

**INSTITUTE OF ARCHAEOLOGY  
BELGRADE, SERBIA**

**1<sup>ST</sup> INTERNATIONAL CONFERENCE WITH WORKSHOP**

**SCIENCE FOR CONSERVATION  
OF THE DANUBE LIMES**

*Mortar Design for Conservation – Danube Roman Frontier  
2000 Years After*

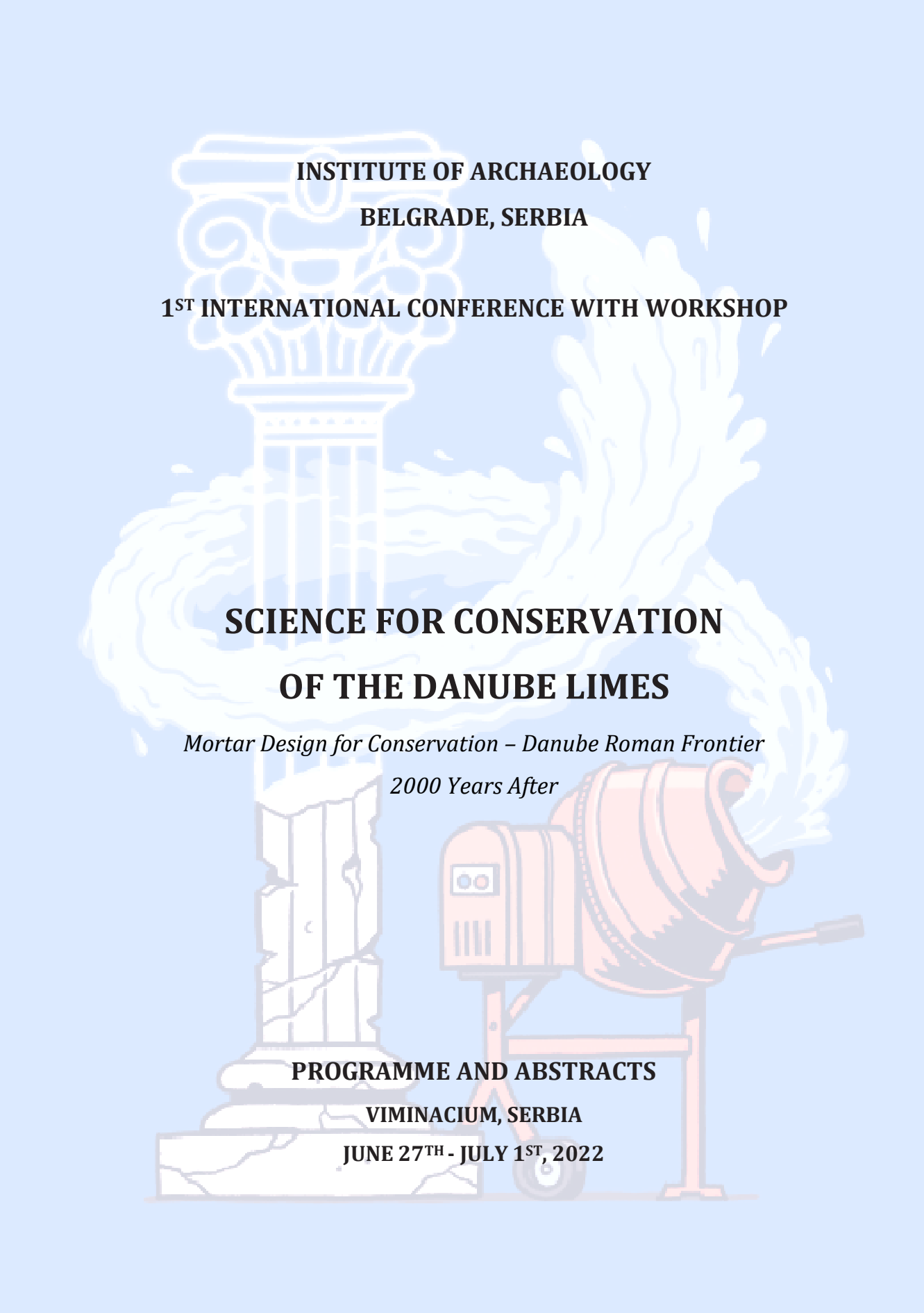


**PROGRAMME AND ABSTRACTS**

**VIMINACIUM, SERBIA**

**JUNE 27<sup>TH</sup> - JULY 1<sup>ST</sup>, 2022**





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# Science Fund of the Republic of Serbia



