



13TH

INTERNATIONAL
SCIENTIFIC
CONFERENCE

METHODOLOGY & ARCHAEOLOGY

Zagreb, 27th–28th November 2025

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Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
and the Croatian Archaeological Society

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eBook of abstracts

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13TH

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The scientific conference *Methodology and Archaeometry* is being organised by the Department of Archaeology, Faculty of Humanities and Social Sciences, since 2013. The goal of the conference is to entice interdisciplinarity, critical thinking, new insights and approaches as well as new theoretical frameworks in contemporary archaeological science.

Coverage of a wide spectrum of themes and scientific disciplines has resulted in papers and discussions that promote scientific issues in the fields of methodology, documentation and interpretation of archaeological data.

The interdisciplinary character of the conference brings together archaeologists and researchers from other scientific disciplines with whom archaeologists collaborate closely, and who, through their work, projects and ideas, promote new insights about the interpretation of human life in the past.

Section Methodology

Obtaining and collecting data is an essential part of the archaeological research process. How we collect and interpret data defines the validity of our interpretation. We use different techniques, approaches and tools which help us to reconstruct past processes and to give a more objective and comprehensive picture of the past. Contemporary interpretation tools alleviate and speed the data collection and also provide us with countless possibilities for the interpretation, protection and presentation of archaeological sites and the landscapes encompassing them.

Section Archaeometry

Having in mind the limited information we obtain from archaeological excavations and from the classification of archaeological material, cooperation with other scientific disciplines becomes necessary to obtain as much information as possible on the conditions and the way in which humans lived in the past. Contemporary archaeology is a very heterogeneous discipline encompassing interest groups focused on various periods, regions, theoretical frameworks and methodological techniques. Aside from the description of mechanical and physical features of a specific artefact or material, various archaeometrical analyses help us to direct our scientific focus to questions regarding the ways and features included in the social and cultural life of people who made, used, exchanged and discarded those objects. Cooperation with the natural sciences provides answers to many questions, but it also demands an additional level of caution when selecting adequate scientific analysis for a specific archaeological problem. It also demands the continuous cooperation of a specific expert and an archaeologist from sample collection to the final interpretation.

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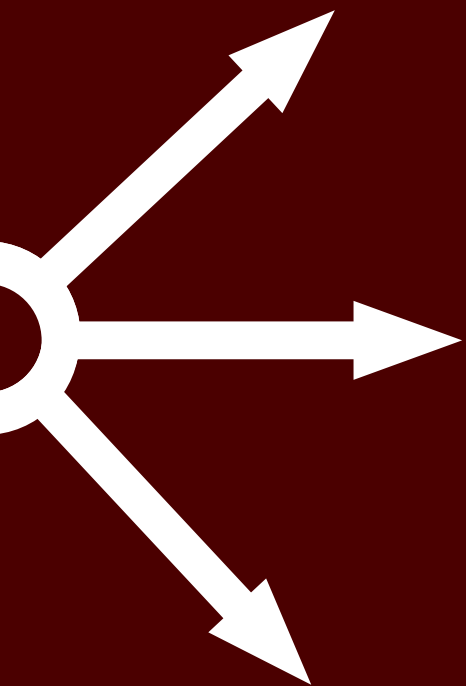
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PROGRAMME

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Thursday, 27th of November

9:00 – 9:10

Conference opening

Key-note lecture:

Chair: Ina Miloglav

9:10 – 9:55

Cristina Barrocas Dias*Meat in the Pots, Plants in the Bones: Integrating Organic Residues, Isotopes, and Proteins in Paleodietary Reconstruction*

10:00 – 10:20

Coffee break**Session 1****Chair: Miroslav Vuković**

10:20 – 10:35

Dimitrij Mlekuž Vrhovnik & Tomaž Fabec*Prehistoric Hunting Megastructures in the Adriatic Hinterland*

10:40 – 10:55

Ivor Kranjec, Jelena Behaim & Miljenko Jurković*New LiDAR-Based Insights into Post-Roman Landscape Transformations of the Northern Adriatic: Three Case Studies from Istria and the Quarnero Islands*

11:00 – 11:15

Tino Leleković*Boundaries Without Borders: What LiDAR and Magnetometry Revealed About the Croatian Limes*

11:20 – 11:35

Srđan Beck & Katarina Šprem*Roman centuriation of ager Polensis in southern Istria (Croatia)*

11:40 – 11:55

Marin Buble & Lujana Paraman*Data sharing and the protection of archaeological heritage – possibilities of the intersectoral co-operation on mitigating the risk of wildfire damage to the archaeological heritage. The example of the Trogir area*13TH



12:00 – 12:20

Coffee break

Session 2

Chair: *Jacqueline Balen*

12:20 – 12:35

Kyriakos Sgouropoulos, Dushka Urem-Kotsou & Apostolos Sarri

Combining Field-Based and Remote Digital Approaches in Archaeological Surface Survey

12:40 – 12:55

Martina Naso, Arthur Leck, Rémy Chapoulie, Gabriele Gattiglia, Francesca Anichini, Bruno Dutailly, Claudia Sciuto, Théophane Nicolas, Ariane Menu, Amala Marx, Kai Salas Rossenbach, Nevio Dubbini, Ivan Radman Livaja, Jana Kopackova & Filomena Sirovica

Integrating 3D digitisation and archaeometric analyses in ceramics and lithics: automated workflows in the AUTOMATA project

13:00-13:15

Marko Porčić

A new approach to quantifying vessel shapes from profile drawings

13:20 – 13:35

Andreja Kudelić, Natali Neral, Dinko Tresić Pavičić, Filomena Sirovica, Ana Maričić, Mia Marijan & Dalibor Branković

Archaeology and Geology in Ceramic Studies: Towards an Integrated Framework for Interdisciplinary Pottery Technology Research in Croatia

13:40 – 14:40

Lunch break

Session 3

Chair: *Jasna Vuković*

14:40 – 14:55

Katja Kavkler, Elena Leghissa, Miran Pflaum, Peter Turk, Maja Gutman Levstik, Lidija Korat Bensa & Sabina Dolenec

Preliminary Results of Archaeometric Analyses of White Incrustations on Third Millennium BC Pottery – A Case from the Ljubljansko barje area

15:00 – 15:15

Atanas Tsurev & Nikolina Nikolova

Beyond Red and White: Archaeometric Perspectives on Early Neolithic Pottery at Chavdar



15:20 – 15:35

Bogdan Manea, Valentin Radu, Daniela Dimofte, Ioana Poroșnicu, Adrian Sima, Florin Vlad, Ion Tiseanu & Cătălin Lazăr

Born by Nature, Shaped by Man: Archaeometric Insights into Shell-Tempered Chalcolithic Pottery from Săveni-La Movile

15:40-15:55

Massimiliano Puntin

Protocol for investigating ancient colours: a multi-analytical non-destructive approach to the study of Roman painted plasters

16:00-16:15

Coffee break

Session 4

Poster presentation

16:15-17:00

Jelena Bulatović, Ivana Dimitrijević, Ina Miloglav, Jacqueline Balen & Krešimir Filipec

Animal Exploitation in the Copper Age of Eastern Slavonia: Zooarchaeological Evidence

Izaskun Egilegor Uranga

Beyond Prehistory: Towards a Methodology for Contemporary Archaeology of Megaliths

Marija Kostić, Nejra Omerović, Jugoslav Pendić, Maja Kokanović, Tamara Blagojević & Jelena Jovanović

The use of micro computer tomography (mCT) in scientific purposes and preservation of cultural heritage

Ante Lozina & Andrej Bašić

Digitization of the Sacred: Initiating a Digital Database of Saints' Archaeological Remains and Relics in Dalmatia – Interdisciplinary Approach and Knowledge Transfer

Anna Nicolussi & Diana Dobрева

Late Antique Coarse Ware from Negrar di Valpolicella (Verona, Italy): Local Production and Regional Exchange

Petra Nikšić & Krešimir Filipec

Reassembling the past: four methods used for determining the minimum vessel number at the early medieval site Stari Perkovci – Debela šuma (Eastern Croatia)

Almir Olovčić & Katarina Šprem

Chert samples from the Istrian peninsula (Croatia) and their chemical signatures: can we make a distinction based on the results?



