



# STONE 2025

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P a r i s

**Programme**

**5<sup>th</sup> to 7<sup>th</sup> September**

### Friday 5th of September

13.30 - 14.00	Registration
13.50 - 14.00	Welcome
13.00 – 15.30	“Architects approach conservation projects” Nevenka Novakovic
15.30 - 16.20	Coffee Break
16.20 - 18.00	"Heritage Conservation and Climate Neutrality: Challenges and Opportunities in the Context of the Paris Agreement" Ann Bourghès
18.00 - 20.00	Round table and discussion

### Saturday 6th of September

8.30 -10.30	“Safeguarding cultural heritage from climate change induced hazards: methods and approaches of safeguarding in facing gradual and extreme variations “ Alessandra Bonazza
10.30 -11.00	Pause
11.00 - 13.00	“Strength testing of stone and stone weathering” Ákos Török
13.00 - 14.00	Lunch Break
14.00 - 15.30	“Hygrothermic decay of stone: frost weathering as example” Tim de Kock
15.30 - 15.50	Coffee Break
15.50 - 17.50	“Alteration Mechanism and Conservation Treatments” Elisa Franzoni.
17.50 - 20.00	Practical Work

### Sunday 8<sup>th</sup> of September

08.30 - 11.00	On site Work
11.00 - 13.00	<i>Modeling Salt Mixture Behavior with ECOS/RUNSALT: Practical Applications and Challenges.</i> Sebastiaan Godts
13.00 - 14.00	Lunch Break
14.00 -18.00	On site work and Student’s presentations

## **Architects approach conservation projects**

**Nevenka Novakovic** Cultural Heritage Preservation Institute of Belgrade, Belgrade, Serbia,

Observing the conservation problem from the architect's point of view  
In this part of the course you will learn how architects approach conservation projects, what methods we use and what knowledge we combine. Learn how to properly look at a problem, how to break down its various aspects and how to approach the task practically. You will gain insight into which segments of science and testing are included in the process and how scientific results are used. Examples of real problems and situations conservators face in the decision-making process will be shown. Regardless of which phase you participate in, you will gain an impression of the complexity of the architectural aspect of restoration-conservation projects and therefore better understand your role in them.

## **"Heritage Conservation and Climate Neutrality: Challenges and Opportunities in the Context of the Paris Agreement"**

**Ann Bourgès**, Director of the object department at the Centre de recherche et de restauration des musées de France C2RMF.

In response to climate change, the Paris Agreement signed in 2016 places climate issues at the heart of the debate and commits ratifying countries to the goal of “zero carbon” by 2050. The stakes are immense, and the current energy crisis amplifies the urgency and expectations.

How do these objectives translate into our heritage challenges?

How can heritage contribute positively to this goal by inventing new ways of conservation?

Life cycle analysis, targeted interventions, decarbonized or passive solutions, bio-based materials, and reassessment of conservation standards: it is therefore between valuing what already exists and innovation that many options are available to all heritage professionals, providing an opportunity to act and contribute effectively and sustainably to better conserving our heritage and our planet

## **Safeguarding cultural heritage from climate change induced hazards: methods and approaches of safeguarding in facing gradual and extreme variations**

Alessandra Bonazza

National Research Council, Institute of Atmospheric Sciences and Climate University of Bologna

The lecture will focus on the methods and approaches developed in the framework of EU funded projects for the analysis of the observed and projected impacts of climate change on cultural heritage in relation to gradual and extreme variations of climate/pollution parameters. Starting by discussing the first scenarios provided by the Noah's Ark Project in relation to damage processes, such as surface recession, biomass accumulation and thermoclastism, the lecture will illustrate the recently achieved results on risk assessment of cultural and natural heritage exposed to climate induced extreme events (floods, heavy rain and drought). The "Risk Mapping Tool for Cultural Heritage Protection" (WGT) will be presented alongside results deriving from the application of its tools: climate modelling, open search tool box and vulnerability ranking. The WGT, implemented within the Interreg Central Europe projects ProteCHt2save and STRENGTH and currently under further development in the framework of the Interreg Central Europe project INACO, aims to support private and public authorities in the safeguarding of cultural heritage in Europe and in the Mediterranean Basin from climate induced events (<https://www.protecht2save-wgt.eu>.)