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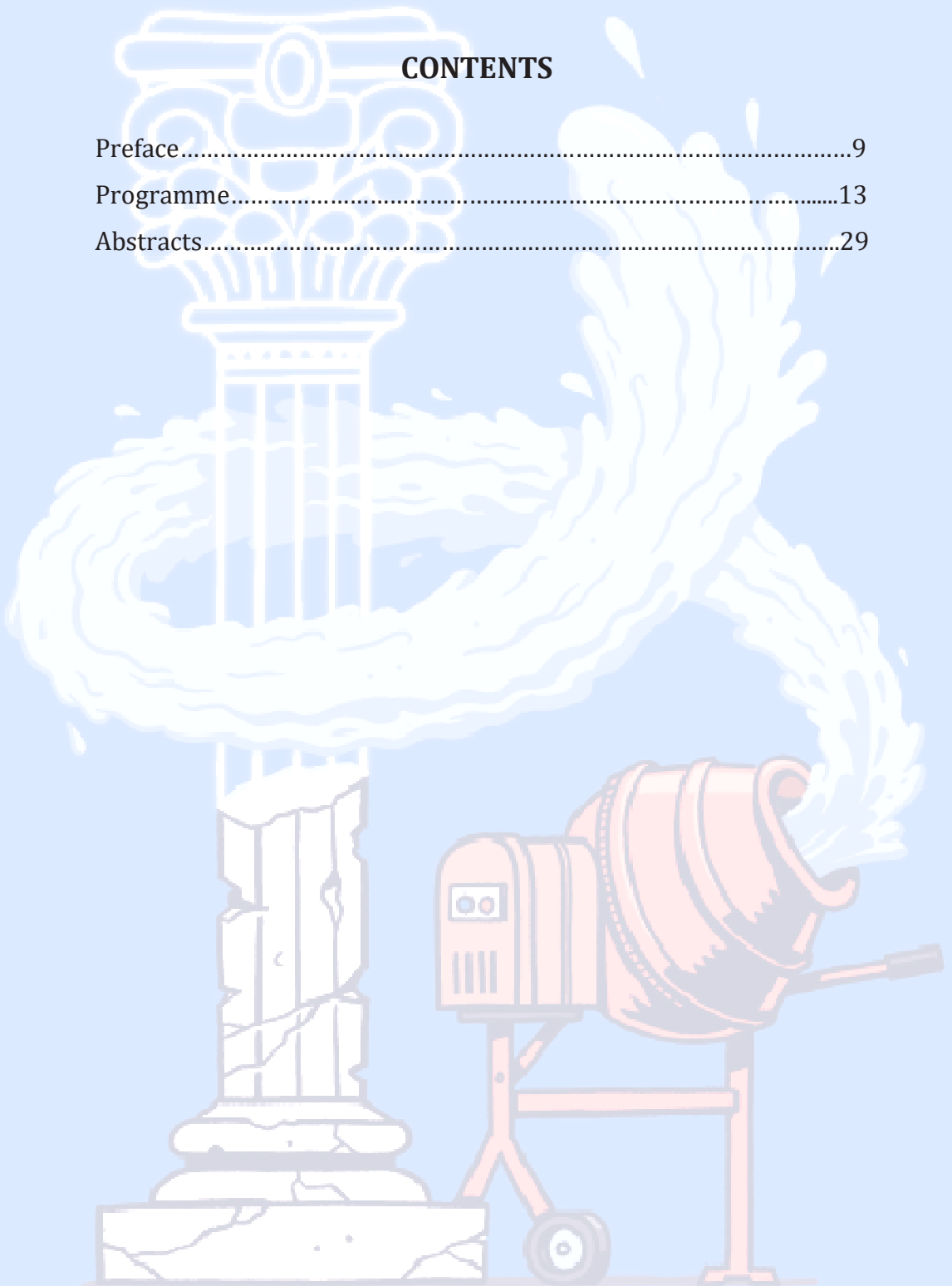
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## PREFACE

*The dust that a building is transformed into when it becomes a ruin holds precious traces of the past. The hands of an archaeologist will search through it patiently, and find a necklace bead of a woman that lived in it. The hands of an architect will virtually transform the dust into a mortar, brick, or stone. The first profession sees through the unbuilt. The second one builds from it. However, both perform their work by communicating with the sciences.*

*Throughout history, various components were chosen, measured, and mixed into one of the most complex building composites ever - mortar, whose re-creation is of invaluable importance for architectural conservation. Geologists and chemists will best tell us about its composition. However, sometimes, while excavating a ruined wall, an archaeologist finds a mortar trowel, accidentally left by the past builder. Is this a more valuable trace for revealing the creation of a wall than the binder/aggregate ratio of the mortar used? Can we pick it up and imagine the hands that combined colourful aggregate grains with the earth, gypsum, lime, or cement?*