Franka Ovčarić & Janja Mavrović Mokos

Shaping the Edge: Late Bronze Age Fortifications of Northwestern Croatia

Ivana Pandžić & Milica Tapavički Ilić

Salt Through Time – A Multidisciplinary Approach to Understanding Salt, Life, and the Earth System

Maarten Peels

An epistemology for prehistoric filmmaking

Milica Tapavički-Ilić, Theodora Moullou & Barbara Care

COST action GameTable (CA 22145) computational techniques for tabletop games heritage

Milica Tapavički-Ilić, Ivan Radman Livaja & Gabriele Gattiglia

COST action MAIA (CA 23141) – managing artificial intelligence in archaeology

Friday, 28th of November

Session 5

Chair: Marko Banda

10:00 – 10:15

Boris Rozić

Spatial Analysis of Mousterian Sites in Bosnia and Herzegovina

10:20 – 10:35

Petar Minkov, Zheni Vasileva, Denitsa Sandeva, Yana Dimitrova, Hanna Aleksandrova & Nadezhda Karastoyanova

Unveiling the Past: Interdisciplinary Methods Applied to the Late Bronze Age Site of Kamenovo, Northeast Bulgaria

10:40 – 10:55

Katarina Šprem, Damir Pocrnić & Damir Palenik

Veli Brijun quarries, Istria, Croatia – historical and geological context

11:00 – 11:15

Marta Rakvin & Jacqueline Balen

Developing Interdisciplinary Strategies for Public Engagement with Iron Age Heritage

11:20 – 11:40

Coffee break



Session 6

Chair: Goran Tomac

11:40 – 11:55

Mario Novak, Valentina Martinoia, Mario Carić, Natalija Čondić, Domagoj Perkić, Dinko Tresić Pavičić, Morana Vuković, Joško Zaninović, Emily Zavodny & Sarah McClure

Comparative regional stable isotope analysis reveals fluctuations in millet consumption during the Bronze and Iron Ages in Croatia

12:00 – 12:15

J. Marla Toyne, Donovan Adams, Andrea Rimpf, Mario Carić & Mario Novak

Unpacking 'Fuzzy' Diets: Using Fuzzy Clustering Analytical Methods of Stable Isotopes to Examine Community Identity in Late Avar Period Šaregrad, Croatia

12:20 – 12:35

Valentina Lončarić, Mafalda Costa, Domagoj Perkić, Hrvoje Potrebica & Marko Dizdar

Threads of Glass: Production and Provenance of Iron Age Adornments from the Zakotorac and Nakovana tumuli

12:40 – 12:55

Marin Šoufek & Iva Kaić

The use of SEM-EDS in the analysis of 13 green-coloured Roman engraved gems from Sisak, Croatia

13:00 – 13:20

Coffee break

Session 7

Chair: Petra Nikšić

13:20 – 13:35

Selena Vitezović & Gordana Jeremić

Technology and function of bone objects from the Roman period: some preliminary results

13:40 – 13:55

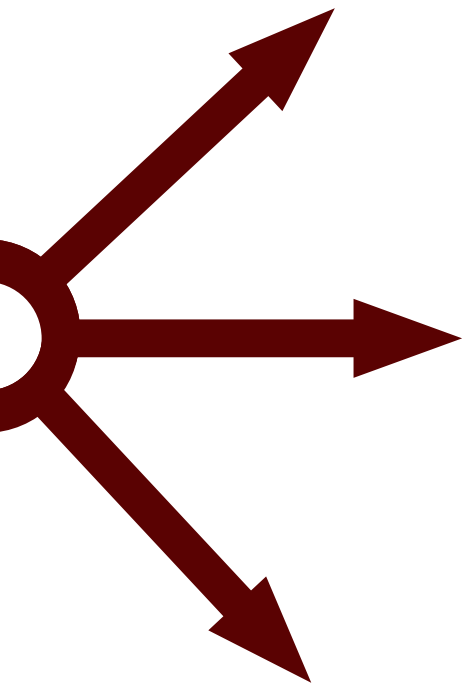
Zheni Vasileva, Petar Minkov, Vanya Petrova, Denitsa Sandeva, Hanna Aleksandrova & Yana Dimitrova

Caught in Arachne's net: Old Artefacts and New Discoveries from the Chalcolithic Period through Interdisciplinary Methods

14:00 – 14:15

Tena Karavidović, Janja Mavrović Mokos & Tajana Sekelj Ivančan

Technological Insights into Iron Age Ironworking: Evidence from the Late Hallstatt Settlement of Sveti Križ (North-West Croatia)



ABSTRACTS

Cristina Barrocas Dias

Chemistry and Biochemistry Department, School of Sciences and Technology, HERCULES Laboratory and IN2PAST Associated Laboratory, University of Évora, Portugal

Meat in the Pots, Plants in the Bones: Integrating Organic Residues, Isotopes, and Proteins in Paleodietary Reconstruction

Organic residue analysis (ORA) and stable isotope analyses are among the most powerful tools for reconstructing ancient diets, yet they often tell divergent stories. Lipid residues absorbed in ceramics typically indicate the processing of land animal products, whereas isotopic data from human remains frequently reveal diets rich in cereals, pulses, other plant proteins, and some fish intake. This persistent mismatch challenges our understanding of how different analytical proxies record past subsistence and culinary behaviour.

The bias toward animal signatures in ceramic lipids arises from both biochemical and cultural factors. Land animal fats are lipid-rich, thermally stable, and readily absorbed into porous pottery walls, while most plant foods contain limited, unsaturated lipids that degrade rapidly. As a result, even societies with plant-based diets may leave predominantly animal-derived lipid traces in their ceramic assemblages. Stable isotope values in bone collagen, by contrast, integrate long-term protein intake and often record the contribution of plant, legume and fish proteins.

Bridging these seemingly discordant signals requires new biomolecular approaches. Proteomics, applied to ceramic residues, offers a promising path forward. The detection of specific plant proteins, such as seed-storage, legume, and fish proteins, could help identify foods invisible to lipid analysis, expanding the molecular record of ancient cuisine. Combined with lipid biomarkers and isotopic baselines anchored in local ecology, such integrated analyses may finally align the “meat in pots” and “plants in bones” narratives.

The presentation will review fundamental principles, methodological advances, and selected case studies from the Mediterranean basin, highlighting both the interpretive potential and the limitations of each proxy. Particular attention will be given to the pitfalls of over-interpreting ORA data in the absence of contextual and multi-proxy validation, as well as to the importance of developing coherent frameworks that combine molecular, isotopic, and archaeological perspectives in the reconstruction of past foodways.



Dimitrij Mlekuž Vrhovnik¹ & Tomaž Fabec²

¹University of Ljubljana, Slovenia

²Institute for the Protection of Cultural Heritage of Slovenia

Prehistoric Hunting Megastructures in the Adriatic Hinterland

Large-scale linear stone alignments, commonly referred to as ‘desert kites’, are well-documented across the arid landscapes of North Africa, the Near East, and Central Asia, where they were used for communal hunting of ungulates. Until now, no comparable structures have been identified in Europe. Here, we report the discovery of four extensive prehistoric structures in the Karst Plateau of the Adriatic hinterland, revealed through airborne laser scanning (ALS). These features consist of low dry-stone walls that converge into deep enclosures strategically positioned beneath natural drops. Their placement on natural movement corridors suggests they functioned as large-scale traps designed to capture herds of wild animals, representing the first evidence of such hunting megastructures in Europe.

Excavations and radiocarbon dating indicate that the structures were abandoned before the Late Bronze Age, suggesting an origin potentially in the Mesolithic or earlier. The architectural complexity and estimated construction effort, requiring significant coordination and labour, underscore their importance within past subsistence strategies. GIS-based analyses further demonstrate that these structures were deliberately positioned within the topography to maximize their effectiveness in channelling animal movement. Given the regional distribution of Mesolithic sites, these megastructures may have been used for mass hunting of deer, a key prey species in the area. Our findings challenge existing paradigms of prehistoric hunting strategies in Europe and highlight the previously unrecognized role of large-scale communal hunting in the prehistoric Adriatic landscape.

Ivor Kranjec¹, Jelena Behaim² & Miljenko Jurković³

¹Department of History, Faculty of Humanities and Social Sciences, University of Zagreb, Croatia

²University of Barcelona – Institute of Archaeology (IAUB), Barcelona, Spain

³Department of Art History, Faculty of Humanities and Social Sciences, University of Zagreb, Croatia

New LiDAR-Based Insights into Post-Roman Landscape Transformations of the Northern Adriatic: Three Case Studies from Istria and the Quarnero Islands

The publication of the complete national LiDAR dataset marks a critical milestone in contemporary landscape archaeology in Croatia. This advancement has provided the means to transcend the limitations of previous research initiatives, most often restricted to geographically confined microregional studies. Although not without its limitations, the new spatial data enables systematic detection, documentation, and interpretation of archaeological features on a much more extensive scale.

