NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

Conserve O Gram

June 1997 Number 8/2

Storing And Handling Plaster Objects

Plaster objects are associated with duplication methods in both art and science. Sculpture, paleontology and the decorative arts are primary sources for a variety of plaster artifacts. This *Conserve O Gram* describes the properties of plaster objects and provides guidance on storing and handling these materials.

Plaster Model of Mount Rushmore
Courtesy of Mount Rushmore National Memorial

National Park Service museum collections contain various types of plaster objects. The largest NPS collection of plaster objects is at Saint-Gaudens National Historic Site. These include death masks, relief casts, three-dimensional casts, piece molds, sculptural fragments and mold fragments from the artwork of Augustus Saint-Gaudens and other members of the Cornish Art Colony.

A plaster cast of the *Minute Man* bronze statue by Daniel Chester French at Minute Man National Historic Park, was produced in case of disaster to the bronze since no original model remained. A large 1:12 scale plaster model and a series of masks used by Gutzon Borglum to transfer measurements during the carving of Mount Rushmore are preserved in the museum collection at Mount Rushmore National Memorial.

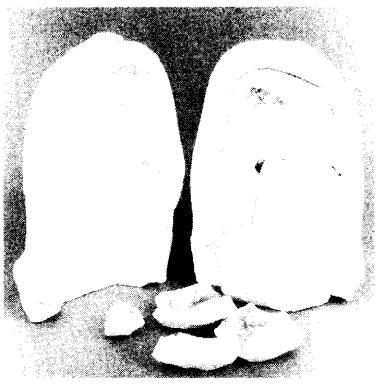
Plaster objects are in paleontology collections including plaster casts of fossils and positive and negative molds for making fossil replicas. Plaster is used in the bases that support finished mounted fossil assemblages and plaster jackets are used to encase fossils for transport between field and laboratory as well as for long-term storage. Plaster is also used to infill missing parts of bone in fossil specimens, and to complete theoretical models of skeletons when a specimen is missing parts.

Decorative picture frames and architectural elements cast from plaster are also found in many park collections.

Origin of Plaster

Plaster has been a popular material for casting, mold making, and modeling because it is inexpensive, easy to manipulate, takes detailed surface impressions, and doesn't noticeably shrink or expand as it hardens. Many plaster objects were originally made for temporary use during the production of more permanent objects.

Most common forms of plaster are derived from the mineral calcium sulfate, better known as gypsum. Another type of plaster is made from calcium carbonate found in limestone. Lime



Plaster piece mold for a reduction of **Diana of the Tower** *by Augustus Saint-Gaudens (1848-1907). Courtesy of Saint-Gaudens National Historic Site.*

plaster has somewhat different properties and is used primarily as a building material. This *Conserve O Gram* will emphasize gypsum plaster that is associated primarily with mold-making and casting.

When gypsum is heated to drive off 75% of its chemically-bound water, a fine powder material called *plaster of Paris* or *casting plaster* results. *Plaster of Paris* originally referred to plaster made from gypsum mined near Paris in the 19th century. *Casting plaster* is a broader term that refers to plaster made from any gypsum source. U.S. Gypsum also makes a series of high-grade plasters identified by the trade names Hydrostone®, Hydrocal®, and Ultracal®. *Cast plaster* refers to plaster which has been mixed with water and rehardened into a solid form that has the same chemical composition as gypsum, but a finer texture.

Properties of Plaster Objects

Density. The density of cast plaster objects will vary according to the ratio of solids to water in the plaster slurry used for casting. Inconsistencies in the mix or the application of the material may cause variable density in the object. The lower the density, the more fragile the object.

Brittleness. Cast plaster chips and breaks easily. It is also easily scratched.

Solubility. Hardened plaster remains slightly soluble in water. Therefore, exposure to moisture in the environment will cause disintegration of plaster.

Porosity. Plaster tends to be porous, having many tiny open spaces within its crystalline structure. Pores trap dirt which can cause discoloration and deterioration. Porosity contributes to the hygroscopic nature of plaster, causing plaster to absorb water more readily than it loses it. Plaster's porosity also makes it susceptible to mold and mildew; the pores in plaster trap the airborne organic particles in dust that are host material for spores.

Mixed Media. Plaster objects often contain materials other than plaster. Many plaster objects have armatures made of metal or wood for support. Larger plaster objects may contain animal hair, burlap, or plant materials such as excelsior, hemp, and jute for reinforcement. Materials that may be added to the surface include shellac, oil, wax, and paint. The variety of materials in plaster objects can cause problems in preservation that are sometimes unsolvable.

Storing Plaster Objects

Maintain temperature and relative humidity as stable as possible, preferably in a range between 13°-18°C (55°-65°F) and 35%-45% relative humidity (RH). It is important to minimize fluctuation even if this only can be done outside the target ranges. Store or exhibit mixed media plaster objects away from areas with the greatest temperature fluctuation, such as windows that receive direct sunlight or HVAC vents. Condensation on plaster indicates that temperature and RH changes are too abrupt.

The different materials in plaster objects absorb-and-loose water and heat-and-cool at different rates. The resulting differences in expansion and contraction of materials can cause plaster to crack. Organic materials, especially wood, absorb water and expand faster than plaster, so plaster objects with wood armatures are especially prone to cracking. In wet, high RH environments, metal armatures can corrode and

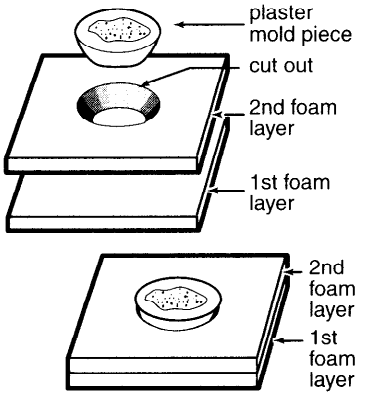
cause *jacking* (expanding and pushing out) of plaster as the corroding metal begins to take up more volume.

Surface materials will have different response rates to environmental change. Differences in an object's overall surface treatment will cause variation in its ability to *breathe*. This can promote delamination and exfoliation. Delamination is the separation of surface material from the object. Exfoliation is the flaking off of material which has become delaminated. Delamination and exfoliation result from repeated wetting/drying or heating/cooling cycles. Problems also occur because many plaster objects were not intended to be final products, and surface treatments may have been made on unclean surfaces with incompatible materials.

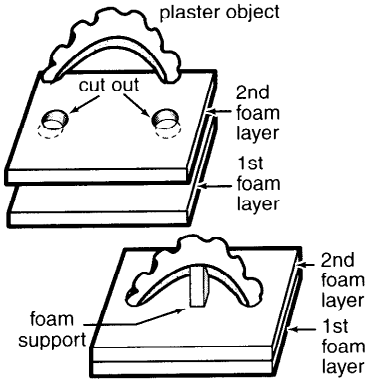
Eliminate direct contact with water. Water will cause the exterior surface of plaster to soften and crumble as the plaster begins to dissolve. Keep objects elevated at least 6 inches off the floor in case of flooding. Don't store objects directly under fire suppression sprinklers.

Store on padded shelves. Plaster objects stored on shelves should be placed on a layer of high-density foam to eliminate chipping. The recommended foam is pH-neutral polyethylene foam (Ethafoam®) available in a variety of thicknesses.

To secure and protect an object in place, particularly one with an uneven or rounded base, and prevent bumping the base of the object, construct a cavity using a second layer of foam with cut out shape of the contour of the base of the object. A pattern for this shape can be made by placing a piece of paper under the object and tracing around the base. Place the first layer of foam on the shelf and then place the second piece of foam with cut out section on top of the first piece. Set the object inside it. If the object is extremely large, lower the second piece of foam on top of it. For cutting thick foam, an electric knife or a sharpened serrated bread knife works well.



Use multi-point supports to distribute weight. For odd-shaped objects that do not have a stable base, use multi-point foam supports for areas of the object to rest on so that the weight of the object is evenly distributed.



Leave sufficient space between objects on shelves to allow for the safe movement on and off the shelves. Adjust shelf height as necessary to create space above objects. Don't crowd objects on shelves.

Use foam-lined trays or shallow boxes for smaller, flat objects. This technique will minimize handling and bumping of objects when removing them from shelves.

Keep storage space well ventilated. Good ventilation combined with low RH will help inhibit the growth of mold and mildew on plaster objects. For guidance on preventing mold and mildew, see *Conserve O Gram* 3/4.

Minimize dust on objects. In addition to promoting mold and mildew, dust embedded in the pores of plaster will cause discoloration. Cover shelving units with thin sheets of polyethylene plastic to keep out dust. See *Conserve O Gram* 4/2 for guidance. Vacuum the surrounding area regularly as needed using a

high-efficiency particulate air (HEPA) filter vacuum cleaner. When cleaning objects, use a soft artist's brush to lift dust on the object toward the nozzle of the vacuum. For procedure for removing dust, see *Conserve O Gram* 8/1.

Handling Plaster Objects

Always follow general rules for handling and moving museum objects. See NPS *Museum Handbook*, Part I (Rev 9/90), Chapter 6. Some specific guidelines include:

Handling. Wear gloves when handling plaster objects to minimize contact with organic acids in skin oils. Use sure-grip vinyl-coated cotton gloves or unpowdered latex surgical gloves to avoid slippage.

Moving. Use a cart padded with polyethylene foam to move small plaster objects. Use larger foam-lined mail carts or dollies to move large objects.

Lifting. When lifting a plaster object, find the heaviest area, the center of gravity, and hold the object at that point to distribute the rest of the weight evenly. Thinner areas of the plaster may break under the weight of the heavier parts. Don't lift an object by its armature if stress will be placed on plaster. Use two or more people to lift large objects and create multi-point support.

Sources

Polyethylene foam is available from Dow Chemical, Midland, MI 48640, (517) 636-6400; Sentinel Foam Products, 70 Airport Road, P.O. Box S, Hyannis, MA 02601, (800) 457-3234; and Stephenson & Lawyer, P.O. Box 8834, Grand Rapids, MI 49518, (616) 949-8100.

A variety of carts are available from General Services Administration (GSA) and from local office supply vendors.

Latex gloves can be purchased from local medical supplies vendors. Sure-grip vinyl-coated cotton gloves are available from Hayden School Supply, P.O. Box 27777, Tempe, AZ 85282, (602) 968-2670; and Man-How School Band Supply, P.O. Box 2705, Trenton, NJ 08607, (609) 392-4895.

HEPA filter vacuum cleaners are available from Nilfisk of America, 300 Technology Drive, Malvern, PA 19355, (610) 647-6420; and from Lab Safety Supply, P.O. Box 1368, Janesville, WI 53547-1368, (800) 356-0783.

Electric knives and serrated bread knives are available in the housewares sections of most department stores.

References

Penny, Nicholas. *The Materials of Sculpture.* New Haven: Yale University Press, 1993.

McDermott, Richard. *Figure Sculpture in Wax and Plaster.* Watson-Guptill Publications, 1971.

Wasserman, Jeanne L., ed. *Metamorphoses in Nineteenth Century Sculpture.* Cambridge: Harvard University Press, 1975.

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