*From the exploitation, transport, and use of raw materials, to the product called mortar, we pass by the people from the past, the quarries, roads, and rivers, we look at the craftsmen working with tools, and observe the investors negotiating with engineers, and the rulers supervising the construction. The four hands from the beginning of the story can combine the chemistry of the red, blue, green, yellow, black, and white mineral grains with the found trowel, and help us revive many*

*unknown hands from the past. Thus, the research of historic mortars for conservation purposes must not be a purely technical process. Only by understanding the multiple values of a historic building, we can adequately protect it.*

*The project Mortar Design for Conservation – Danube Roman Frontier 2,000 Years After (MoDeCo2000), funded by the Science Fund of the Republic of Serbia, was created with the sincere intent and great hope that it could help in the future discoveries and preservation of the rich heritage in Serbia from the period of the magnificent Roman Empire, whose Danubian monuments are part of the preliminary list for UNESCO World Heritage. Different researchers and professionals - architects, archaeologists, geologists, chemists, materials scientists, physicists, biologists, restorers, craftsmen, and managers have all made an effort to get closer to the fulfilment of the wish of the project creators.*

*After sampling and investigating numerous mortars originating from the structures dating to the period from the 1<sup>st</sup> to the 6<sup>th</sup> century, many conclusions were made, but challenges for future researchers and conservators also arose, telling us we need to continue our work in the future, in an attempt to gain more knowledge and, thus, preserve our heritage more adequately.*

*We welcome you to the Viminacium Archaeological Park and the 1st International Conference with Workshop, Science for Conservation of the Danube Limes. With the hope that many new fruitful collaborations between our guest researchers will be developed on this occasion, taking us one step further towards long-term technical*

*solutions for architectural conservation and civil engineering based on nature, but also to new cognitions about the life of the past people, always for the cause of the preservation of rich world material and immaterial cultural heritage and our planet, we invite you to peruse this publication. All the authors have shown their enormous affection and passionate devotion towards the discoveries of ancient knowledge, advocating its use in the further preservation of the most monumental physical witnesses of the past – buildings, for future generations.*

## **EDITORS**

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**PROGRAMME**

**MONDAY, JUNE 27<sup>TH</sup>**

**08.30 – 10.00** *Breakfast / Coffee and registration*

**WELCOME AND INTRODUCTORY SPEECHES**

**10.00 – 10.40**

MIOMIR KORAĆ, Institute of Archaeology, Director

EMILIJA NIKOLIĆ, Institute of Archaeology, PI MoDeCo2000

DUBRAVKA ĐUKANOVIĆ, Institute for the Protection of Cultural Monuments  
of Serbia Belgrade, Director

JAROSLAV KATONA, Faculty of Technology Novi Sad, University of Novi  
Sad, Vice Dean for Finances

**10.40 – 11.00** NEMANJA MRĐIĆ, IVANA KOSANOVIĆ, MILICA MARJANOVIĆ

***Danube Limes in Serbia: On the Way to a UNESCO World Heritage Site –  
Problems, Challenges and Solutions***

**11.00 – 11.20** EMILIJA NIKOLIĆ, MLADEN JOVIČIĆ, IVANA DELIĆ-NIKOLIĆ,

LJILJANA MILIČIĆ, SNEŽANA VUČETIĆ, JONJAUA RANOGAJEC

***Our MoDeCo2000: Results Overview of the Scientific and Research  
Project***

**11.20– 11.40** *Coffee break with snack*

**LECTURES**

**11.45 - 12.05 MLADEN JOVIČIĆ**

***Researching Roman Mortars from the Danube Region - Archaeological Perspective of the MoDeCo2000 Project***

**12.05 - 12.25 SNEŽANA VUČETIĆ, JONJAUA RANOGAJEC, IVANA DELIĆ-NIKOLIĆ, LJILJANA MILIČIĆ, EMILIJA NIKOLIĆ, MLADEN JOVIČIĆ**