This development has facilitated the advancement of multiscalar research into the post-Roman transformations of settlement patterns and landscape organization across the Quarnero Islands and the Istrian Peninsula, conducted within the long-term research framework of the IRCLAMA Center. While macro-scale, landscape-oriented analyses remain ongoing, this paper presents preliminary results from three micro-scale case studies in which the spatial configuration and long-term functional dynamics of selected sites are examined through the integration of LiDAR-derived data with



existing archaeological evidence, complemented by analyses of historical cartographic sources. Each of the three sites (the remains of the church of St Lawrence in Lovreški Dol on the island of Cres, the church near Gožinka Cove on the island of Rab, and the well-known remains of the monastery of St Mary the Great near Bale in southern Istria) illustrates a specific historical development within its respective microregional context. However, a common characteristic can be recognized: the continuity of activity around prominent geographical points within the Adriatic landscape, spanning from Antiquity through Late Antiquity and into the Middle Ages. During these transitions, both the architectural forms and the sociocultural roles of the sites underwent significant transformations. The most recent insights into the previously unknown (or, at the very least, long-neglected) surroundings of these sites will undoubtedly contribute to a better understanding of these transformations, as well as the patterns of adaptation to changing socio-economic and political circumstances.

Tino Leleković

Croatian Academy of Sciences and Arts, Zagreb, Croatia

Boundaries Without Borders: What LiDAR and Magnetometry Revealed About the Croatian Limes

As part of the preparation of the nomination dossier for the inscription of the Danube Limes on the UNESCO World Heritage List, the Ministry of Culture and Media of the Republic of Croatia has, over the past five years, invested substantial resources in the research of the Croatian section of the Limes. From the very beginning, a strategic decision was made to direct most of the funding toward non-invasive research methods – primarily because they allow for the broadest possible insight within a relatively short timeframe, without disturbing the integrity of archaeological sites.

In this presentation, I will discuss the results and the development of the research approach applied in the Osijek–Baranja County area, i.e. on the segment of the Limes under my responsibility. Considering that previous investigations were often fragmented and insufficiently precise, it became clear that real progress could only be achieved through systematic collection of concrete, quantifiable data – those necessary to meet the requirements of the nomination dossier: the delineation of core and buffer zones, spatial extent and density of finds, and the nature of subsurface remains.

Accordingly, most of the available resources were directed toward LiDAR surveys and large-scale geophysical prospection – primarily magnetometry, followed by GPR – which proved to be the most efficient way to obtain reliable results over extensive areas within a relatively short period.

The paper presents an overview of the “evolution of approach” in the application of non-invasive methods, as well as a personal insight into how practice (and the occasional mistakes) helped shape the most effective research procedures. Through examples from Batina, Kneževi Vinogradi, Bilje, Osijek, and Dalj, I will show how modern technologies have quite literally transformed our understanding of the Roman frontier system in this region – and how the newly obtained data have enabled the Croatian segment of the Danube Limes to finally be represented in dimensions that meet the international standards set by ICOMOS.



Srđan Beck,¹² & Katarina Šprem²

¹Department of Art History, Faculty of Humanities and Social Sciences, University of Zagreb, Croatia

² Association “Petra”, Pula, Croatia

Roman centuriation of ager Polensis in southern Istria (Croatia)

This presentation will showcase the results of research aimed at investigating the Roman centuriation in ager Polensis, bordered by the Lim channel in the north and Raša bay with the Liburni to the east. Although remains of the centuriation in the modern landscape were detected previously using the Croatian basic map (HOK), we have documented more of the Roman division using visualizations of data obtained from airborne laser scanning (ALS). Quantum GIS software was used to draw and analyze the detected lines of the centuriation. Examples of centuriation, like the ones from Italy and northern Africa, have become a paradigm of Roman technology and economy. It has become and was often used as an example of one of the *signa imperii*, the symbol of Roman domination and imperialism over the conquered territories. We will present the state of research into the Roman division of land in the southern part of the Istrian peninsula – ager Polensis.

Marin Buble¹ & Lujana Paraman²

¹Public Fire Brigade of the City of Trogir, Croatia

²Trogir City Museum, Croatia

Data sharing and the protection of archaeological heritage – possibilities of the intersectoral cooperation on mitigating the risk of wildfire damage to the archaeological heritage. The example of the Trogir area

During the summer season, forest fires are a daily occurrence in Mediterranean countries, and due to their size and frequency, in addition to representing a general threat to human safety and property, they also pose a significant risk to archaeological heritage. As an inseparable part of the landscape, the archaeological record is irreplaceable and non-renewable and, in addition to its general and scientific value for the heritage of mankind, it can also have significant historical, visual, and economic value for the social community. Numerous studies have already shown that fire can have a significant impact on archaeological features and artefacts and that it can potentially lead to the loss of information and of the mentioned general, scientific and social values of the archaeological record. There is also a growing body of literature dealing with the issues of fire and archaeology, from the impact of fire on various archaeological features, above and below ground, to studies on the specific impact of fire on certain materials. Although the current situation of increasing open-air fires could potentially result in damage, destruction and loss of value of the archaeological record at numerous sites, in the Republic of Croatia, there is still no cooperation between communities dealing with fire protection and institutions for the protection of archaeological heritage. From the point of view of firefighting tactics, in conditions of fire intervention, the duty of fire commanders is to save human lives and property. Knowing the exact locations of archaeological sites in the field is the first prerequisite for preserving such sites during forest fires. Using the example of the Trogir Operational Area, our goal is to implement the available data on archaeological sites in the area of the City of Trogir and neighbouring municipalities into the Croatian Fire Association's tracking system used in managing wildfire interventions. With this data, fire commanders in the field will be able to more effectively coordinate available capacities with the aim of preserving archaeological heritage.



Kyriakos Sgouropoulos,¹ Dushka Urem-Kotsou¹ & Apostolos Sarris²

¹Department of History and Ethnology, Democritus University of Thrace, Komotini, Greece

²University of Cyprus, Nicosia, Cyprus

Combining Field-Based and Remote Digital Approaches in Archaeological Surface Survey

The development of digital technologies offers archaeological fieldwork multiple techniques for data collection and analysis. This paper presents a workflow consisting of complementary digital approaches: (a) digital recording of surface finds by fieldwalkers using GPS-enabled mobile devices, (b) automatic finds detection using machine learning and drone imagery, and (c) geophysical prospection for subsurface mapping.

The digital recording technique was developed and tested during the MapFarm archaeological project and allows the rapid, real-time recording of the location of each surface find during systematic fieldwalking, leading to the creation of high-spatial-resolution density maps. These maps serve to evaluate the reliability of the automatic detection method of surface pottery finds, which is performed by neural networks trained to identify pottery fragments in aerial images. The combination of manual and automatic recording methods allows for quantitative assessment of automated classification accuracy and surface visibility factors. Furthermore, the integration of geophysical data obtained with magnetometers into the archaeological field survey enables multi-level digital mapping of the site. The spatial analysis of surface and subsurface data allows us to explore potential spatial correlations between the density of surface finds and the structures located below the surface.

Martina Naso¹, Arthur Leck², Rémy Chapoulie², Gabriele Gattiglia³, Francesca Anichini³, Bruno Dutailly², Claudia Sciuto³, Théophane Nicolas⁴, Ariane Menu⁴, Amala Marx⁴, Kai Salas Rossenbach⁴, Nevio Dubbini⁵, Ivan Radman-Livaja⁶, Jana Kópačková⁶ & Filomena Sirovica⁶

¹Università degli Studi di Roma “La Sapienza”, Italy

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³Università di Pisa, Italy

⁴INRAP (Institut National de Recherches Archéologiques Préventives), France

⁵Miningful srl, Italy

⁶Archaeological Museum in Zagreb, Croatia

Integrating 3D digitisation and archaeometric analyses in ceramics and lithics: automated workflows in the AUTOMATA project

AUTOMATA (AUTOMated enriched digitisation of Archaeological liThics and cerAmics), a Horizon Europe-funded project, is developing an integrated system that combines 3D digitisation with non-destructive archaeometric analyses such as hyperspectral imaging, pXRF, and Raman spectroscopy. Traditionally, data from the different tools have been acquired and processed separately, which makes integration and cross-comparison difficult. AUTOMATA addresses this challenge by embedding acquisition, positioning, and analysis within a unified and robotic workflow that enables automated and repeatable data collection.