State of advancement and still existing gaps in the research devoted to climate change impact on cultural heritage will be debated with the aim to highlight future perspectives of development. The discussion will be centered on the driving role of research in supporting heritage managers and policy-decision makers in safeguarding cultural heritage at risk.

## **Strength testing of stone and stone weathering**

**Ákos Török** Budapest University of Technology and Economics, Dept. of Engineering Geology and Geotechnics, Hungary, [torok.akos@emk.bme.hu](mailto:torok.akos@emk.bme.hu)

Heritage stone structures are strictly protected in most countries, regulations and laws limit the access or sampling of these historic sites; therefore, the application of non-invasive tools in monument diagnosis is essential. The presentation outlines the available test methods, focusing on strength tests, but also outlining other methods, such as stone surface temperature recording. The working principles and the application of non-destructive strength test devices, such as the Schmidt hammer or Durosokop will be presented. The working principles of these devices will be explained. To understand the applicability of these methods in condition assessment, the various weathering forms that can be observed on stone surfaces will be outlined first. The strength parameters and their differences mark the rate of weathering; therefore, examples will be provided showing the different surfaces and their rebound values. In addition to strength testing devices, tools for testing the moisture content and water absorption properties of heritage stones will be demonstrated, with several examples. Stone surface temperature recordings and thermal behaviour of various stones also form part of the presentation. Finally, case studies provide an overview of the complex application of these tools in heritage stone condition assessment.

## **Hygrothermic decay of stone: frost weathering as example**

De Kock, Tim, Antwerp Cultural Heritage Sciences (ARCHES), University of Antwerp,  
Mutsaardstraat 31, 2000 Antwerp, Belgium, tim.dekock@uantwerpen.be

**Keywords:** Natural stone, brick, building envelope, salt, monitoring

Natural stone in cultural heritage can be subject to a diverse range of environmental conditions that can provoke stone decay. The most important drivers for decay, especially for porous stone, are moisture and temperature. In this contribution, we have a particular look at the water transport and retention properties of natural stone and their impact on stone weathering. We will dive into the generalized pore network properties of several rock types. We will have a look at test methods to define water absorption and retention properties in situ and in the laboratory, in alignment with general concepts of stone weathering and in-situ testing that are tackled within this summer school. In this particular session, we will apply this to weathering through freeze-thaw action, and test methods for its evaluation.

## **Alteration Mechanisms and Conservation Treatments**

Prof. Elisa Franzoni, professor at the Department of Civil, Chemical, Environmental, and Materials Engineering

Academic discipline: IMAT-01/A Materials Science and Technology

In this lecture the student will learn how the Consolidating materials behave, their effectiveness, compatibility and durability issues and the last Challenges for the research on new consolidants. Moreover the same topic on Protecting materials will be explain : effectiveness, compatibility and durability issues. Challenges for the research on new protectives.

Practical demonstration #2: measurement of UPV in unweathered and thermally deteriorated marble The scope is to detect the thermal deterioration of marble by ultrasonic testing and to observe how difficult the visual assessment can be.

The observation and analyses of treatment sample will also be conducted



## **Modeling Salt Mixture Behavior with ECOS/RUNSALT: Practical Applications and Challenges**

**Instructor:** Dr. Sebastiaan Godts

Royal Institute for Cultural Heritage (KIK-IRPA), Brussels, Belgium

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### **Abstract:**

This course will provide an in-depth introduction to ECOS-RUNSALT, a thermodynamic model used to predict the behavior of salt mixtures in porous materials under varying environmental conditions. The program is widely applied in heritage conservation for managing salt crystallization cycles that can damage historic masonry and structures. Participants will explore the core functionality of ECOS-RUNSALT, including data input, output interpretation, terminology, and the limitations of the model. Through a combination of theoretical lectures, demonstrations, and hands-on exercises, attendees will learn how to handle ion data to achieve charge balance and use the model to predict salt behavior under different humidity and temperature scenarios. Special attention will be given to identifying common pitfalls in modeling, understanding the effects of salt mixture kinetics, and addressing the limitations of the software, as outlined in recent studies. Real-world applications will be demonstrated, and participants will engage with the model and case studies where ECOS-RUNSALT has been applied to conservation challenges. By the end of the course, participants will be able to confidently handle ion data and use ECOS-RUNSALT to simulate salt crystallization in heritage materials, interpret complex outputs, and apply these results to inform conservation strategies, while also recognizing the program's boundaries and the need for further research in modeling salt damage over time.