***Design of Compatible Mortars for Conservation Interventions***

**12.25 - 12.45 EUGEN VAIDA, VERONICA VAIDA, ALEXANDRA TEODOR**

***The Ambulance for Monuments - Safeguarding Heritage through Community Engagement***

**12.45 - 13.30 NIGEL COPSEY**

***Rediscovering Traditional Mortars, part 1***

**13.30 - 14.30 Lunch break**

**LECTURES**

**14.35 - 15.20 NIGEL COPSEY**

***Rediscovering Traditional Mortars, part 2***

**15.20- 15.35 Coffee break**

**LECTURES**

**15.40 - 16.25 NIGEL COPSEY**

***Rediscovering Traditional Mortars, part 3***

***17.00 - 18.30 Viminacium sightseeing***

***18.30 - 19.30 Dinner***

***21.00 Viminacium Fest / Theatre festival***

***(Closing night in the Viminacium amphitheatre with a jazz concert)***





**TUESDAY, JUNE 28<sup>TH</sup>**

**07.30 – 09.00** *Breakfast / Coffee*

**PRACTICAL WORKSHOP ON LIME MORTARS**

**09.00 – 13.00** NIGEL COPSEY DEMONSTRATION

***Building Experimental Structures of Brick and Stone with Lime Mortar***

**13.30 – 14.30** *Lunch break*

**LECTURES**

**14.35 – 15.05** VLADICA CVETKOVIĆ, KRISTINA ŠARIĆ

***Tuffs of Serbia – What We Need to Know when Characterising Them as Archaeological Raw Material***

**15.05 – 15.35** KRISTINA ŠARIĆ, SUZANA ERIĆ, VLADICA CVETKOVIĆ,

JOSIP ŠARIĆ, DRAGANA ANTONOVIĆ, VESNA BIKIĆ

***Geological Knowledge in Service to Archaeological Investigations: Rock and Ceramic Findings as Examples***

**15.35 – 15.55** YOTAM ASSCHER, MICHELE SECCO, GIULIA RICCI, SERGIO

TAMBURINI, GILBERTO ARTIOLI (*virtual*)

***Evaluation of Ancient Mortars Hydraulicity through the Characterisation of Long and Short-range Crystallinity***

**15.55 – 16.15** LJILJANA DAMJANOVIĆ VASILIĆ, VESNA BIKIĆ, SRNA STOJANOVIĆ, IVANA RADOSAVLJEVIĆ EVANS, DANICA BAJUK – BOGDANOVIĆ, IVANKA HOLCLAJTNER – ANTUNOVIĆ

***Physicochemical Characterisation of the Medieval Pottery Excavated in Serbia***

**16.15 – 16.35** *Coffee break with snack*

### **LECTURES**

**16.40 – 17.00** MARIA STEFANIDOU

***Technological Characteristics of Fired Bricks from Roman and Byzantine Period in Greece***

**17.00 – 17.20** SIMONE DILARIA, CATERINA PREVIATO, JACOPO BONETTO, MICHELE SECCO, ARTURO ZARA, DOMENICO MIRIELLO, RAFFAELLA DE LUCCA, GILBERTO ARTIOLI

***Pyroclastic Rocks in the Structural Mortars of Roman Nora (Sardinia). A Green Material for the Production of Sustainable Concretes in Antiquity***

