# 20th International Course on Stone Conservation-SC17. ICCROM-INAH

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Abstract
The 20th International Course on Stone Conservation of ICCROM has been organized in association with INAH; it took place from March to May 2018 in Mexico, being the first time the course is held outside of Italy. A team of 32 multidisciplinary expert teachers and 18 participants from different countries, who work directly with stone-built heritage, dedicated 9 weeks for lectures, lab practices, round tables and field work around the conservation of this vast heritage.

Keywords
Conservation; stone; International course; ICCROM; INAH.

The International Centre for the Conservation and Restoration of Monuments (ICCROM) has five areas of activity: training, information, research, cooperation and awareness (ICCROM, 2011). As a strategy to achieve its goals, ICCROM has generated regional programs in collaboration with other institutions in different countries. In 2008, it launched its most recent program: LATAM for the conservation of cultural heritage in Latin America and the Caribbean.

This program's "main objectives are to improve and strengthen the abilities of professionals involved in the sector of cultural heritage conservation in Latin America and the Caribbean, as well as to improve communication and exchange in the region and increase the awareness of a vast audience regarding the need to protect that heritage"(ICCROM, 2011).

Since the launch of the Program for the Conservation of Cultural Heritage in the Americas and the Caribbean 2008-2019,

> *INAH (Instituto Nacional de Antropología e Historia) and ICCROM signed a memorandum of understanding to carry out activities related to this program, as well as to support other ICCROM activities and courses. It also considered other forms of collaboration, such as the translation of materials into Spanish and the dissemination of information. This memorandum was signed in the second half of 2010* (Magar, 2019).

According to Valerie Magar, LATAM contemplates five lines of action: training; fighting illicit traffic; creating indicators for conservation; risk management; translation and dissemination of information, for which priority topics and possible collaborations were sought. Magar mentions that one of the main problems identified was the need for training regarding stone conservation, because the cultural heritage made of stone in the region is vast, and the academic training programs on this topic are practically non-existent (2019).

From 2014 to 2016 LATAM has had activities and courses focused on the conservation of cultural heritage built in stone: a module on "observation, documentation and diagnosis", followed by two courses at the Archaeological Sites of Tula in Hidalgo and Chicanná in Campeche.

> *The objectives of these regional courses, carried out in Spanish within the framework of the LATAM Program were to generate and update the specialists' knowledge on stone conservation, as well as discuss common methodologies and terminologies, and gradually move towards other more specific topics: analysis, conservation and restoration of specific types of stone, among others. In addition to generating local networks of interdisciplinary nature* (Magar, 2019).



The Stone Course, directed by Giorgio Torraca, started in Venice in 1976 with the objective to solve the conservation problems created by the floods in Venice in 1966. The export of Mediterranean stone created a mosaic of complexities that were used as case of study (Warrack, 2019). Nineteen courses were satisfactorily given in Venice since then up to 2009, and since 2011 they have been carried out biannually in Rome (ICCROM 2019).

In 2017, ICCROM was looking for new collaborators to conduct this important course, in order to bring a new perspective. Given the solid working relationship with INAH and the positive experiences of the LATAM courses, it seemed very logical to develop and carry out the International Stone Course in Mexico (Heritage, 2019). INAH agreed to join forces and have an in-depth review of the program, with the purpose of integrating requirements for the participants, advances in practice, science and technology, and the possibility of having practical activities during the course (Magar, 2019).

For Simon Warrack (coordinator of the Stone Course for four years) "ICCROM was delighted to collaborate with INAH, that not only offered to provide funds but made available the extraordinary facilities of the Coordinación Nacional de Conservación del Patrimonio Cultural-INAH (CNCPC) in Mexico City and work together with the Universidad Nacional Autónoma de México (UNAM)"

(Warrack, 2019). In this sense, it is necessary to highlight the extraordinary resources and support of the UNAM, from the introduction to the basic field techniques, and the mineralogical identification given by the Geology Department, to the avant-garde analytical facilities in the Science Laboratory for the Research and the Conservation of Cultural Heritage (Heritage, 2019).

The International Stone Conservation Course (SC17) was the first to be executed outside of Italy; it was held from March 19 to May 18, 2018 at the CNCPC, the archaeological site of Chicanná[1] in the state of Campeche, and at the department of Applied Physics of the Institute of Geology of the UNAM.

For nine weeks, the authors of this article, along with 15 other participants including conservators, architects, engineers, and scientists from different countries of America, Asia, Europe and Africa, had the honor to learn from a team of experts in conservation techniques, documentation, diagnosis, analysis and management, applied in different sites of the world that hold cultural heritage manufactured in stone.