Ongoing work focuses on complementary strands. An automated robotic 3D digitisation system is being developed to manage object manipulation and scanning, while tailored workflows for archaeometric data processing are being designed to ensure transparency, comparability, and reproducibility. Both strands will converge in RIS3D, a shared infrastructure cre-

ated to host, manage, and enrich 3D datasets with archaeometric and contextual information. To validate this approach, a reference dataset is being assembled that integrates geometry, surface appearance, and analytical measurements. This dataset will be progressively enriched through robotic acquisitions and manual annotations, combining automated and human inputs. The resulting collection will serve as a first comprehensive test case for multi-proxy integration and data quality assessment through comparison with traditionally acquired data. This contribution will discuss the methodological challenges of combining heterogeneous analytical proxies in a single computational environment and will highlight how robotic automation and integrated workflows can advance archaeological practice.

Marko Porčić

Department of Archaeology, Faculty of Philosophy, University of Belgrade, Serbia

A new approach to quantifying vessel shapes from profile drawings

The classification of ceramic vessels into types has always been one of the central concerns of archaeological research. Historically, this practice has been associated with culture-historical archaeology, but contemporary approaches likewise require the classification of pottery as a preliminary analytical step for tracing cultural patterns across space and time. Traditional methods relied on visual inspection and manual sorting, whereas modern archaeology demands more objective techniques capable of handling large datasets and automating the process. Geometric morphometrics combined with numerical taxonomy has emerged as a standard approach in contemporary pottery analysis. However, numerous methods exist for quantifying vessel shape and for classifying pottery. In this paper, I present preliminary results from a new approach to quantifying vessel shapes based on profile drawings. These results tentatively indicate that this method may outperform more conventional quantitative techniques when the goal is to group vessels with similar profile syntax.

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⁵Heritage 993, Split, Croatia

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Archaeology and Geology in Ceramic Studies: Towards an Integrated Framework for Interdisciplinary Pottery Technology Research in Croatia

As part of the final stage of the research project “*Technological Features and Cultural Practices in Prehistoric Pottery Traditions in Croatia*” (UIP-2020-02-3637), the first integrated archaeological-geological database in the Republic of Croatia has been developed. The database encompasses a physical and digital study collection of archaeological and geological samples — including ceramics, raw materials, and experimental reference materials — and serves as a foundation for future interdisciplinary research on the technology and provenance of archaeological artefacts.

To ensure the structured and sustainable development of this research infrastructure, the Laboratory for the Analysis of Archaeological Ceramics and Raw Materials (LaKeS) was established at the Institute of Archaeology. The laboratory focuses on the integration of macroscopic and analytical methods, the application of contemporary methodological approaches, and the establishment of collaborations with national and international institutions. This presentation will outline the conceptual framework, structure, and methodology of data collection and classification within the study collection and its associated database. Particular attention will be given to how the database supports analytical and interpretive research on pottery technology and on the conceptual framework of chaînes opératoires, as well as its potential to facilitate open-access scientific data sharing. The initiative also underscores the role of LaKeS in ensuring data quality and encouraging interdisciplinary collaboration across the natural sciences, humanities, and social sciences contributing to the broader development of archaeometric research in Croatia.

Katja Kavkler¹, Elena Leghissa², Miran Pflaum³, Peter Turk³, Maja Gutman Levstik¹, Lidija Korat Bensa⁴ & Sabina Dolenc⁴

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³National Museum of Slovenia, Ljubljana, Slovenia

⁴Slovenian National Building and Civil Engineering Institute, Ljubljana, Slovenia

Preliminary Results of Archaeometric Analyses of White Incrustations on Third Millennium BC Pottery – A Case from the Ljubljansko barje area

Among Slovenian prehistoric sites of the 3rd millennium BC, Dežman's pile dwellings near Ig in the Ljubljansko barje area are particularly distinctive. Discovered and archaeologically excavated 150 years ago, they represent an important site from the Late Copper and Early Bronze Ages. A unique feature of these settlements is the exceptionally well-preserved ceramic vessels, attributed to the Vučedol and Ljubljana cultures. Most vessels are richly decorated with incised and impressed motifs, originally filled with a white incrustation. Although this inlay has not survived uniformly, in some cases it remains clearly visible even today.

To investigate the composition, technology, and application of these white pastes, a series of archaeometric analyses was carried out at the Department of Natural Sciences (IPCHS). The study focused on ceramic samples from Dežman's pile dwellings near Ig, with additional comparative material from the contemporaneous pile-dwelling site of Špica in Ljubljana, excavated in 2009 and 2010. Both Vučedol and Ljubljana cultural contexts were included in the investigation. Analytical methods, including optical microscopy (OM), Fourier-transform infrared spectroscopy (FTIR), Raman microspectroscopy (RS), X-ray fluorescence spectroscopy (XRF), and X-ray diffraction (XRD), scanning electron microscopy with energy dispersive x-ray spectroscopy (SEM EDS), microtomography (μ-CT), were employed to identify the raw materials used for the incrustations and clarify the technological processes of their preparation. In addition to the fillers in the ornaments, the study also sought to determine the composition of the fired clay and the temperatures to which it was exposed.

The results suggest that the pile-dwellers used several different components in their white pastes: bone white (hydroxyapatite), lime (calcite), or kaolinitic clay. These findings provide the first archaeometric insight into the technological choices behind the distinctive decorative practices of the Ljubljansko barje pile-dwellers and open new perspectives for understanding cultural traditions in the broader 3rd millennium BC Central European context.



Atanas Tsurev & Nikolina Nikolova

National Archaeological Institute and Museum, Bulgarian Academy of Sciences, Sofia, Bulgaria

Beyond Red and White: Archaeometric Perspectives on Early Neolithic Pottery at Chavdar

The Early Neolithic settlement near the village of Chavdar is located in the Zlatitsa–Pirdop Basin, a fertile valley of the Topolnitsa River, about 80 km east of Sofia, Western Bulgaria. Excavated in full during rescue investigations between the late 1960s and 1980, the site dates to the first half of the 6th millennium BC.

The ceramic assemblage is distinguished by its polychrome decoration, produced through the combination of white and dark pigments on a red background. While in most Balkan regions at the time vessels were typically decorated with white paint, and more rarely with dark, at Chavdar, polychrome designs occur with far greater frequency. Comparable finds from other Eastern Balkan sites point to direct cultural connections between this region and areas to the west and southeast. The diversity and complexity of the motifs suggest that this decorative tradition was particularly developed here, making Chavdar a key center of ceramic innovation in the Neolithic. The presentation introduces new results from the study of painted and unpainted pottery sherds from this assemblage. These analyses, carried out within a broader project revisiting the legacy materials from the settlement and supporting the renovation of the local exhibition dedicated to the site, address the full chaîne opératoire of pottery production, from raw material selection to firing technology. Particular attention is devoted to the pigments used in decoration. By integrating technological and stylistic perspectives, the research provides new insights into both the production practices and the cultural significance of Chavdar's ceramics within the wider Neolithic networks of Southeast Europe.

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Born by Nature, Shaped by Man: Archaeometric Insights into Shell-Tempered Chalcolithic Pottery from Săveni-La Movile

The archaeological site of Săveni-La Movile is located on the high terrace of the Ialomița River in the southern Bărăgan Plain, near the Săveni commune (Ialomița County, SE Romania). Excavations revealed a Cernavodă I settlement (4th millennium BC), a phase technologically distinguished by the deliberate addition of crushed shells into pottery paste, a feature different from those previously observed within other Chalcolithic communities in the Muntenia region. By implementing an archaeometric approach that integrated macroscopic investigation, thin-section petrography coupled with optical microscopy (OM), and X-ray computed tomography (CT), two representative shell-tempered pottery fragments were characterized both externally and internally, based on inclusions, texture, porosity, and firing criteria.



Preliminary results provide information on the nature of the shells (fossil vs non-fossil), their presence (natural vs deliberate), morphology, dimensions, frequency, distribution, orientation (preferential vs non-preferential), and firing parameters. In addition, they offer some methodological insights regarding the possibilities of identifying shell species based on the crushed valve fragments present in pottery bodies. The acquired data indicate that the two analysed samples are well-fired and exhibit semi-fine fabrics with a consistent presence of deliberately added crushed shell valve temper, while the distribution and orientation of both pores and inclusions suggest laminar forming techniques.

This research emphasizes the importance of archaeometry and its interpretative value in reconstructing prehistoric technological, social, environmental, and economic behaviours. By integrating the obtained results into broader chronological and geographical frameworks, this work contributes to the overall understanding of shell-tempered ceramics through space and time. This work was supported by a grant of the Romanian Ministry of Education and Research, CNCS-UEFISCDI, project number PN-IV-P1-PCE-2023-1899 (BioArhSteppe), and ISDS-FSI-UB.