**17.20 – 17.40** ANNA ARIZZI

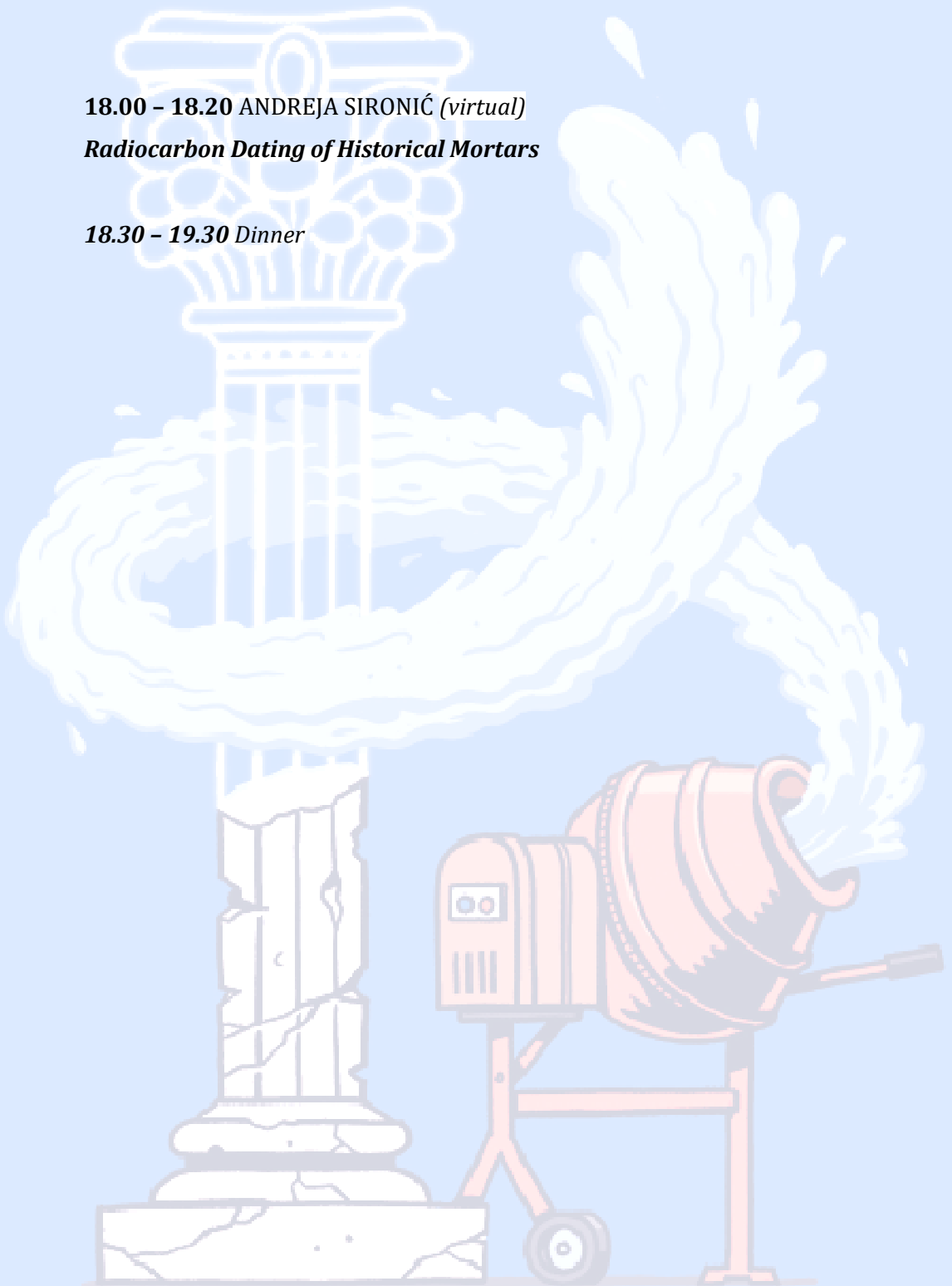
***Learning from Historic Mortars: Studies on Lime Manufacturing and Fresco Conservation***

**17.40 – 18.00** MICHELE SECCO SIMONE DILARIA, GIULIA RICCI, ENRICO GARBIN, SERGIO TAMBURINI, YOTAM ASSCHER, GILBERTO ARTIOLI, CATERINA PREVIATO, JACOPO BONETTO

***Novel Scientific Perspectives on Ancient Pozzolanicity***

**18.00 – 18.20 ANDREJA SIRONIĆ (virtual)**  
***Radiocarbon Dating of Historical Mortars***

**18.30 – 19.30 Dinner**



**WEDNESDAY, JUNE 29<sup>TH</sup>**

**International Danube Day**

**07.30 - 09.00** *Breakfast / Coffee*

**LECTURES**

**09.00 - 09.20** IVAN BOGDANOVIĆ

***Roman Construction Techniques Used on the Viminacium Amphitheatre***

**09.20 - 09.40** FLORIAN MATEI-POPESCU

***New Archaeological Excavations at the Drobeta Military Amphitheatre***

**09.40 - 10.00** JASMINA POPOVIĆ RUSIMOVIĆ

***Restoration of Ram Fortress***

**EXCURSION**

**10.15 - 11.20** Viminacium – Golubac Fortress

**11.30 - 12.30** Golubac Fortress Tour

**12.40 - 13.45** Golubac Fortress - Golubinje

**14.00 - 17.00** Hiking to viewpoint Ploče and back (lunch package at the top)

**17.15 - 19.05** Golubinje – Ram Fortress

**19.15 – 20.30** Ram Fortress tour

**20.30 – 21.10** Ram Fortress – Viminacium

**21.10 – 22.10** *Dinner*



**THURSDAY, JUNE 30<sup>TH</sup>**

**07.30 – 09.00** *Breakfast / Coffee*

**PRACTICAL WORKSHOP ON LIME MORTARS**

**09.00 – 13.00** NIGEL COPSEY DEMONSTRATION

***Testing Conservation Mortar Mixtures on a Part of an Authentic Structure***

**13.30 – 14.30** Lunch break

**LECTURES**

**14.35 – 15.05** IOANNA PAPAYIANNI

***Analysis of Ancient Mortars from Roman Monuments in Northern Greece. Design and Application of Compatible Repair Mortars***