The professors who taught at the SC17 are professionals internationally renowned who work in the field of conservation of stone heritage, this team of experts that moved to Mexico and Chicanná, consisted of conservators, architects, engineers, chemists, biologists, historians, archaeologists and museographers with a vast experience, and who have worked for institutions such as ICCROM, the English Heritage Building Conservation Research, the Historic Preservation Program of the Metropolitan Museum of Arts, the Stone Conservation Laboratory of the Vatican Museum, the Department of Conservation of Spanish Historical Heritage of the Fundación Caja Madrid, the INAH, the UNAM, and have participated in national and international conservation projects in the five continents.



Regarding the content of the course, Valerie Magar comments that:

> *The program proposed for the SC17 course is very different from the previous courses. The content was revised to try to balance structural elements and decorative elements in stone and above all, to be able to have more practical work throughout the course, including aspects of laboratory analysis and identification, in collaboration with the UNAM and at the CNCPC; technical aspects, such as desalination tests and stone carving; and a very practical component, using a case study for the last modules: observation, documentation, diagnosis and treatments* (2019).

The course was developed based on the following guidelines:

- Theory and principles of conservation.
- Heritage manufactured in stone from Mexico: materials and construction techniques.
- Materials Science as a tool for the identification, analysis and design of conservation treatments.
- Mechanisms of deterioration.

[1] Chicanná is a mayan word that means in the mouth of the serpent.

- Diagnosis techniques to identify causes and effects of alteration.
- Methodology for condition assessment.
- Documentation: observation, records, planimetry, photogrammetry, 3D, among others.
- Development of conservation strategies for immediate and long-term actions, including prevention, maintenance, repair and treatment.
- Management of conservation projects on stone-built heritage, and the value of working in multidisciplinary teams.

The development of the contents was divided into modules with theoretical and practical sessions, as well as some visits to sites and museums. At the end of each module, evaluations were carried out by the participants and the professors in order to obtain feedback about the contents and discuss their relevance.

Warrack mentions:

> *The content is determined by the needs and opinions of the participants who carry out weekly evaluations in the period between courses, these evaluations and the comments of the teachers are taken very seriously. There is a strong didactic and laboratory-based percentage, but perhaps, the strength of the course lies in the effort to link practical work with theory* (2019).



Here is a brief overview of each module:

### Module 1. Conservation in context

The course began with an introduction to Mexican architecture from pre-Columbian times to present day architecture. After a brief historical preamble, we worked on the identification of the values that are contained in a monument, their classification, and the importance of the protection of its attributes to ensure that their values remain active. Both teachers and participants made a review of the history of conservation and the evolution of intervention criteria linked to practical cases.

During the first weeks the theoretical sessions imparted at the CNCPC offices were alternated with interesting visits: the Templo Mayor Archaeological Site, the Historical Center of Mexico City, the National Museum of Anthropology, the La Conchita church in Coyoacán and the Archaeological Site of Teotihuacán in the Estado de Mexico. In each site, different restoration criteria were highlighted, as well as successful conservation cases, heritage management and examples of multidisciplinary projects.

### Module 2. Construction systems

In this module the topics related to the construction systems of Mexico were developed, the use of materials and construction techniques in archaeological, colonial and some early 20th century examples. In this case, the participants of the course had the opportunity to visit the Historical Center of Mexico as well as various mansions and buildings, such as the Casa de los Azulejos, the Cathedral of Mexico, the Fifth Post Office, among other emblematic buildings of the area.

Also, a brief introduction was given in the field of Geology, from the macroscopic and microscopic analysis of the components of the rocks to their multiple creation variations. These analyses were performed with petrographic microscopes in order to identify elements of different rocks of igneous, metamorphic, and sedimentary nature.

Figure 1. Participants of the SC17 performing rock identification practices in the faculty of Engineering of the UNAM. *Image: © Valerie Magar.*



Simultaneously, there was a carving workshop, where we experimented with different techniques that can usually be found in stone-built heritage, which supports the identification of manufacture techniques.

By the end of this module, the 18 participants of the SC17 had the opportunity to present a brief conference open to the public, where we shared information about the conservation projects where we have been involved. This allowed us to have an overview of the problems that we usually face in different contexts; it also fulfilled the objective of sharing experiences and paving the way for cooperation between experts and participants.

### Module 3. Alteration and deterioration

A fundamental part for understanding the state of conservation of a monument is the knowledge of the mechanisms of alteration through the study of the observed effects, so practices were carried out within the LANCIC laboratory in the Instituto de Investigaciones Estéticas of the UNAM, where we had the opportunity to get to know different analytical tools.

The characteristics of the stones and their relationship and interaction with the environment, degradation processes due to intrinsic and extrinsic causes, environmental contexts, temperature, pH, air, humidity, contamination particles, biological damage, micro and macro organisms, structural damage, etc. were studied. We also looked over how to apply different techniques to understand particular problems, as well as their physical-mechanical properties such as color, hardness, resistance to compression, water absorption, resistivity, conductivity, porosity, density, thermal expansion, and adhesion. The above, with the purpose of generating a scientific diagnosis that would help us determine the state of conservation and possible solutions to specific problems.

