APPENDIX 5.1
CONSERVATION TREATMENT SCHEDULES FOR CASTLE HILL ARTIFACTS
(Dave McMahan)

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Polymer Passivation (Silicone Impregnation)

Polymer passivation consists of dehydration of the artifact, treatment with a silicone oil and crosslinker, and application of a catalyst. The conservation use of the process has been developed by the Texas A & M University Archaeological Preservation Research Laboratory (APRL) and the Dow Corning Corporation (Smith 1997, 1998). Because oils of several molecular weights are available, the material to be treated must be matched with the best combination of oil, crosslinker, and catalyst. Experimentation and practical experience with the Castle Hill collection has shown the best treatment schedule for various types of materials as follows:

Wood:

(1) The artifact was dehydrated in an acetone bath from approximately 2 days to several weeks, depending on the size of the artifact. The acetone bath was sometimes changed, depending on the moisture content of the item treated. In the final stages of dehydration, the artifact was sometimes placed under a very low vacuum.

(2) For wood, polymerization was achieved by placing the item in a glass dish with PR-10 polymer mixed with 3-5% CR-20 crosslinker. PR-10 allows for a slightly harder, more brittle finish than other silicone conservation oils. The artifact covered with solution was placed under vacuum for one to several days, depending on size. The vacuum was gradually increased until bubbles from the expelled acetone were observed, generally to a maximum of about 10 lbs. Upon release of the vacuum, the artifact was allowed to achieve equilibrium very slowly.

(3) The artifact was removed from the silicone oil solution and carefully dried with paper towels and lint free lens wipes. It was then bathed or brushed with CR-20 crosslinker to remove access oil from the surface, and again dried with paper towels.

(4) A catalyst (CT-32) was applied to the artifact with a swab, then removed from the surface with absorbent towels. It was then placed in an airtight container (plastic, with snap-on lid), along with a few drops of CT-32 in a small paper container (base of a dixie cup) overnight or longer. In most instances, the CT-32 in the paper container was refreshed once before the artifact was removed a day or two later.

(5) A minor, but recurring problem, was the occasional formation of a white residue on the surface of the artifact. This was easily removed with a swap dampened with CR-20 crosslinker.

Leather:

(1) The artifact was dehydrated in an acetone bath from 1 to several days, depending on the size of the artifact. Bulky composite items, such as boot heels, were generally dehydrated for a longer period. The acetone bath was sometimes changed, depending on the moisture content of the item treated. In the final stages of dehydration, the artifact was sometimes placed under a very low vacuum.

(2) For leather, polymerization was achieved by placing the item in a glass dish with PR-12 polymer mixed with 3-5% CR-20 crosslinker. The process was also applied with CR-22 crosslinker, or a mixture of CR-20 and CR-22 crosslinkers at about 5% by weight, with no apparent change in outcome. PR-12 allows for a slightly more flexible finish than PR-10. The artifact covered with solution was placed under vacuum for several hours to several days, depending on size. The vacuum was gradually increased until bubbles from the expelled acetone were observed, generally to a maximum of about 20 lbs. Upon release of the vacuum, the artifact was allowed to achieve equilibrium very slowly.
(3) The artifact was removed from the silicone oil solution and carefully dried with paper towels and lint free lens wipes. Large items such as boot heels were then bathed or brushed with CR-20 crosslinker to remove access oil from the surface, and again dried with paper towels.
(4) A catalyst (CT-32) was applied to the artifact with a swab, then removed from the surface with absorbent towels. It was then placed in an airtight container (plastic, with snap-on lid), along with a few drops of CT-32 in a small paper container (base of a dixie cup) overnight or longer. In most instances, the CT-32 in the paper container was refreshed once before the artifact was removed a day or two later.
(5) A minor, but recurring problem, was the occasional formation of a white residue on the surface of the artifact. This was easily removed with a swap dampened with CR-20 or CR-22 crosslinker.

Basketry:

The site produced spruce root basketry, grass basketry, and cedar bark matting. Some of these materials were difficult to treat with the polymer passivation process. These artifacts were evaluated individually to determine the feasibility of silicone treatment. Basketry specimens were typically in very poor condition when removed from the ground. The first specimen to be treated, at MEHS in Sitka, was a flattened spruce root "berry" basket that was removed to the lab in a block of soil. After separation from the soil matrix, and soaking and cleaning in distilled water, the basket was dehydrated in acetone for several weeks. Under vacuum, the item was then impregnated with PR-10 polymer mixed with 3% CR-20 crosslinker. Upon removal from the polymer, the basket was cleaned with paper towels and bathed in CR-20. It was then again cleaned with paper towels and fume-catalyzed with CT-32. Several problems arose during the process. The item remained "tacky" to the touch, despite repeated brushing with CR-20 and re-exposure to CT-32 catalyst fumes. The problem may have been due to contaminated chemicals, or our limited experience in using the polymer passivation process. Also, the item appeared much darker following treatment, and design elements that had been barely visible to the naked eye were no longer visible. The disappearance of design elements may have resulted from leaching of the dyes by acetone, or simply from darkening of the finish. Finally, because the artifact was in very deteriorated condition, cleaning with paper towels compressed the individual fiber bundles (split roots), giving the specimen a flattened appearance. Similar problems were encountered during the treatment of a grass basket in Sitka. These specimens were treated with Polymer PR-10, which is not as flexible nor as desirable for basketry specimens as PR-12 or PR-14. In the Anchorage laboratory, specimens were treated more successfully by use of the following treatment schedule (based partially on experimentation with comparative specimens):