**15.05 – 15.25** SLAVICA VUJOVIĆ, RASTKO VLAJKOVIĆ

***Holism as a Framework for Understanding and Preserving Heritage – the Example of the Cultural Landscape of Bač***

**15.25 – 15.45** BURCU TAŞCI ÖZDEMİR, HASAN BÖKE (*virtual*)

***Raw Material Characterisation of Roman Mortars in Western Anatolia (Turkey)***

**15.45 – 16.05** ALEKSA JELIKIĆ

***Lime Kiln. The Divine Crucible***

**16.05 – 16.25 LJUBOMIR JEVTIĆ**  
***Ceramic Building Materials of Viminacium***

**16.25 – 16.45** *Coffee break with snack*

**LECTURES**

**16.50 – 17.10 ANA RADIVOJEVIĆ**  
***The Role of Brick in the Late Antique Architecture of the Central Balkan Roman Provinces***

**17.10 – 17.30 IGOR BJELIĆ**  
***Construction Methods Applied to the Structures of the Trajan's Bridge over the Danube***

**17.30 – 17.50 BOJAN POPOVIĆ**  
***Reconsidering the Archaeological Site of Glamija – Rtkovo, Serbia***

**17.50 – 18.10 TINO LELEKOVIĆ**  
***How to Present the Ancient City of Aelia Mursa***

**18.10 – 18.30 HELENA HIRŠENBERGER, SNEŽANA VUČETIĆ, JONJAUA RANOJAJEC**  
***Cross-disciplinary Collaboration in Conservation Projects – Managing Key Challenges***

**18.30 – 19.30** *Dinner*

**FRIDAY, JULY 01<sup>ST</sup>**

**07.30 – 09.00** *Breakfast / Coffee*

**LECTURES**

**09.00 – 10.30** BRANKO ORBANIĆ

***Traditional Lime Production and its Application on the Monuments of Culture – Experience from the Work on Ancient Monuments***

**10.30 – 10.50** *Coffee break with snack*

**LECTURES**

**10.55 – 11.15** MAJA FRANKOVIĆ, VESNA MATOVIĆ, NEVENKA NOVAKOVIĆ

***Intrinsic Properties of the Limestone Used in the Belgrade Fortress and their Influence on Degradation Processes***

**11.15 – 11.35** DRAGANA GAVRILOVIĆ

***Analyses of the Pigments and Plasters on the Examples of Roman Wall Paintings from Sirmium and Viminacium***

**11.35 – 11.55** MARIA ARGIROVA, GERGANA KABAKCHIEVA, DENITSA YANCHEVA, BISTRA STAMBOLIYSKA, NIKIFOR HARALAMPIEV, DIETER FISCHER, ALBENA LEDERER

***Pigment Identification in the Mural Decoration from the Roman City of Ulpia Oescus by Vibrational Spectroscopy and SEM-EDS Analysis***



**11.55 -12.15** NIKOLA UNKOVIĆ, ŽELJKO SAVKOVIĆ, MILOŠ STUPAR,  
ALEKSANDAR KNEŽEVIĆ, IVICA DIMKIĆ, MILICA LJALJEVIĆ GRBIĆ  
***Fungal Proliferation on Fresco Painting: Deterioration of Mortar and  
Painted Layer***

**12.15 - 12.35** IVAN VANJA MARTINOVIĆ  
***Benefits and Limits of DRMS Technology in the Purpose of Designing  
Repair Mortars by Drilling Resistance Criterion***

**12.35 - 12.50** *Coffee break with snack*

### ***LECTURES***

**12.55 - 13.15** MARKO NIKOLIĆ, ENA TAKAČ, JELENA ŠČEKIĆ  
***Contemporary Approaches to the Revitalisation, Presentation and  
Promotion of Cultural and Natural Heritage of the Part of the Roman  
Limes - Case Study of the Late Antique Tomb in Brestovik***

**13.15 - 13.35** SILVANA BLAŽEVSKA, ANGELA PENCHEVA (*virtual*)  
***Master Conservation Plan for the Archaeological Site of Stobi: Goals and  
Outcomes***

**13.35 - 13.55** BOJAN MILJEVIĆ, ALENKA MAUKO PRANJIĆ, SERGEY E.  
KICHANOV, SNEŽANA VUČETIĆ  
***Computed Tomography as a Tool for Non-destructive Investigation of  
Cultural Heritage Materials' Inner Structure***

**13.55 - 14.15** ROMAN BALVANOVIĆ, PERICA ŠPEHAR, DRAGANA SPASIĆ-  
ĐURIĆ, OLIVERA MILOVIĆ, MIHAILO MILINKOVIĆ

***Roman, Late Antique and Byzantine Window Glass from 3<sup>rd</sup> - 6<sup>th</sup> Century  
in Serbia: Chemical Characteristics, Compositional Groups and  
Provenance***

**14.15 - 14.30** *Closing of the event*

**14.30 - 15.30** *Lunch*

## **SPECIAL GUEST OF THE WORKSHOP**

### **NIGEL COPSEY, Stonemason and Building Conservator**

Starting out as a dry-stone waller in Cornwall, Nigel trained after 1989 as a stonemason and carver at Weymouth College, working largely thereafter in the conservation industry across the south and south-west of England, as well as travelling widely in the USA, working and advising upon building conservation projects in Vermont, New York City and Nebraska as well as in Granada, Andalusia, and, more recently, in British Columbia and Alberta, Canada.