Massimiliano Puntin

Sapienza, University of Rome, Italy

Protocol for investigating ancient colours: a multi-analytical non-destructive approach to the study of Roman painted plasters

The non-destructive analysis of painted plasters represents a major challenge in archaeometry, requiring integrated protocols capable of combining macroscopic and microscopic observation with chemical investigation. How can these materials be examined in a non-invasive way? What combination of techniques allows us to fully understand and characterise pigments? What are the strengths and limitations of the most used spectroscopic methods? And is it possible to achieve a satisfactory screening through portable, non-destructive instruments?

This contribution presents a multi-analytical methodology combining portable, non-invasive and micro-invasive techniques for the characterisation of pigments, from raw materials to their processing and application strategies. The investigated materials come from the coastal and insular areas of Roman Etruria.

The proposed protocol involves an initial phase of macro- and microscopic observation, using a DinoLite digital microscope, followed by elemental (Bruker Elio XRF) and molecular analyses (Bruker Bravo Raman, Bruker Alpha ATR-FTIR, B&W Tek Inc. BPS101 FORS, and Specim IQ HSI). The integration of these methods enables a comprehensive screening of painted surfaces, distinguishing pigment compositions, painting techniques, and traces linked to application processes. The proposal critically discusses the potential and limitations of each technique in the study of ancient pigment palettes, with particular attention to the constraints associated with portable, non-destructive tools that require no sample preparation. The aim is to propose a replicable analytical protocol useful both for preliminary diagnostics and for the selection of representative samples to be subjected to further micro-invasive archaeometric analyses. Preliminary results from the doctoral research and parallel projects demonstrate how a multi-proxy approach can significantly enhance our understanding of Roman painting materials and their technological processes.



Boris Rozić

Faculty of Humanities and Social Sciences, University of Mostar, Bosnia and Herzegovina

Spatial Analysis of Mousterian Sites in Bosnia and Herzegovina

This study examines the spatial characteristics of Mousterian sites in Bosnia and Herzegovina, beginning with a reassessment of the methodological frameworks that have shaped earlier interpretations of site distribution. By applying spatial analysis, network modelling, and statistical evaluation, the distribution of sites is reconsidered from both quantitative and qualitative perspectives. The results show a clear association between site locations and primary chert outcrops, underlining the role of raw material availability in settlement choices and mobility strategies. In addition to geology, terrain morphology is also shown to have influenced the positioning of sites, particularly concerning accessibility, visibility, and proximity to natural communication routes. A comparison with earlier interpretations reveals shifts in the understanding of cultural relationships and regional dynamics. Particular attention is given to Herzegovina, where the apparent absence of Mousterian sites may be explained through a combination of geomorphological constraints, limited survey coverage, and taphonomic processes that have reduced the archaeological visibility of potential sites.

On the basis of these findings, the study identifies several areas with considerable archaeological potential. These are proposed as priorities for future systematic survey and targeted fieldwork, with the aim of testing the identified spatial patterns and refining our comprehension of the Middle Paleolithic in this region.

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Unveiling the Past: Interdisciplinary Methods Applied to the Late Bronze Age Site of Kamenovo, Northeast Bulgaria

This study presents a new multidisciplinary approach to the archaeological investigation of a Bronze Age site. The site is located in the land of the village of Kamenovo, Kubrat Municipality, in the heart of the Ludogorsko Plateau in Northeastern Bulgaria.

The first step of the research involved the observation of satellite imagery and its subsequent verification through targeted field surveys, which confirmed the presence of a Bronze Age site. After registering the site in the GIS and Archaeological Map of Bulgaria, a large-scale geophysical survey was conducted.

Following the analysis of the geophysical survey results, an archaeological excavation was carried out. Based on the material obtained from the fieldwork, interdisciplinary studies were conducted. Archaeobotanical samples were analysed, providing important information about palaeobotany during the Bronze Age. Archaeozoological analyses revealed a variety of domesticated animals and likely hunting practices of the ancient population. A major contribution of the research at the Kamenovo site is the series of ¹⁴C dates, currently the first of their kind for sites from this period in Northeastern Bulgaria.

The Ludogorsko Plateau is well known in archaeological literature for numerous chance finds and hoards from the Late Bronze Age. Nevertheless, Kamenovo is the first site in the Ludogorie region to



be studied through archaeological excavations in combination with a wide range of interdisciplinary methods. Of particular interest is the discovery of a stone mold, which underwent XRF analysis with very intriguing results.

Also noteworthy are the petrographic studies of the stone artefacts, as well as the flint raw materials for which the area is well-known. The Ludogorsko Plateau has numerous flint sources that were used throughout Southeastern Europe due to their high quality. The results of the investigations provide new and valuable information about life during the Bronze Age in a region that remains largely unexplored.

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Veli Brijun quarries, Istria, Croatia – historical and geological context

The Brijuni archipelago, located in southwestern Istria, is known for its rich history, having been inhabited since at least the Middle Neolithic. Better known are the Roman villae rusticae and maritimae scattered across the island, as well as churches from Late Antiquity and Austro-Hungarian fortresses. Due to its long history of habitation, Veli Brijun island had a great need for stone material, which was extracted heavily on the island itself. The surface deposits are characterised by Lower Cretaceous limestone of Barremian, Aptian and Albian age, with Quaternary sediments of bone breccias, red-brown soil on carbonate, lake sediments, sea beach and anthropogenic deposits. Quarries on Veli Brijun have been mentioned in the bibliography before; however, none of them have been satisfactorily documented and sampled. We will present the current state of research into quarrying on Veli Brijun Island, as well as describe the lithotypes extracted. Samples taken from the island were classified according to Dunham (with additions of Embry and Klovan) and Folk, with microfacies analysis done according to Flügel.

Marta Rakvin & Jacqueline Balen

Archaeological Museum in Zagreb, Croatia

Developing Interdisciplinary Strategies for Public Engagement with Iron Age Heritage

This paper presents a systematic, interdisciplinary approach developed by the Archaeological Museum in Zagreb to enhance public awareness and presentation of Iron Age heritage within the Požega Valley, Croatia. Effective knowledge transfer requires understanding both the scientific basis and the intrinsic heritage value, while shifting the focus from individual sites to complex cultural landscapes offers innovative promotional opportunities. The methodology, developed over two systematic DTP Interreg projects—Iron Age Danube and Danube’s Archaeological eLandscapes—highlights the necessity of inter- and multidisciplinary collaboration and a strong network of experts to create successful new visitor programs. The key strategies employed included building a georeferenced database utilizing ALS imagery and previously published research to assess site suitability for public presentation based on accessibility, existing infrastructure, and preservation state. Once sites were selected, the project developed information boards and trails to directly interpret



existing archaeological features to visitors. Furthermore, the team used Virtual Reality (VR) to virtually connect sites and landscapes with their respective archaeological finds, offering new immersive interpretations, and utilized published lipid analysis research to recreate Iron Age menus, providing a tangible connection to past life. Finally, the project underscores the critical role of strong international collaboration, which continues through the Iron Age Danube Route (IADR), a vital platform connecting diverse stakeholders and facilitating ongoing cooperation in interpreting and presenting archaeological research to a wider public audience. This demonstrates a successful model for transforming archaeological data into engaging, accessible, and sustainable cultural tourism products.

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Comparative regional stable isotope analysis reveals fluctuations in millet consumption during the Bronze and Iron Ages in Croatia

This study presents the largest regional-scale stable isotope investigation of human and faunal remains spanning the Bronze and Iron Ages (c. 2400–100 BCE) in present-day Croatia to date. New $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ data from 40 individuals were integrated with previously published results ($n = 233$) to explore long-term and region-specific dietary trends, with a focus on the emergence of broomcorn millet (*Panicum miliaceum*) as a dietary component. Results reveal a distinct inland–coastal contrast: while coastal populations consistently consumed C3 – based diets, inland groups show consistently higher $\delta^{13}\text{C}$ values indicative of direct millet intake from the Middle/Late Bronze Age onwards. Statistical analyses confirm strong effects of both period and location on $\delta^{13}\text{C}$ values, with inland populations exhibiting enriched signatures particularly during the Middle/Late Bronze Age transition and again in the Iron Age. A probabilistic two- endmember mixing model estimates millet contributions reaching up to ~15% of dietary protein in these inland groups, suggesting episodic but meaningful integration of C4 crops into subsistence systems. In contrast, faunal baselines reflect purely C3 diets, confirming that the C4 signal in humans derives from direct millet consumption. These findings help refine the chronology of millet adoption in the eastern Adriatic, pushing its significant dietary incorporation back to the Middle/Late Bronze Age transition, and highlight fluctuating patterns of C4 plant consumption through the Bronze and Iron Ages, likely shaped by ecological conditions and local adaptive strategies rather than uniform cultural change.