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**Dr. Nevenka Novaković** lives in Belgrade, Serbia. She has a PhD in Geoscience and is an experienced architect and conservator specialized in restoration of culturally significant buildings and protected sites. Consultant for restoration and conservation of building materials, especially stone. Vice president of the ICOMOS ISC Stone. Project management experience in leading various teams (local and international) in restoring culturally important and protected structures. Currently working in the Institute for the Protection of Cultural Monuments of Belgrade, as an architect-conservator, senior associate. As a leading architect Nevenka is responsible for conservation and restoration of Belgrade fortress – one of the most significant cultural monuments in the state and other cultural monuments, mostly made of stone. Responsible for all projects in this cultural zone, including both conservation interventions and implementation of contemporary contents, defining the future development of the site. Combining her knowledge of Geosciences, Architecture and Conservation, she is distinguished by the ability to apply scientific and practical experience in her work.

**Pr. Tim de Kock** is professor at the University of Antwerp in the department Heritage. He holds a PhD In Geology from the university of Ghent. His research focus on stone-built heritage, on particular multi-scale assessment of material characterization, degradation processes and conservation in the context of cultural heritage and changing environments (including climate change).

**Dr. Sebastiaan Godts** is a scientific research at the Royal Institute for cultural Heritage (KIKIRPA) in Belgium. He holds a PhD in Geology & Doctor of Conservation-Restoration. His has strong expertise in the conservation of monuments, sculptures, and archaeological sites, with particular expertise in soluble salt and moisture problems and in modeling salt crystallization.

**Dr. Alessandra Bonazza** is a research scientist at the National Research Council, Institute of Atmospheric Sciences and Climate at the University of Bologna. She is responsible for the Unit “Impacts on Environment, Cultural Heritage and Human Health”. Her academic background is geology, though she has worked in the field of heritage science for jhr entire career moving from building material characterization to evaluation of pollution and climate impact on monuments and archaeological sites. Her research has a strong focus on resilience and adaptation of cultural heritage to climate changes and environmental compatibility and durability of materials in restoration.

**Dr. Ann Bourguès** worked as a conservation scientist specialising in the conservation of stone and unbaked earth at the Getty Conservation Institute (GCI-Los Angeles) for 3 years and at the Laboratoire de recherche des Monuments historiques (LRMH) for 13 years. Currently she is the director of the objects department at the Centre de recherche et de restauration des musées de France (C2RMF). She is Secretary General of ICOMOS France, where she leads the Climate and Heritage working group and the Climate and Interface WP6 of the Equipex+ Espadon national research project. She also leads the AFNOR group on the standardisation of cultural property - inorganic porous materials constituting cultural heritage.

**Pr. Ákos Török** is Professor at the university of technology and economics , faculty of civil engineering of Budapest. He is the Head of Department Faculty Council – Representative of Organization Units Habilitation and Doctoral Council of the Faculty of Civil Engineering – Head. His research focus on monumental and dimension stones, Weathering, Air pollution related stone decay, Carbonate sedimentology, radioactive waste disposal, environmental geology.

**Prof. Elisa Franzoni** is professor at Department of Civil, Chemical, Environmental, and Materials Engineering Academic discipline, Materials Science and Technology. She holds a PhD in Materials Engineering. Since 2025, she is Scientific Director of Centro Ceramico Since 2024, she is the Reseach Delegate of DICAM Department. Her research interests in the field of building materials mainly concern materials for Cultural Heritage conservation, sustainable building materials and ceramic materials. She works with companies and universities in Italy and abroad.

She is involved in national and international research projects and responsible for many projects funded by industry. She is member of RILEM, member of the Executive Board of the Committee “Heritage and Regeneration” within the European Platform ECTP and member of CIRI Buildings and Constructions.