Deller Conservation

Conservation Services for Historical & Artistic Objects

August 30, 2016

Annie C. Stewart Memorial Fountain

Condition Assessment and Treatment Proposal

The Annie C. Stewart Fountain, constructed and completed in 1926, is in extremely poor condition. These facts are well known and documented. (See attached "Sculpture Conservation Survey, Tony Rajer, 2007")

Careful examination by this conservator has concluded the following:

- The Marble figures, created by Frederic Clasgens, are to be lifted and removed from the base and transported to a temperature controlled facility on city property to be cleaned and treated.
- The cement renders added in the 1990's (?) are poorly executed and tightly bound to the original (now substrate). *(1)*
- The six shells of later addition should be molded with silicone rubber for later re-casting. *These are all identical so only one mold should necessary.*
- The decorative bas-relief carvings of various flora are to be molded for later casting. There are 6 (six) carvings which are all different. *(see attached photos).* Therefore 6 (six) separate molds will be made, one of each. Due to the poor execution of the cement rendering, the detail of the bas-relief carvings are muted. Once the molds are made, an initial cast of plaster will be created so they may be re-carved to enhance the details and then re-molded and cast in fiber-reinforced concrete.*(see note on concrete recommendations)*
- The missing Triton figures (presumed marble) are currently missing. One presumed lost, the other unaccounted for. *(Any costs for treatment to Tritons are not part of this proposal)*
- The unaccounted Triton, if found, should repaired for future display. The missing one is to be replaced as a cast. **Treatment of existing Triton or the re-construction of the missing one is not included in the costs estimates until they can be located.**
- The condition of the existing concrete base has been determined to be unsound and of no significant historical context with the exception of the bas-relief flora and protruding shells. Therefore, the existing concrete will be removed and replaced including the newly cast shells and bas-relief flora. With the removal of the existing concrete base, there is no need to analyze the existing by previously proposed X-Ray Diffraction (XRD).

COSTS:

Removal and transport of marble figures……..……..$3000.00

- Reynolds Crane.

Treatment of marble figures (does not include Triton)……$3500.00

1. (Treatment is to take place in a heated park facility)

Create silicone rubber molds……..…..$2500.00 (seven different molds)

- Mold Max® XLS® II-30
- PolyTek FormRub-60 Pourable Polyurethane Mold Rubber

Materials: 4- 80 pound kits ……...$2200.00 (materials only)

Cast Shells…….……$2500.00 (six from one mold)

Cast bas-relief……...$ 4500.00 (six different)

Estimated Total……..$18,200.00

The re-installation of new castings and marble figures will be coordinated with the cement contractor and will be decided at that time.

Treatment of Marble Mermaid & dolphin:

The surface of the marble will be cleaned first by the removal of accumulated debris, (lichen, etc.) by mechanical means.

The surface is then cleaned further by steam cleaning*.

***** *L'Innocenza Perduta (Lost Innocence): Conserving a Carrara Marble Statue----*
Chris Cleere mailto:brian.hole@ubiquitypress.com *University College London, GB*

The deep stains will be treated by a poultice.*

** The aqueous phase in the poultice featured a chelating material, nitrilotriacetic acid (NTA)**. The log dissociation constant for NTA with Ca+2 (7.60) favors the formation of Ca+2 NTA complexes in the presence of various other calcium salts, but not the dissociation of the stone substrate itself (log pKsp CaCO3 is 8.54). Under essentially CO2 free conditions (e.g. under a gel or poultice) where air is restricted*

severely at the substrate surface or is completely unavailable, the most stable pH for a carbonate like marble is about 10.3 (Livingston 1992). At pH values this high however NTA would be of little use since, like most of the common anionic chelators, NTA works best above its highest pKa (5.5) and below pH 9. By way of compromise, the pH of the cleaning system was elevated to about 9 using a sodium borate (pKa 9.3) buffering system. A non-ionic surfactant (Triton XL-80N) was also included because of its general compatibility with the other ionic materials in the mixture (Triton X:-80N is an alkyloxypolyethyleneoxypolypropyleneoxy ethanol type surfactant produced commercially by Union Carbide. As a neutral or non-ionic structure, it can be mixed with other ionic solutes without precipitating them from solution.) The HLB for Triton XL-80N is 12.5, and is just sufficient for detergency and solubilization of likely residual soiling, coating, and staining materials ('HLB' is an acronym for 'Hydrophile Lipophile Balance' number, which defines a surfactant's functionality and strength. See Wolbers for more detailed discussion of surfactants and HLB number in aqueous cleaning systems). To summarize, the poultice contained the following aqueous solution:

The proposal for treatment includes seven steps: 1) vacuum to remove loose dust and soil; 2)clear the gel with mineral spirits using pre-cut absorbent cotton pads (Webril, Handi-Pads, available from Talas, NY) and cotton swabs; 4) apply the NTA gel paste poultice and cover with polyethylene film; allowing the mixture a minimum of 6 hours to work; 5) clear the gel paste using paper towels, Webril pads and swabs; 6) clear all residues with thorough water washing; and finally, 7) apply a protective coat of microcrystalline wax.

