An Extreme Case of Byne's Efflorescence: A Novel, Two-Pronged Approach to Consolidation

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Society for the Preservation of Natural History Collections Annual Meeting, Gainesville FL • May 2015
American Institute for Conservation 43rd Annual Meeting • Miami, Florida • May 2015

Introduction

A two-pronged approach to consolidation was developed to stabilize extremely fragile cuttlefish bones or cuttlebones in *Greek Beach V*, a contemporary mixed media construction by artist Ilse Getz. The cuttlebones had developed extensive Byne's efflorescence resulting in severe delamination with active flaking and loss. The extremely unstable condition of the cuttlebones meant that they could not take the slightest touch. Typical application of a consolidant with a brush was not appropriate as it caused the surface to disintegrate further. Consolidation was carried out by fixing the outer layers in place via mist consolidation, thereby allowing, as a second step, a more complete and in-depth consolidation of the interior layers with micro-pipette consolidation. This combination of consolidation methods provided minimal aesthetic change to the outer surface, yet adequate consolidation of the cuttlebones. This poster provides a context for the object and treatment, explains Byne's efflorescence, its development within this object, and the step-by-step method used for consolidation.

Greek Beach V (1965), Ilse Getz, overall before treatment in Plexiglas display case.

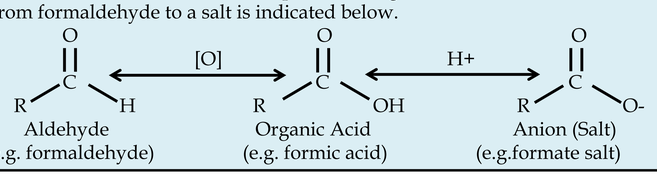
Detail showing active delamination and flaking of the cuttlebones; minute powdery losses were everywhere.

Context

Greek Beach V, by artist Ilse Getz (1917-1992), was gifted to the Winterthur/University of Delaware Program in Art Conservation (WUDPAC) as a student treatment project. The piece is composed of found materials: a plywood support, woven rattan caning, cuttlefish bones, an animal phalange, and a whole chicken egg. The artwork, displayed in a Plexiglas case as per the artist's wishes, was in poor condition: the cuttlebones had developed extensive Byne's efflorescence and were actively delaminating, while only a third of the egg remained intact and attached to the wicker substrate. Examination with the Plexiglas cover removed, showed the presence of mold and corrosion of metal wire components, indicating it sustained periods of high relative humidity. It became apparent that high RH, along with the plywood support and limited ventilation within the case had accelerated degradation and the development of Byne's efflorescence on the shell components.

What is Byne's efflorescence?

Byne's efflorescence (also called Bynesian decay or Byne's disease) occurs when organic carbonyl pollutants attack shells. This typically happens when shells are stored in poor quality wooden cabinets that off-gas formaldehyde and other organic acids such as acetic acid. Especially when moisture is present, these react with the calcium carbonate composing the shell to form water-soluble salts. While appearing at first as a whitish film on the shell, as the reaction continues the accumulation of efflorescence can lead to complete disintegration of the shell. The reaction mechanism from formaldehyde to a salt is indicated below.



Aldehyde (e.g. formaldehyde) — Organic Acid (e.g. formic acid) — Anion (Salt) (e.g.formate salt)

Bone, shell and eggshell, and their sensitivity to Byne's efflorescence

A mollusk shell and an eggshell both have a calcium carbonate matrix, while bone has a calcium phosphate matrix. Cuttlebone is the internal shell of a mollusk of the order Sepiida, and belonging to the class Cephalopoda. Cuttlebone is a misnomer and is composed primarily of calcium carbonate, just like an eggshell, with one of the main differences being that cuttlebones are lamellar and porous, while eggshells have an organic cuticle and membrane that protect and partly seal the calcium carbonate matrix. In *Greek Beach V*, this meant that the cuttlebones were most susceptible to Byne's efflorescence and had begun to disintegrate, while the eggshell was minimally affected, and the bone phalange not at all.

Materials and supplies

Nebulizer (we used a Devilbliss Ultra Neb 99) ; 100µL micropipettes.
0.5% solution of gelatin in deionized water; 5% solution of Paraloid® B-72 in acetone (w/v); acetone.