(1) The basketry specimen was dehydrated in an acetone bath from 1 to several days, depending on size and moisture content. The acetone bath was changed if judged necessary to eliminate all water content. In the final stages of dehydration, the artifact was placed under vacuum.
(2) For basketry, polymerization was achieved by placing the item in a glass dish with PR-12 polymer mixed with 3-5% CR-20 crosslinker. The process was also applied with CR-22 crosslinker, or a mixture of CR-20 and CR-22 crosslinkers at about 5% by weight, with no apparent change in outcome. PR-12 allows for a slightly more flexible finish than PR-10. The artifact covered with solution was placed under vacuum for several hours to several days, depending on lab scheduling. The vacuum was gradually increased until bubbles from the expelled acetone were observed, generally to a maximum of about 20 lbs. Upon release of the vacuum, the artifact was allowed to achieve equilibrium very slowly.
(3) The artifact was removed from the silicone oil solution and carefully dried with paper towels and lint free lens wipes. Care was taken not to compress the fiber bundles from which the basketry was woven
(4) A catalyst (CT-32) was applied to the artifact with a swab, then removed from the surface with absorbent towels. The artifact was then placed in an airtight container (plastic, with snap-on lid), along with a few drops of CT-32 in a small paper container (base of a dixie cup) overnight or longer. In most instances, the CT-32 in the paper container was refreshed once before the artifact was removed a day or two later.
(5) A minor, but recurring problem, was the occasional formation of a white residue on the surface of the artifact. This was easily removed with a swab dampened with CR-20 or CR-22 crosslinker.

Electrolytic Reduction

In the MEHS field lab, some iron artifacts were subjected to electrolysis immediately following excavation. Artifacts were suspended from a cathode into a lye solution through which intermittent 10 amp current was conducted. Stainless steel plates served as annodes. The pH of the solution was not monitored, and current generally turned off at night. Following electrolysis, artifacts were further cleaned with picks and stainless steel brushes, then soaked in distilled water. After drying on a hotplate at low temperature for several hours, the artifacts were dipped in or coated with melted bee's wax.

The technique was refined in the Anchorage laboratory through consultation with Dr. Donnie Hamilton, a conservation expert in the Nautical Archaeology program at Texas A & M University. Some of the original specimens were retreated due to incomplete removal of moisture in the field laboratory. The following treatment schedule, implemented by UAA student Mark Haughaboo, produced excellent results.

(1) Flotation cells were constructed from plastic wash basins, with anodes made from hardware cloth bent to conform to the bottom of the basin. Cathodes were comprised of a steel bar, that rested across the top of the basin, from which

artifacts were suspended.

(2) A solution pH of >11 was maintained by the use of commercial lye (i.e., drain cleaner). The pH was tested routinely, and additional water or lye was added as necessary.
(3) Artifacts were initially soaked in a 25% lye solution 2-3 days without current.
(4) Artifacts were subjected to 3-5 amps (50-100 volts) current for approximately 1 day, depending on artifact size and fragility.
(5) The artifacts were mechanically cleaned twice each day to remove loose scale. This was an important part of the process.
(6) Artifacts were subjected to 1-3 amps (50-100 volts) current for 1-2 days.
(7) Artifacts were submersed in an acetone bath for 3-4 days, then air dried to remove moisture.
(8) Artifacts were initially coated several times with a commercial rust converter (i.e., tannic acid with a wetting agent such as isopropynol). Experimentation later demonstrated that better results were achieved by coating the artifact with phosporic acid with isopropynol (approx. 95:5 ratio).
(9) After drying for at least 1-2 days, the artifacts were coated with microcrystalline wax (BeSquare 185 Amber Wax).

Acryloid B-72

This Ethyl Methacrylate copolymer is a general purpose transparent resin that is durable and non-yellowing. A single Castle Hill specimen, a wooden barrel stopper, was treated with Acryloid B-72. Most similar specimens were treated by polymer passivation. The Acryloid B-72 schedule was as follows:

(1) The object was submersed in a 25% solution by weight of Acryloid B-72 pellets dissolved in acetone. The container with the object was placed under low vacuum for several days.
(2) The object was removed from the solution, and air-dried on a mesh rack for several days. Surface defects caused by the rack impression were removed with acetone.
(3) The object was brushed with a 50% solution by weight of Acryloid B-72 pellets dissolved in acetone and air-dried for several days.
(4) Lastly, the object was wiped with acetone to remove surface gloss and defects caused by the drying rack.