Objects Specialty Group Postprints, Volume Fourteen, 2007; Kory Berrett, Virginia Naude, and Richard Wolbers

- As the statue is on open display and accessible to the public, the figure will still be vulnerable to the same destructive elements that had caused its previous deterioration - i.e. airborne pollutants and vandalism. For this reason it was decided that the surface of the statue and base will be coated with wax. Once cleaned of surface mineral deposits, a wax mixture of microcrystalline (Multiwax W-835) ***(a),*** Polywax 2000 ***(b)*** will be applied hot to seal the surface.
- Once set (12-24 hours) the wax surface will be buffed using a heat source and mechanical buffing.

(a), Microcrystalline wax (Multiwax W-835)

Microcrystalline waxes are a type of wax produced by de-oiling petrolatum, as part of the petroleum refining process. In contrast to the more familiar paraffin wax which contains mostly unbranched alkanes, microcrystalline wax contains a higher percentage of isoparaffinic (branched) hydrocarbons and naphthenic hydrocarbons. It is characterized by the fineness of its crystals in contrast to the larger crystal of paraffin wax. It consists of high molecular weight saturated aliphatic hydrocarbons. It is generally darker, more viscous, denser, tackier and more elastic than paraffin waxes, and has a higher molecular weight and melting point. The elastic and adhesive characteristics of microcrystalline waxes are related to the non-straight chain components which they contain. Typical microcrystalline wax crystal structure is small and thin, making them more flexible than paraffin wax. It is commonly used in cosmetic formulations.
Microcrystalline waxes when produced by wax refiners are typically produced to meet a number of ASTM specifications. These include congeal point (ASTM D938), needle penetration (D1321), color (ASTM D6045), and viscosity (ASTM D445). Microcrystalline waxes can generally be put into two categories: "laminating" grades and "hardening" grades. The laminating grades typically have a melt point of 140-175 F (60 - 80 oC) and needle penetration of 25 or above. The hardening grades will range from about 175-200 F (80 - 93 oC), and have a needle penetration of 25 or below. Color in both grades can range from brown to white, depending on the degree of processing done at the refinery level.
Microcrystalline waxes are derived from the refining of the heavy distillates from lubricant oil production. This by product then must be de-oiled at a wax refinery. Depending on the end use and desired specification, the product then may have its odor removed and color removed(which typically starts as a brown or dark yellow). This is usually done by means of a filtration method or by hydro-treating the wax material.

(b) *Polywaxes*

Polywax 2000 is a polymer of ethylene with a molecular weight of 2000. It melts at 257°F (125°C) and can be most easily thought of as a high melting microcrystalline wax. Small percentages of Polywax 2000 can be added to regular microcrystalline waxes to substantially prolong the life of outdoor wax coatings.
Polywax 500 has a lighter molecular weight and a melting point of 190°F (97°C).

**** Nitrilotriacetic acid** (NTA) is the aminopolycarboxylic acid with the formula $N(CH_2CO_2H)_3$. It is a colorless solid that is used as a chelating agent, which forms coordination compounds with metal ions (chelates) such as Ca^{2+}, Cu^{2+}, and Fe^{3+}.[4] The uses of NTA are similar to that of EDTA, both being chelating agents. In contrast to EDTA, NTA is easily biodegradable and is almost completely removed during wastewater treatment. It is used for water softening and as a replacement to sodium and potassium triphosphate in detergents, and cleansers.[5] NTA is a tripodal tetradentate trianionic ligand.[7] In the laboratory, this compound is used in complexometric titrations. A variant of NTA is used for protein isolation and purification in the His-tag method. The modified NTA is used to immobilize nickel to a solid support. This allows purification of proteins containing a tag consisting of six histidine residues at either terminus.[8]

