert family. The crest incorporates the Cross botony of the Crossland and Mynne



families, and the Calvert "pales". These two symbols are "cross-quartered". The same symbols occur on the Maryland flag.

Window Lead



Conservator's Notes

Turned window leads are commonly found on colonial sites. Due to the softness of the lead, a window came is rarely found completely intact. They are commonly found smashed, twisted, bent and misshapen with the sides bent inwards. Leads are commonly cleaned in the conservation laboratory to remove obscuring lead-oxide and lead-carbonate corrosion products. Unlike harder metals such as iron and coppers, lead cannot be cleaned mechanically because it can easily be scratched or damaged during this process. Instead, lead is one of the only metals that is still best cleaned by immersing the artifact in a mild acid solution. Slowly, bit by bit, the

corrosion is removed from the surface of the lead without damaging the soft metal. This process is very slow, and must be performed carefully so that only the corrosion products are removed and nothing else is damaged. After cleaning the lead is then rinsed, dried and coated. But before these final steps are taken, a window lead may undergo an additional step in the conservation process.

Window leads are special artifacts, because they are often marked inside with the maker's mark, initials, emblems and/or a date. The maker of the window lead commonly "marked" the interior of the lead came with a date and mark using a tool during manufacturing. In order to locate this type of mark on a window lead, the conservator must open the lead which has become smashed together during burial. The edges of the "H" design (see below under Curator's notes) are carefully and slowly pried apart using very soft wooden tools, allowing for minimal damage. When the two edges of the window came are straightened into the original "H" shape, the lead is then cleaned further to remove any remaining dirt and corrosion. If you are lucky, a maker's mark and date could be located in this area of the artifact. Not every window came has a mark, some are marked with simple lines from the manufacturing or part of an original mark may be all that remains visible. These marks are very important as they can pinpoint specific dates for the archaeologists and tell us when buildings were constructed, deconstructed and/or moved.



Curator's Notes

The glass in windows in the 17th century was held together with small "H" shaped lead strips known as turned lead. Often, these bear maker's marks and dates. The marks are located inside the "H" and cannot be seen in a completed window. They served to identify the maker of failed windows.