At the laboratory we worked with thermal cameras and infrared thermography; durometer and Mohs scale to identify the density and hardness of the rocks; Munsell table and colorimeter to register, identify and catalog; and measurements of electrical resistance generated by salts at different areas of an object. We were also introduced to the operation and application of X-ray Diffraction (XRD) equipment, Fourier transform infrared spectroscopy (FTIR), Scanning Electron Microscope with energy dispersive X-ray spectroscopy (SEM/EDAX), X-ray fluorescence (FRX), X-ray spectroscopy induced by charged particle -proton- (PIXE), Thermo gravimetric analysis (TGA), Gas / mass chromatography (GC / MS), Nuclear magnetic resonance spectroscopy (NMR), Optical microscope (MO), RAMAN dispersion spectroscopy, Surface-enhanced RAMAN spectroscopy (SERS), and Pelletron Ion Accelerator External Beam Line of the Physics Institute of the UNAM.



**Figure 2.** Javier Reyes Trujeque and SC17 students at LANCIC, performing tests with the durometer. *Image: © Valerie Magar.*

### Module 4. Treatments and conservation materials

Once we analyzed the alterations and their possible mechanisms, we studied conservation treatments, the teachers presented a review of the products that have been used for intervention since ancient times, up to the latest technologies such as treatments with nanotechnology.

We carried out a round table on the relevance of the interventions, the concepts of re-treatment and minimum intervention, as well as material compatibility. The applicability of each of the materials was analyzed according to their origin, their behavior at high or low temperatures, and their reaction to sunlight or chemical behavior. In addition, products for consolidation, cleaning, elimination of previous interventions, protection or maintenance, and monitoring were studied.

We carried out practices with cotton plasters, consolidants, different cleaning methods and techniques such as micro emulsions and gels, as well as joining methods. We discussed the lack of benefits of water repellent materials, and finally, we talked about the control of micro and macro flora, as well as fauna.

The following modules were carried out in Chicanná, Campeche:

### Module 5. Observation

The first step was to recognize the archaeological site of Chicanná, observe it and carry out an exercise based on Corrado Pedelli's Organized Visual Observation methodology (OVO), which has been applied in different regional ICCROM courses.




Figure 3. Corrado Pedelli, teaching the OVO methodology. *Image: ©Valerie Magar.*

This methodological proposal for the visual examination phase, as the first approach to the objects of study, seeks that each specialist is able to obtain and organize the information of the system that makes up the site or monument. Which must be seen as a dynamic system that can be deconstructed into subsystems and entities, and when analyzing its functional components they can finally relate to causes of alteration, managing to detect the mechanisms of deterioration.

OVO presents itself as an opportunity to organize the information obtained by observation in a logical manner, leaving behind preconceptions or unverifiable assumptions derived from a judgment biased by the specialization of each professional. The data collected is organized in diagrams, so that in a multidisciplinary team, everyone can understand the information of the system that is intended to be analyzed.

### Module 6. Documentation

Once the observation exercise was carried out, three structures of the Chicanná archaeological site were documented, in accordance with the knowledge obtained from the module where we examined documentation methods and the process of data collection in the field like architectural survey, principles of topography, use of GPS, photography and applications, a brief sketch of photogrammetry and its techniques, a theoretical revision of the laser scanner application and other tools like drones. All this information was complemented with practical activities in the different work fronts at the archaeological site of Chicanná.

We formed multidisciplinary groups, carried out planimetric surveys, took measurements in the field with various equipments, as well as photographs for desk work with software support.

For information processing, we carried out the rectification of images with Perspective Rectifier®, 3D models with Agisoft Photoscan®, manipulation of images with Photoshop®, and registration of alterations, plans and dimensions with Autocad®. This exercise allowed us to learn about the skill and dexterity needed for the gathering of information in the field, and the office work facilitated the photo-modeling of some of the work areas for the evaluation and the presentation of the information obtained to the group.



### Module 7. Diagnosis

During this module we had the opportunity to test diagnosis methodologies in situ, and collected information on the materials and pathologies present in each of the areas destined for intervention. These data allowed us to establish: the presence of salts, water absorption levels, color changes, thermal changes, pH levels, changes in hardness, etc., and to understand the particular problems of each structure we worked on.

With all these data, we obtained verifiable information about the conditions we found in Chicanná structures, and their mechanisms of alteration. This allowed us to diagnose and analyze the possible conservation treatments to be applied.

### Module 8 Conservation treatments

This module was divided into two parts: the first one consisted in lessons on biological control treatments, supported by an essential oils application workshop, as well as on principles of stabilization, consolidation, the use of different technologies, and the application of contemporary materials. The second part was an extensive analysis of lime, its chemical composition, uses and applications, complemented with the study of mortars, criteria for its selection and use, as well as its macroscopic and microscopic characterizations, which ended with a practical session of application and mixtures.

Figure 4. Students of SC17 Conducting hardness tests in structure 2 of Chicanná. *Image: ©Valerie Magar.*



Figure 5. Analysis of Mortars taught by David Odgers. *Image: ©Valerie Magar.*

Finally, with the information obtained throughout the eight modules of the course, we formed multidisciplinary teams among the participants and prepared an intervention proposal in six areas of two structures of the archaeological site (structures 1 and 3). This proposal was presented to a scientific committee (headed by the faculty) for approval and / or observations; simultaneously, the committee approved the intervention processes, with certain modifications, and we had a week to carry out the proposed in situ conservation actions.

This exercise gave rise to the practical part of the course in which for six days, all participants worked on treatments approved by the scientific committee, which consisted of the stabilization of the panels of the main facade of both structures. Other processes were necessary to achieve the objective, like the elimination of previous interventions, cleaning of agents adhered to the surface, microorganisms' removal, adhesion of scales, consolidation, application of mortar layers for the diversion of water, application of sacrificial mortars, plastering and chromatic reintegration. These interventions were carried out with the supervision of members of the scientific committee. Some actions done on the structure 3 also required the approval of the National Archeology Council, because it was considered necessary to eliminate architectural interventions.

Figure 6. Participants of SC17, carrying out conservation processes in structure 3 of Chicanná. *Image: ©Valerie Magar.*

Once the practical work was finished, each team presented the interventions made; comparing what was initially projected with what was executed. Finally, feedback and proposals related to the course were carried out, in which the personal and professional experience of each one of the participants and the tools provided to continue the work in their respective countries of origin were highlighted.

## Conclusions

The SC17 was an enriching experience for those of us who had the opportunity to learn and increase our knowledge with experts on the conservation-restoration field of stone-built heritage.

> *The partnership with INAH firmly established the course in the context of the country and provided a large amount of resources in terms of knowledge, experience, teaching spaces, laboratories and, most importantly, access to a large number of heritage sites, in particular the archaeological site of Chicanná* (Heritage, 2019).

As professionals in the field of conservation and restoration, we were able to learn the necessary tools that, regardless of the language, allow us to establish a work methodology in an interdisciplinary and global way, as Alison Heritage points out "the participants were exposed to complex conservation problems on a large scale , and the opportunity to teach in the field and carry out conservation work, which in turn also provided a tangible benefit for Mexico, that is, as a result of the course, archaeological heritage was preserved" (2019).

Another fundamental part is the fact that the course calls on specialists from various professional areas and from different parts of the world, which helps us to generate a multidisciplinary approach around the conservation of stone-built heritage, as Magar points out:

> *The selection of participants from different countries and regions is always an important challenge, since their training and their profiles are very different. This necessarily implies different levels of knowledge in the various modules of the course. However, despite the possible challenges for teaching, this diversity is also what makes up one of the richest and unique character of the participants, since it allows to know about heritage protection systems in about 20 different countries* (2019).



For Heritage, the commitment and enthusiasm at the ICCROM training courses is great because the participants face their own struggle in order to get there, with all the arduous travel, bureaucratic obstacles or the difficulties to continue working while studying, among others (2019).

The course was organized in such a way that the theory was applied week after week "a practical component was sought, using a case study for the last modules of the course (observation, documentation, diagnosis and treatments)" (Magar, 2009). The participants greatly valued the opportunity to intervene in areas belonging to two structures of the archaeological site of Chicanná with the appreciable assistance of experts.

Those of us who participate take back to our countries the tools and resources to face this type of heritage, but, above all, the responsibility to replicate in our own context what has been learned. The wide variety of topics covered in this course allows all professionals to develop activities based on the acquired knowledge, "it is a great challenge because contexts are often difficult, remote and/or scarce resources" (Heritage, 2019). In addition, we form a global network that is continually in contact and in which we can discuss various issues, whether specific problems, academic experiences, application of certain resources, etcetera.

We want to emphasize that the execution of the SC17 in Mexico brought us closer in many ways to its diverse patrimony, its rich cultural heritage, and the warmth of its people. To develop a course of this level in Latin America is a unique opportunity to study the conservation and protection of its cultural heritage. The techniques taught by different professionals demonstrate a global approach that can be obtained throughout different conservation practices. The study of traditional and contemporary techniques, as well as scientific analysis, contributes to the execution of an adequate intervention of cultural heritage, in accordance with the current regulations established by the United Nations Educational, Scientific and Cultural Organization (UNESCO). So, as Heritage points out, "continuing to teach the International Stone Course is a must, because many member countries suffer from training needs, professional isolation, and lack of materials and resources" (2019).

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