1. Nitrilotriacetic acid
2. *"Nitrilotriacetic Acid - Compound Summary". PubChem Compound. USA: National Center for Biotechnology Information. 26 March 2005. Identification. Retrieved 13 July 2012*
3. ChemBK Chemical Database http://www.chembk.com/en/chem/Nitrilotriacetic%20acid
4. NITRILOTRIACETIC ACID AND ITS SALTS, International Agency for Research on Cancer (IARC)
5. [b] *Charalampos Gousetis, Hans-Joachim Opgenorth (2005), "Nitrilotriacetic Acid", Ullmann's Encyclopedia of Industrial Chemistry, Weinheim: Wiley-VCH, doi:10.1002/14356007.a17_377*
6. Hart, J. Roger (2005) "Ethylenediaminetetraacetic Acid and Related Chelating Agents" in *Ullmann's Encyclopedia of Industrial Chemistry*, Wiley-VCH, Weinheim. doi:10.1002/14356007.a10_095
7. B. L. Barnett, V. A. Uchtman "Structural investigations of calcium-binding molecules. 4. Calcium binding to aminocarboxylates. Crystal structures of Ca(CaEDTA).7H2O and Na(CaNTA)" Inorg. Chem., 1979, volume 18, pp 2674–2678. doi:10.1021/ic50200a007
8. qiaexpressionist

Recommendations for New Base:

The future maintenance of the new base will be an on-going concern,
therefore, the new base will be constructed with the most secure and conservation-grade materials.

The following conditions are to be met by the contractor:

- The use of metakaolin concrete *(2)*, with attention paid to the alkali-silica reaction (ASR).*(3)*
- The use of either stainless steel and fiber-reinforcement.*(4)*
- The use of autogenous healing cement is at all possible. *(5); (6)*

(1) "Deterioration Mechanisms of Historic Cement Renders and Concrete"
Isobel Griffin. MA (Hons)
A thesis submitted to the University of Edinburgh
for the Degree of Doctor of Philosophy
July 2013
Institute for Materials and Processes in the School of Engineering

(2) "Durability of Metakaolin Concrete to Sulfate Attack"
Nabil M. Al-Akhras
Civil Engineering Department, Jordan University of Science and Technology, P.O.Box 3030, Irbid 22110, Jordan
Received 21 March 2005; accepted 26 March 2006

(3) "Diagnosis and Control of Alkali-Aggregate Reactions in Concrete"
by James A. Farny and Beatrix Kerkhoff*
* Program Manager, Masonry and Special Products and Program Manager, Cement and Concrete Technology, respectively, Portland Cement Association
PCA R&D Serial No. 2071b
ISBN 0-89312-146-0

.(4) Fiber-reinforced concrete

Fiber-reinforced concrete contains an array of different fibers (polypropylene, metal, fiberglass, carbon, etc.) that create a reinforced mesh, improving the concrete's solidity and resistance to cracking. This is a rapidly developing approach to reinforcing concrete.

Ultra-high performance fiber-reinforced concrete

Ultra-high-performance fiber-reinforced concrete is an innovative construction material. The addition of metal fibers increases its resistance 6-fold compared to standard concrete and also increases its durability.

(5) A Review: Self-healing in Cementitious Materials and Engineered Cementitious Composite as a Self-healing Material
Min Wu, Björn Johannesson, Mette Geiker
Department of Civil Engineering, Building 118, Technical University of Denmark, 2800 Lyngby, Denmark
Department of Structural Engineering, Norwegian University of Science and Technology, Trondheim, Norway

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Available online 14 December 2011

(6)Self-Healing Phenomena in Cement-Based Materials
State-of-the-Art Report of RILEM Technical Committee 221-SHC: Self-Healing Phenomena in Cement-Based Materials

Mario de Rooij, Kim Van Tittelboom, Nele De Belie, Erik Schlangen
ISBN: 978-94-007-6623-5 (Print) 978-94-007-6624-2 (Online)

Langelier Saturation Index (LSI)

The Langelier Saturation index (LSI) is an equilibrium model derived from the theoretical concept of saturation and provides an indicator of the degree of saturation of water with respect to calcium carbonate. It can be shown that the Langelier saturation index (LSI) approximates the base 10 logarithm of the calcite saturation level. The Langelier

saturation level approaches the concept of saturation using pH as a main variable. The LSI can be interpreted as the pH change required to bring water to equilibrium.

Portland

The name 'Portland' comes from a peninsula in Great Britain.
The gray stone of this area has a composition and appearance similar to that of cement. Portland cement is the generic name of basic, highly-efficient hydraulic cements. They are obtained by grinding clinker, which is made from firing a carefully-composed mixture of limestone, silica, alumina and, in some cases, other products.

Respectfully submitted,

Craig Deller
Conservator

Bas-Relief Photos: