International Course on Stone Conservation SC13

SESSION: Introduction to porous building materials and stone conservation

INSTRUCTOR: Giacomo Chiari

TIME: Thursday, April 18th / 11:30 – 13:00 (1.5 hours) & 14:30 – 16:00 (1.5 hours)

SESSION OUTLINE

These lectures are dedicated to the memory of Giorgio Torraca, who was my mentor, my colleague and my friend for over 42 years. His ability to make complex concepts simple and understandable was proverbial. I will do my best in his honor.

ABSTRACT

Conservation technology and science in use today was developed in the second half of the 20th century. Conservation techniques are designed to mitigate the factors of decay, to reconstitute the cohesion of the materials when needed, and to delay the unavoidable onset of future decay processes. In the past, scientists and conservators sometimes naively supposed that a few conservation remedies were applicable to all architectural surfaces. Especially in the case of chemical treatments, a conservation 'formula' was too often viewed as a miraculous panacea able to consolidate any type of stone and to indefinitely arrest multiple types of decay. This theoretical framework has changed. What conservation science and conservation methodology offer today are a sequence of operations, with several options available at each step. The results of each step and action are effective within limits and each treatment has a lifetime, over which the treatment should be evaluated and, ideally, monitored. The main steps in the sequence of operations aimed at the conservation of architectural surfaces are: knowing the object and its context, documentation and recording, identifying the causes of deterioration, analyzing the problem, resolving the cause of the problem, developing a preventive approach to future damage, cleaning, consolidation and protection.

OBJECTIVES

- To gain a basic understanding of the behavior and conservation of porous building materials.
- To present the basic concepts and the most accepted procedures in conservation, including minimum intervention, compatibility, re-treatability and preventive conservation.

CONTENT OUTLINE

<u>Recording and documentation</u>

All conservation begins with knowing the object and its context. This process includes archival research, site recording, and investigation into the use, meaning, condition, environment, construction history, maintenance and conservation history of a building, as well as into the stewardship of its care.

<u>Condition assessment and diagnosis</u>

The condition assessment provides a record of the condition of the 'object' at a specific point in time as well as serves as a tool for diagnosis of the problem(s). The condition assessment can help link the problems to their causes and identify the sources of decay. Once the problems have been diagnosed,

their causes identified, and the problems analyzed, the next step is the development of a conservation plan. The conservation plan includes the vision and objectives of the conservation – To what point? For what purpose? – and the consequent design of repairs, alone (rare) or in sequence (more common).

Architectural repairs

All loss of or changes to original architectural features should be noted. Of particular importance are those features which serve a protective function such as those that were intended to shed water from the building and to prevent its infiltration. Features that are no longer functional, either due to deterioration, poor design, or faulty restorations should be repaired and returned to a satisfactory operational condition.

Cleaning

From a purely material, conservative point of view, the main reasons for cleaning an architectural surface of artistic or historic value are the following:

- to remove material depositions - natural or artificial (applied), e.g. soluble salts, gypsum-rich crusts, or pollution, which contribute to accelerated decay;

to remove extraneous material (e.g. dust or remains of earlier treatments) to facilitate other necessary and sequential conservation treatments. Sometimes the sequence of cleaning followed by consolidation is reversed when original surface material is so fragile as to require consolidation prior to cleaning. This measure is sometimes referred to as pre-consolidation.

In most cases the primary motive for cleaning stems from a desire to improve the "legibility" of the object. This is a legitimate reason; however, it does not conform to the above listed conservative conservation notions of minimal intervention for the exclusive purpose of securing the physical stability of an object. At times, the proposal to clean may be in opposition to those criteria.

Cleaning is a necessary operation but can also be a dangerous one. Many mechanical and abrasive architectural cleaning processes can cause the formation of micro-fissures in brittle stone surfaces. Chemical cleaning can leave residues of soluble salts. In the case of painted decorated surfaces, it is always necessary to determine the solubility of the applied decoration and the presence of any organic materials prior to cleaning.

Consolidation

Consolidation processes improve the overall cohesion of a deteriorated stone. These processes may be chemical or physico-mechanical. Chemical consolidation re-establishes the grain to grain strength of a stone that has lost the binder from its matrix. Physico-mechanical consolidation reconstitutes a continuous surface by re-adhering loose fragments that would otherwise be lost or patching losses or would permit water penetration.

According to the type of damage that is to be cured various techniques are available:

- **adhesion** of partly detached material;
- **grouting** i.e. superficial injection of fluid mortars or adhesives;
- **filling** of all superficial discontinuities with suitable mortars;
- **impregnation** with a consolidant, a process that should be applied only to crumbling stones with open gaps not exceeding 0.1 mm width. A brief description of the most used consolidants, both organic and inorganic, is given.

Preventive conservation

Preventive measures are those which seek to mitigate the external conditions which pose a threat to the physical integrity of the object. Examples of preventive measures include, but are not limited to, improved drainage or grading, removal of external causes (such as the use or storage of salt laden materials), or a physical barrier. Preventive conservation measures seek to go beyond the symptoms of damage and to prevent or mitigate future deterioration.

Protective coatings

The application of protective hydrophobic coatings on stone requires careful consideration before such a decision is taken. Hydrophobic coatings (mainly synthetic polymers) are not efficient, and can cause problems if applied on very porous stone. On low porosity stone (such as white marble), and in particular in the case of surfaces of artistic or historic importance, the protective action of hydrophobic films, in principle, can be quite useful. However, the service life of the most suitable materials (silanes and silicones) is still rather short (5 to 10 years) and there is always the consideration of negative optical effects.

READINGS

📖 = Essential reading material
💻 = Available online

These lectures are based essentially on the work of Prof. Giorgio Torraca, who for many years taught the present module in the Stone Course. The Getty Conservation Institute printed an English version of his teaching notes at the University "La Sapienza" in Rome. **Lectures on Material Science for Architectural Conservation.**

📖💻 Torraca, Giorgio. 2009. *Lectures on Materials Science for Architectural Conservation*. Los Angeles: Getty Conservation Institute. Ch. 4, 6 & 7.
http://www.getty.edu/conservation/publications_resources/pdf_publications/pdf/torraca.pdf

The printed book it is available on demand for a small sum at:
http://stores.lulu.com/gettyconservationinstitute

📖 💻 Doehne, Eric, and C. A. Price. 2010. *Stone Conservation: An Overview of Current Research*. 2nd ed. Research in Conservation. Los Angeles, Calif.: Getty Conservation Institute. Ch 6.
http://www.getty.edu/conservation/publications_resources/pdf_publications/pdf/stoneconservation.pdf