Nigel was consultant stonemason for the Irish Hunger Memorial project in Battery Park City, New York, 2001. Since 2001, Nigel has worked extensively as a consultant and practitioner in the field of building conservation and repair in North Yorkshire on a wide range of vernacular and high status buildings, as a building conservation consultant for the Fitzwilliam Estate in Malton, 2003-2010, designing, specifying and executing major repair projects on a wide range of historic buildings within the town, as well as researching, designing and specifying a number of building repair and conservation projects on behalf of Natural England, most recently at Scampston Hall.

A committed SPAB-member, Nigel is also a professionally accredited conservator-restorer and determined advocate for the thoroughgoing use of traditional materials in the care and repair of old buildings, and a leading advocate for the routine use of traditional

earth-lime and hot mixed lime mortars for most applications, working with Historic England, Historic Environment Scotland and CADW and international partners in the delivery of practical training and education regarding the informed use of traditional quicklime mortars for the like for like and compatible repair of historic buildings. In recent years, Nigel has worked closely with the North York Moors National Park, educating and upskilling builders and professionals regionally in the use of like-for-like traditional mortars.

A Research Associate of the Department of Archaeology, University of York, Nigel regularly delivers hot mixed earth and lime mortars and traditional skills training and led the Practical Skills module for the MA Conservation Studies 2012-2018. Nigel has a BA (Hons) in Political Science from the University of York, a PGDip in Building Conservation from Bournemouth University, and an MA (by research) awarded by the University of York in 2019, for his critical review of historic texts, thinking and craft practice in the preparation and use of lime (and earth-lime) mortars.

Nigel has contributed to several volumes of the recently published Historic England Practical Conservation series. He has published a book on the subject of Traditional Mortars (2019) as well as a review of Historic Literature on Lime and Lime Mortars (HES Technical Paper 30 (2019)).

[www.nigelcopsey.com](http://www.nigelcopsey.com)

[www.maltonbuildingsgroup.com](http://www.maltonbuildingsgroup.com)

[www.hotmixedmortars.com](http://www.hotmixedmortars.com)



**ABSTRACTS**



## CERAMIC BUILDING MATERIALS OF VIMINACIUM

**LJUBOMIR JEVTIĆ**

Institute of Archaeology, Belgrade, Serbia

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Ceramic building materials<sup>1</sup> were one of the key building materials of the Roman Empire. They were introduced to the area of the province of Moesia Superior and ancient Viminacium by the Romans. Prior to their arrival, the province was sparsely urbanised, and in the following centuries, Viminacium grew to be its largest agglomeration<sup>2</sup>. The site is located in Eastern Serbia, next to the modern town of Kostolac, on the right bank of the Mlava river, near its confluence with the Danube. It was first established as a legionary camp (*castrum legionis*), whose oldest phase dates to the Flavian period. In the late 1<sup>st</sup> - early 2<sup>nd</sup> century, a civilian settlement developed to the west of the camp. The city gained the status of *municipium* in AD 117, during the reign of Emperor Hadrian, and in AD 239, during the reign of Emperor Gordianus III it was granted the status of *colonia*. The city and its surroundings were destroyed by the

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<sup>1</sup> Hereafter CBM.

<sup>2</sup> Regarding the history and development of Viminacium *cf.* Mirković 1986, 21–59.

Huns in AD 441 and never again regained its former glory.

In the earliest phases of its development, locally available construction materials were preferred,<sup>3</sup> but from the late 1<sup>st</sup> – early 2<sup>nd</sup> century onwards came the widespread usage of CBM. The intense CBM production in Viminacium is attested by the immense quantities of the material, used in all types of buildings and objects, as well as by numerous traces of the production process, including more than 15 quadrangular kilns and several production structures and features (cf. Jevtović and Danković, in print).

The purpose of this study is to analyse the CBM material from Viminacium. Our primary focus will be on the shapes and their morphometric characteristics, as well as the characteristic features of some shapes. During the Empire, the Romans used some eight standardised forms of CBM, all of which, as well as some unorthodox ones, are present in Viminacium, but in significantly varying quantities. As the quantities of the discovered materials are vast, we will primarily focus on the stamped material. This will provide a chronological aspect to our study. Additionally, the study will include a comparative analysis regarding the provincial and regional characteristics of the CBM. Unfortunately, the material was rarely the subject of dedicated studies, although there are some noteworthy examples (cf. Jeremić 1997; Radivojević 2018). As the brickyards of

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<sup>3</sup> For the construction materials and techniques applied in the territory of Viminacium, cf. Nikolić 2013.