Methodology

1. Mist consolidation with 0.5% gelatin in deionized water
The nozzle on the nebulizer was held 1.5 inches from the cuttlebone and passed over the surface until it appeared damp. A small brush was used to test the surface after each application to ensure the cuttlebone was now stable. Three overall mist applications were required before moving to the next treatment step.

2. Micro-pipette consolidation with 5% Paraloid® B-72 in acetone
To reduce surface tension and for better penetration, acetone was applied to the surface before application of the 2nd consolidant. The B-72 was then applied, while the cuttlebone was still saturated with acetone. For application, the micropipette was placed into the solvent or consolidant, and capillary action drew the solution into the pipette. A finger was placed over the opposing end to hold the solution in the pipette until it was transferred to the cuttlebone. Once the micropipette was in contact with the cuttlebone, the finger was lifted and the solvent or consolidant gently wicked into the porous surface. This technique was used once overall and followed by a 2nd application in the most unstable areas. Effectiveness of the consolidation was again tested with a brush. When no detachment of fragments occurred and the lamellar plates were stable under slight pressure, the cuttlebone was considered fully consolidated.

3. Display alterations
As a part of the project, the artist's daughter, Patricia Preziosi, was interviewed. Since the display case was likely added by the artist with specific aesthetics in mind, it was necessary to preserve the current format. Several options were considered to minimize future build-up of acidic gasses within the display case. Installing scavenging material within the case was considered as least invasive. This was done by creating spacers between the plywood support and display board with small Ethafoam® blocks. Open Melinex® sleeves, adhered to the display board behind the artwork were created for holding sheets of Artcare™ board with MicroChamber technology. Testing the efficiency of the system, however, revealed that acidic gases were still present, although in small quantity. Recommendations were then made to drill discrete ventilation holes in the Plexiglas for the next time the artwork will be put on display.

4. Storage considerations
As the artwork is currently going into storage, it was important to create a housing that would allow the whole assembly to be kept together, yet not fully assembled to limit the build-up of acidic gasses . The solution was a two-tiered storage box constructed of Blueboard, Ethafoam®, Volara®, and Artcare™ board with MicroChamber technology installed along all sides. The design allows for the fragile artwork to remain fastened to the canvas-covered display board and stored on the top tier of the box, while the Plexiglas cover is placed on the bottom tier. A separate, small, partitioned box constructed out of Blueboard and Volara® that fits into the top tier holds minute loose fragments of eggshell and cuttlebones. Testing again with an A-D Strip indicated that acidic gases were effectively scavenged or dispersed through the Blueboard enclosure.

Mist consolidation of the cuttlebone with a 0.5% gelatin in deionized water.

Consolidation of the cuttlebone using a 10 µl micropipette and 5% Paraloid B-72.

Detail during consolidation: lifting finger off the upper end of the micropipette to allow the consolidant to flow into the cuttlebone.

The authors lifting Plexiglas cover for initial examination.

Rationale

The basic principle consists in consolidating the brittle outer surface of the shell using a gentle method of application with a consolidant that will not be affected during the more in-depth consolidation. 1) A low concentration of gelatin applied as a mist is an appropriate choice as it is compatible in composition with the protein present in the shell. 2) Following with a low concentration of Paraloid® B-72, applied with a micro-pipette, allows for in-depth consolidation without the outer surface being affected.

Greek Beach V (1965), Ilse Getz, overall after treatment. Note how eggshell was also reassembled as part of this project.

Two-tiered housing for safe storage of the artwork.

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Acknowledgements:
This work was made possible through the donation of the Ilse Getz artwork by Werner and Sally Kramarsky and the advice and support of many Winterthur/University of Delaware Faculty members including Lauren Fair, Dr. Joelle Wickens, Joan Irving, Debbie Hess Norris, as well as Dr. Jennifer Mass, and Catherine Matsen in the Winterthur Museum's Scientific and Research Analysis Laboratory.

Thanks are also extended to Julie Ream, Patricia Preziosi, Rachel Nackman, the Hirshhorn Museum and Sculpture Garden, Stephen O'Banion, Doug Nishimura, as well as Dr. Jean Woods and Dr. Elizabeth Shea (Delaware Museum of Natural History) for their time, advice, and expertise given to this project. Finally thanks to SPNHC 2015 for providing a forum to present the results of this project.