Viminacium were the largest producer of CBM in the Middle Danube region, these studies are key for understanding the regional brick and tile industries and, more importantly, the intricacies of architecture during the Roman period.

Keywords – Viminacium, *figlinae*, ceramic building materials, Roman bricks and tiles

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L'évolution du format des briques sur la territoire de la Serbie, de l'antiquité au moyen age, *MEFRA, moyen age, Tome 109* -1997-1: 7-20.

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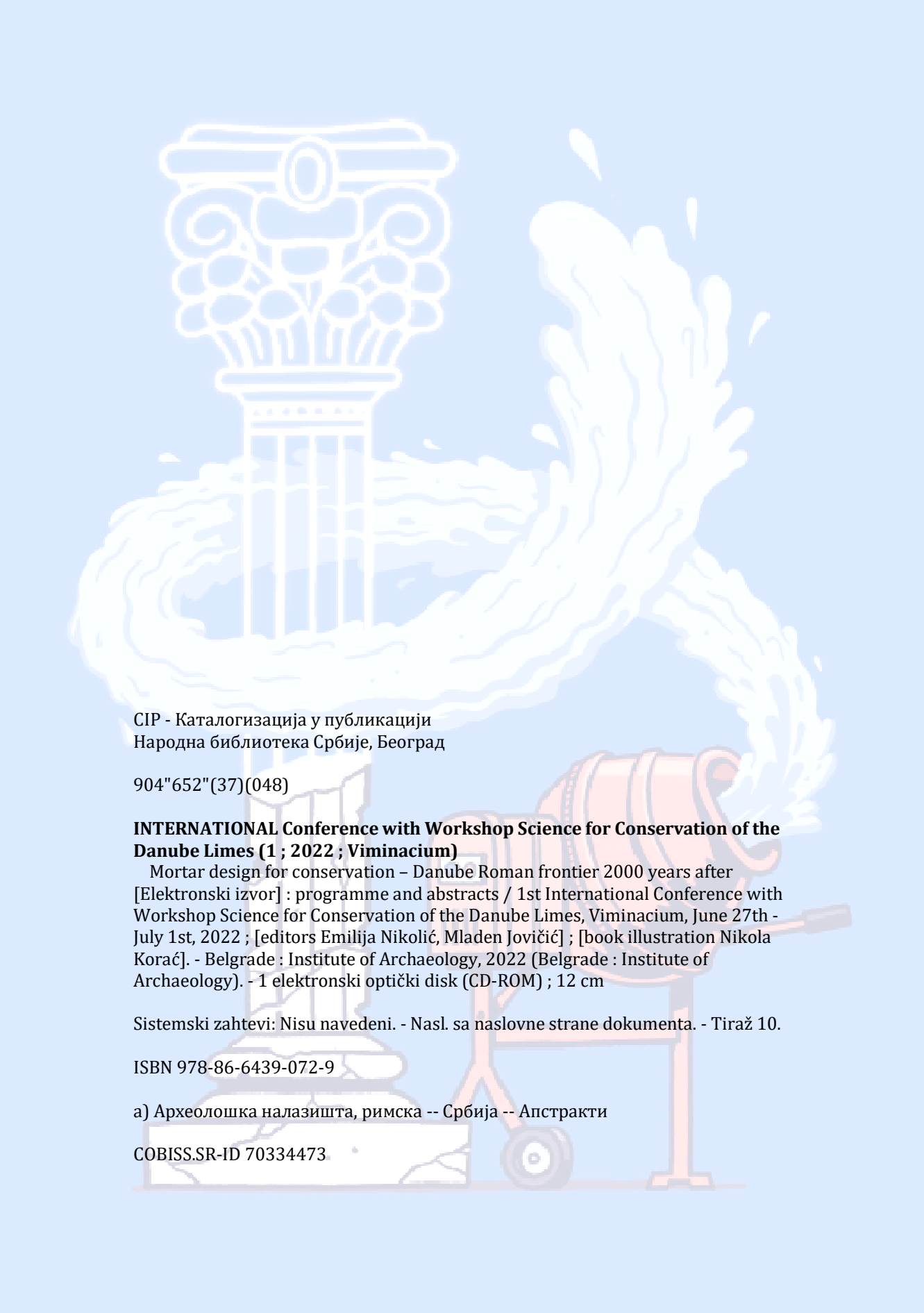
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