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Unpacking ‘Fuzzy’ Diets: Using Fuzzy Clustering Analytical Methods of Stable Isotopes to Examine Community Identity in Late Avar Period Šarengrad, Croatia

Cemeteries are assumed to represent a living community, wherein cultural practices, beliefs, and daily lives are shared among members. Similar interment location and patterns signal this shared existence, while grave goods may indicate some aspect of unique social identity including several adult male individuals interred with horses. Osteological analyses and stable isotopes are used to model aspects of that shared experience, including diet. Categorical aspects of social identities that osteologists identify, including age and sex, often result in patterned variation with stable isotope analyses. We use traditional statistical methods of analysis of stable isotopes of carbon and nitrogen from bone collagen to reconstruct past dietary patterns from the 8-9thc. Avar cemetery at Šarengrad and test expectations for a homogenous community. Additionally, we apply unsupervised possibilistic fuzzy c-means clustering to isotopic data to explore relationships among individuals ($n=55$). This unsupervised method creates clusters of individuals and evaluates the degree of membership that can be evaluated based on archaeological variables (mortuary, osteological, etc.) without a priori assumptions. While the fuzzified clustering of $\delta^{13}\text{C}_{\text{col}}$ and $\delta^{15}\text{N}$ indicates two clusters, which generally fall along broad age differences of young juveniles and the rest of the sample, the membership distribution invites further interpretations. This approach illustrates the potential of fuzzy logic analysis of isotopic variables to analyze coherency of cemetery samples and identify relationships among members.

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Threads of Glass: Production and Provenance of Iron Age Adornments from the Zakotorac and Nakovana tumuli

Ongoing archaeological investigations of Iron Age burials at Zakotorac and Nakovana (Pelješac, Croatia) dated to the second half of the 1st millennium BCE yielded an astounding number of personal adornment objects, including over 500 glass beads and pendants, ranking these sites among the largest known collections of prehistoric glass in Croatia. In this work, we present the results of a multi-analytical archaeometric study of Zakotorac and Nakovana glass assemblages found between 2020 and 2022, including trace element analysis for raw materials provenance. Over 100 studied samples can be characterised as soda-lime-silica glass fluxed with natron, with minor and trace element concentrations fitting well within the established ranges of contemporary glass types originating from the Syro-Palestinian region. Integration of archaeometric data with an elaborate typological scheme based on a systematic re-



cording of morphometric attributes and understanding of the individual chaînes opératoires allows for the observation of specific patterns of production regarding glass colouring and beadmaking techniques. In particular, blue glass beads appear to have been made from at least three chemically distinct colours which correspond to artefact typology. This, in conjunction with a narrower geographical range of small rounded and biconical “folded” beads, as opposed to blue-and-white eye beads and other types of eye beads made by winding, suggests multiple bead workshops could have created the adornments discovered at the sites.

However, caution with conclusions about the location of possible beadmaking workshops and organisational models of production is necessary due to the consumption-oriented find contexts from Pelješac, as well as sporadic publications of glass finds from the region and unsystematic documentation criteria for glass adornments.

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The use of SEM-EDS in the analysis of 13 green-coloured Roman engraved gems from Sisak, Croatia

The glyptic collection of the Archaeological Museum in Zagreb comprises approximately 400 items, of which 122 originate from Sisak (ancient Siscia, Pannonia Superior). Within this assemblage, a distinct subgroup of 13 convex green gemstones has been identified. These pieces belong to a group of small, translucent green chalcedonies distinguished by their convex or biconvex forms and classical iconographic motifs. A potential production centre for such engraved gems has been proposed at Aquileia, with comparable examples reported from Pompeii, Carnuntum, Britain, and Gaul. The production of these gemstones is generally dated to the first century A.D.

Gertrud Platz-Horster conducted the most comprehensive study of this group to date, identifying the material through gemmological analysis as chromium chalcedony. Building upon these findings, the present study applies scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy (SEM-EDS) to the 13 green chalcedonies from Sisak. The primary objective is to establish their precise mineralogical composition and to verify the presence or absence of chromium within their structure. The results will contribute to a broader understanding of the materials used in Roman gem engraving.

Selena Vitezović & Gordana Jeremić

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Technology and function of bone objects from the Roman period: some preliminary results

Technological and functional studies of macro traces that may be noted on bone objects are constantly improving with new theoretical and methodological frameworks and with advances in equipment. Studies of traces of manufacture and usewear were focused mainly on the prehistoric bone tool assemblages, while those from historic periods are rarely included in analyses. Recent excavations at the site of Klenak – Adžine Njive in northern Serbia yielded a bone tool assemblage from several periods, from the Neolithic to the Middle Ages. Several bone objects



were found within features from Roman times, including several bone pins. These pins are usually interpreted as decorative pins used for clothing and for hair. We examined these pins with magnifications up to 50x in order to analyse usewear traces, with the main objective to study the patterns of usewear, possible variations, and to try to determine their function more closely.

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Caught in Arachne's net: Old Artefacts and New Discoveries from the Chalcolithic Period through Interdisciplinary Methods

The present study concerns an exceptionally interesting find – a net, discovered during archaeological excavations in 1952 in the Devetashka Cave, in the area of present-day Lovech, Bulgaria. The net was found in a dwelling attributed to the Chalcolithic period. According to the excavators, the net was made of flax, braided as a rope and twisted from two strands. However, the find has never been studied. After the end of the excavations, the net was transferred to the National Archaeological Museum in Sofia, where this unique artefact fell into oblivion. At the time of study, the net represents a unique find from the prehistory of the Balkans, and more than 70 years after its discovery, it has no known parallel.

The introduction of various interdisciplinary approaches in archaeological research has made it possible to examine this unique artefact from multiple perspectives. The present study will present an AMS date of the net. Following the acquisition of an absolute dating of the artefact, the net was examined by a specialist archaeobotanist to definitively determine the material, as well as to analyze the manufacturing technique and the raw material from which the net was made. Identifying plant fibers is a significant challenge in archaeobotanical research. Concerning the techniques employed, our goal was to understand which methods were used and to evaluate potential changes over time. Knots serve the primary function of fastening pieces of string, cord, or rope together.

The study was accompanied by the production of photomicrographs by a professional photographer, as well as microscopic images detailing the material from which the net was constructed. The study will present possible reconstructions of the net, as well as interpretations of its function. A comparison will also be made with later periods and the results of similar interdisciplinary investigations.

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Technological Insights into Iron Age Ironworking: Evidence from the Late Hallstatt Settlement of Sveti Križ (North-West Croatia)

Sveti Križ, a Late Hallstatt site (6th–4th centuries BC) comprising a settlement and necropolis, lies in the westernmost part of Croatia. Strategically positioned at 310 metres above sea level near the confluence of the Sutla and Sava rivers, the site overlooks the “Brežice Gate,” a key corridor for prehistoric trade and communication.



Systematic excavations undertaken since 2019 by the Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb, have yielded clear evidence of iron-working activities. The recovery of numerous slag fragments, accompanied by a sample of iron ore, a semi-product (iron bloom), and finished artefacts, demonstrates iron production and processing activities. Morphological, mineralogical (XRD), and chemical (p-XRF) analyses of slag and semi-products elucidate the technological procedures employed. The spatial distribution of metallurgical debris and associated features indicates an organized production zone located at the settlement's periphery. Although research remains in progress and the complete chaîne opératoire of iron production cannot be unambiguously defined, the findings provide evidence that illuminates the integration of iron processing into the settlement's economy and constitutes the earliest attested indication of iron processing - and potentially primary production - on a local scale within the region.

POSTER ABSTRACTS

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Animal Exploitation in the Copper Age of Eastern Slavonia: Zooarchaeological Evidence

This paper presents the preliminary results of zooarchaeological analyses carried out as part of the project Culinary practices, husbandry, and land-use strategies during the Copper Age in Eastern Slavonia (CULPLUS). The faunal assemblages originate from three sites: Viškovci-Gradina and Verušed near Đakovo, and Prisunjača near Vinkovci. Species identification was conducted to determine the relative frequencies of domestic and wild taxa, providing a foundation for reconstructing animal husbandry and hunting strategies. In addition, detailed analyses offer insights into meat consumption and refuse disposal practices among these Copper Age communities. The results are presented for each site individually, followed by a discussion of the similarities and differences in animal exploitation, based on regional and diachronic comparisons and taking into account their geographical and chronological affinity. The taphonomic characteristics of the faunal assemblages and excavation methods are also considered in relation to their formation and sample composition. Finally, contextual analyses were applied to identify broader patterns in human–animal relationships.



Izaskun Egilegor Uranga

Built Heritage Research Group / Euskal Herriko Unibertsitatea, Vitoria-Gasteiz, Spain

Beyond Prehistory: Towards a Methodology for Contemporary Archaeology of Megaliths

Since the discovery of one of the earliest megaliths in the Historical Province of Gipuzkoa (northern Basque Country, Spain) —specifically the dolmen of Jentillari (Giant Stone)— research has predominantly focused on prehistoric periods (Altuna et al., 2002). In recent decades, interest in the reuse of megaliths during later historical phases has increased, yet systematic documentation and analysis remain limited. Contemporary materials, frequently recovered both on the surface and during excavations, are often recorded only partially, which hinders their interpretation. This work highlights the importance of developing a clear methodological framework for contemporary archaeology in megalithic contexts. Recognising megaliths as landscapes with long and complex biographies —extending beyond prehistory into the present— allows for a more complete understanding of their role in cultural identity. Establishing such a methodology is essential to ensure the consistent recording, classification, and analysis of both historic and modern traces. The research, based on the author's doctoral study, analyses the evolution and reuse of the megalithic landscape of Gipuzkoa using Bergson's concept of multitemporality (Hamillakis 2015, 150-155; Olivier 2013, 121-122; Olsen 2013). It proposes a transdisciplinary approach integrating archaeological, ethnographic, cartographic, and social data, with the aim of creating an open and accessible database for research and public engagement.

The methodology is organised into three phases:

1. Identification of diverse sources, from archaeological maps and intervention reports to ethnographic materials, ensuring both prehistoric and contemporary data are considered.
2. Systematisation of information through tools such as Google Sheets, PostGIS, QGIS, AutoCAD, Photoshop, and Blender, enabling integrated documentation.
3. Citizen participation as a complementary source, using collaborative mapping and public archaeology to expand the dataset.

By applying this structured methodology, the project seeks to contribute to a more comprehensive understanding of the megalithic landscape, integrating its prehistoric origins with its ongoing cultural significance in the 21st century.

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BioSense Institute, University of Novi Sad, Serbia

The use of micro computer tomography (mCT) in scientific purposes and preservation of cultural heritage

In the past years, means of acquisition of 3D information became all present – the requirements to successfully create an accurately reconstructed copy of an object in 3D dramatically plummeted and made the process broadly available to a wider community, both scientists and enthusiasts alike. One of the most used techniques to access the internal structure of bones and teeth in archaeological samples is micro computed tomography (mCT). The MOVE project, which explores the lifetime movements and residential mobility patterns of the first farmers who settled in the



Southern Carpathian Basin during the Neolithic (~6250-4500 cal BC), implements this technique. Within MOVE we use sequential analysis of tooth dentine to reveal individual early life histories at a high resolution and explore the dietary and mobility patterns of Neolithic humans. To explore the internal tooth structure of Neolithic first agropastoralists and their successors and find adequate samples for stable isotope analyses of carbon, nitrogen, sulfur, and strontium, we are examining and scanning all human and animal teeth thoroughly via SkyScan 1275XL – a fast, automated X-Ray micro-CT system. Since stable isotope analyses can be destructive, we will also create permanent digital models by scanning the teeth. In this way, all teeth will be available for future studies.

This research was supported by the Science Fund of the Republic of Serbia, GRANT No. 7498, Moving across the plain: reconstructing the lifetime movements of farming pioneers and their successors during the Neolithic in the Southern Carpathian Basin-MOVE.

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Digitization of the Sacred: Initiating a Digital Database of Saints' Archaeological Remains and Relics in Dalmatia – Interdisciplinary Approach and Knowledge Transfer

The veneration of saints and their relics has been part of Dalmatia's religious, cultural, and social landscapes from Late Antiquity to the present. Despite their significance, information about the location, authenticity, and historical context of these relics remains scattered across manuscripts, church inventories, archaeological records, and oral traditions.

This poster presents the first phase of a project to build a digital database of saints' relics and archaeological remains in Dalmatia. The database integrates archaeological, historical, and contextual information about the saints, while exploring advanced digital imaging to enhance documentation. Collaboration with ecclesiastical and cultural institutions is emphasized to ensure accuracy, ethical management, and to create a sustainable resource for research and cultural engagement.

The project explores approaches to documentation and data organization while addressing challenges in digitization. It considers the use of advanced imaging techniques—including 3D scanning, computed tomography (CT), and photogrammetry—to produce high-resolution records while minimizing handling of fragile objects. Archival, historical, and oral sources will be collected and integrated with archaeological data to provide context about the relics and saints. These methods support precise study, long-term accessibility, and the development of virtual exhibitions and educational tools. Collaboration with the Church provides access to archives, inventories, and custodial knowledge, ensuring ethical management of cultural information. Although the database is still in development, it is designed for broader societal benefit. Once implemented, it will support knowledge transfer to heritage managers, local communities, and religious tourism initiatives, offering a foundation for pilgrimage routes, exhibitions, and educational programs. This poster outlines the conceptual framework, planning stages, and intended methodology of the project, demonstrating how archaeological research on saints' relics can be transformed into a digital tool for cultural preservation, education, and community engagement.



Anna Nicolussi & Diana Dobрева

University of Verona, Italy

Late Antique Coarse Ware from Negrar di Valpolicella (Verona, Italy): Local Production and Regional Exchange

Late Antique Coarse Ware from northern Italy remains a relatively understudied research area, despite being one of the most frequently recovered pottery classes. Its analysis provides crucial insights into production technologies, usage practices, and the circulation of artefacts. The present study focuses on Late Antique Coarse Ware from Villa dei Mosaici di Negrar di Valpolicella (Verona, Italy). The villa, likely constructed in the second half of the 4th century CE, was situated in a strategically significant area: within a territory characterized by viticulture, suggesting a possible functional link to wine-related production, and in proximity to the urban center of Verona, with connections to surrounding regions, particularly the Trentino region. The existence of such contacts is further substantiated by the discovery at Negrar of archaeological materials that can be attributed to typologies characteristic of the Trentino region. The villa has been the subject of systematic excavations since 2020, directed by the Soprintendenza Archeologia Belle Arti e Paesaggio for the provinces of Verona, Rovigo, and Vicenza, in collaboration with the Department of Culture and Civilization at the University of Verona. A total of 1,337 Coarse Ware fragments, corresponding to 340 minimum number of individuals (NMI), were analyzed through typo-chronological classification and macroscopic observation, identifying seven fabric groups. Subsequently, 17 samples were selected for thin-section preparation and analyzed using petrography and scanning electron microscopy (SEM-EDS), allowing the characterization of clay fabrics, raw materials, and production techniques. The integration of typo-chronological and archaeometric data suggests the possible existence of a local production characterized by homogeneous clay fabrics produced using different techniques. It simultaneously indicates potential exchanges with neighboring areas such as the region of Trentino. This study significantly advances the understanding of the production and circulation of Late Antique Coarse Ware in Northern Italy and stimulates further research on this under-studied pottery class.

Petra Nikšić & Krešimir Filipec

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Reassembling the past: four methods used for determining the minimum vessel number at the early medieval site Stari Perkovci – Debela šuma (Eastern Croatia)

The archaeological site Stari Perkovci – Debela šuma is located in Slavonia, specifically in Brod-Posavina County, 25 km northeast of the county capital, Slavonski Brod. Slavonia, now in eastern Croatia, was a vast woodland and marshland in the early Middle Ages. The early medieval settlement at the site Stari Perkovci – Debela šuma was organized on a small hill, but only part of it was discovered during the protective archaeological excavation in 2006, prior to the construction of the highway to Osijek. Two semisubterranean structures were found and dated from the 7th to the 9th century. Archaeological features and fragments of daub indicate that one structure was a tent-like dwelling, while the other was built with wattle covered in mud. Pottery forms the largest group of finds from these two structures, and the pottery assemblages mainly consist of small and large pots. Unfortunately, the pots are not well preserved, and many are represented by a single sherd.



As the assemblages were not large, it was possible to use four different methods to determine the minimum vessel number in both structures with precision. During the research, methods such as refitting, counting diagnostic sherds, rim-to-base correspondence with cross-matching of other sherds, and fabric and decoration analyses were found to be the most effective for determining the minimum vessel number. From the total of 86 sherds in one structure and 52 sherds in the other, it was possible to determine a minimum number of 23 and 25 vessels, respectively. In turn, these numbers contribute to the interpretation of the structures as dwellings rather than workshops, despite the large amounts of ash and soot, which indicate that the area could have been used for the production of iron.

Almir Olovčić & Katarina Šprem

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Chert samples from the Istrian peninsula (Croatia) and their chemical signatures: can we make a distinction based on the results?

Five samples from Marlera and Vižula, respectively, on the Istrian peninsula (Croatia) were analyzed by means of XRD and FTIR. The aim was to see if there is a measurable difference between these two locations in their chemical signatures, in order to use them in provenance of chert artefacts, from prehistory and antiquity. XRD results showed that all the samples have sharp peaks around $2\theta = 26.6$, representing (101) reflection of α -quartz (SiO_2). Smaller peaks around diffractograms also represent other quartz reflections. Based on the XRD results, the samples are pure quartz, with only the crystalline phase detected.

Since XRD method was unable to provide measurable differences between samples, we decided to try with FTIR. The results showed subtle but clear differences between samples from different locations. In the area of main Si-O band presence ($1000\text{--}1200\text{ cm}^{-1}$ region), Marlera shows peaks at 1127 cm^{-1} and 1080 cm^{-1} , while Vižula has peaks on 1164 cm^{-1} and 1067 cm^{-1} . The slight shift suggests the possibility of the presence of other SiO varieties (opal, chalcedony). Doublet in the $780\text{--}800\text{ cm}^{-1}$ region has slightly stronger separation for the Marlera samples, while in Vižula they are closer in their values. In the region of $600\text{--}700\text{ cm}^{-1}$, Marlera samples shift towards higher wavenumbers (553, in contrast to 540 for Vižula). Also, in the low wavenumber region ($\sim 450\text{--}500\text{ cm}^{-1}$), there is a shift towards higher values for Marlera samples. Additionally, Vižula samples show higher intensity values, suggesting the possibility of impurities or different porosity. Based on the FTIR results, Marlera samples appear to be slightly more crystalline (quartz-rich), while the Vižula samples show shifts consistent with more disorder or different silica polymorphs. The general conclusion is that FTIR method is a more promising approach for differentiation between chert samples from these two locations.



Franka Ovčarić & Janja Mavrović Mokos

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Shaping the Edge: Late Bronze Age Fortifications of Northwestern Croatia

Archaeological investigations conducted at the sites of Gračec, Kosovac near Bregana, and Planina Donja-Gradec have provided new insights into the construction techniques of fortifications during the Late Bronze Age in northwestern Croatia.

At the site of Gračec, the rampart was formed by heaping earth excavated from a ditch located along its northern side, resulting in a horseshoe-shaped defensive structure whose ends rest on the natural slopes of the settlement's eastern and western sides. Inside the rampart, a wooden feature composed of beams and posts was documented, serving as internal support for the earthen embankment, while fragments of carbonized wood indicate the presence of a palisade on its upper section. Geophysical surveys further confirmed the presumed construction method and the existence of a ditch at the base of the rampart. At the site of Kosovac near Bregana, although no defensive structures were previously recorded, a field survey identified the remains of an earthen rampart extending along the western side of the site. The rampart, also horseshoe-shaped like the one at Gračec, protected the most accessible approach to the settlement. It was partially damaged by the construction of a modern road leading to houses on the hilltop, exposing a cross-section that contained several fragments of Late Bronze Age pottery, thus confirming its chronological association with Gračec. At Planina Donja-Gradec, a rampart encircling the entire settlement was investigated. Although differing in form, the wooden construction elements discovered within its structure are similar to those documented at Gračec and Kosovac, indicating a shared building tradition.

The examined sites collectively illustrate a developed and standardized model of fortification construction characteristic of the Late Bronze Age hilltop settlements. All collected data provide a small but highly significant insight into the appearance of fortification systems in northwestern Croatia.

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Salt Through Time – A Multidisciplinary Approach to Understanding Salt, Life, and the Earth System

Salt – an element so fundamental to life – has profoundly shaped both the Earth's systems and human civilizations. The COST Action SaltAges (CA23141) brings together an international, multidisciplinary network of researchers to investigate salt in all its dimensions: from its geological origins and biological significance to its historical, technological, and socio-economic roles. Giant salt deposits, formed in restricted evaporitic basins over millions of years, represent not only archives of Earth's environmental history but also vast resources with the potential to address critical global challenges related to energy, climate, and sustainability.

The SaltAges network integrates approaches from geosciences, archaeology, history, biology, engineering, and social sciences to develop a holistic understanding of “salt giants” and their multifaceted impacts on planetary and human processes. By combining methodological innovation, interdisciplinary collaboration, and cross-sector knowledge exchange, the Action aims to advance research infrastructures and foster new frameworks for sustainable exploration and heritage preservation.



This poster presents the aims, structure, and methodological framework of the SaltAges COST Action, highlighting its potential to bridge the deep-time study of salt with contemporary scientific and societal needs.

Maarten Peels

Independent Researcher

An epistemology for prehistoric filmmaking

Critiquing films for being “inaccurate” representations of prehistory is straightforward, but what does it actually mean to produce an accurate prehistoric film? This paper explores the epistemological challenges involved in translating archaeological and anthropological knowledge into fictional narrative cinema, and proposes guidelines for conceptualizing scientific accuracy in this medium.

Fictional films aligned with current scientific consensus have significant public value: they can inform broad audiences, stimulate critical engagement, and open debate about the human past. Filmmakers then encounter problems parallel to those of archaeologists and anthropologists, especially when “filling in the gaps” with ethnoarchaeological analogies whose limitations are well established. At the same time, filmmaking resembles the practices of museum exhibition design and reconstructive art, where abstract theories and fragmentary data must be given a concrete and persuasive form. Additional challenges arise from cinema's narrative constraints, which typically focus on a single group in a specific place and time rather than broad-scale patterns. I argue that filmmakers should not be tasked with adjudicating between competing interpretations of archaeological evidence. Instead, they may freely choose among scientifically valid theories, provided their depictions remain plausible within the range of current scholarship. This freedom enables filmmakers to pursue narratives that are both engaging and intellectually grounded. In this sense, a prehistoric film functions as a focal point where multiple scientific theories converge into a tangible representation. Moreover, by staging reconstructions of past behaviours and material practices, filmmaking may itself be seen as a form of experimental archaeology. The “accuracy” of prehistoric films is thus best understood not as a matter of definitive truth, but as inhabiting a realm of plausible possibilities. Films created within this space can legitimately be said to show “what it was like,” in a manner that resonates with both scholarly expertise and public imagination.

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COST action GameTable (CA 22145) computational techniques for tabletop games heritage

There have not been many COST actions dedicated to the history of playing board games and how such games can obtain their digital form. In this respect, the COST action GameTable (CA 22145) can be considered as a pioneer undertaking. The action started in 2023 and it will last until 2027.



It seems that the approach to board games has always been twofold. While within mathematics and computer sciences, games have been used as testbeds for the development of the state-of-the-art methods in economics, engineering and AI, within humanities, board games have been studied as motivations that stand behind human play and social implications on individual and societal levels. In connection to this, board games are increasingly becoming accepted as parts of global intangible cultural heritage.

The GameTable action therefore tends to bring together archaeologists, heritage experts, mathematicians and computer scientists, with the aim of developing strategies on how to use game AI to study, reconstruct and preserve the intangible heritage of games. At the same time, the action is focused on introducing games in different stages of education, potentially including them in formal education.

All of the participants of the GameTable action are divided into five groups, according to their respective skills, fields of research and interests. The first group deals with search, planning, learning and explainability. Members of the second group deal with the cultural heritage of games, while the third group works on automated game and puzzle design. The fourth group will be working on mathematics in games. Finally, the fifth group will take care of implementation, dissemination and education.

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COST action MAIA (CA 23141) – managing artificial intelligence in archaeology

For more than a decade, several COST actions took place that dealt with digitization of cultural heritage, aiming to make the data obtained through archaeological research accessible to both fellow-archeologists and the broad public. After the COST actions Arkwork (CA 15201) and SEADDA (CA 18128), the action MAIA was approved. It started in 2024 and will last until 2028. The project focuses on the usage of artificial intelligence in the service of archaeology. As an extension of digitization, the usage of artificial intelligence (AI) applications has brought incredible opportunities in this scientific field. Different AI tools can be applied in detecting archaeological sites, recognition and reassembling different archaeological finds, text mining from historical documents and epigraphs, studying human remains etc. On the other hand, aspects like understanding which archaeological research questions could be addressed, the availability and creation of the data bases used as starting points for such research, ethical and other similar issues still need more in-depth discussion and exploration. This is why the MAIA COST Action focuses on creating a community of archaeologists, digital archaeologists and computer scientists with the common aim of developing a shared understanding of AI applications in archaeology. This goal will be achieved through meetings and workshops that will bring together researchers who wish to create or use digital collections and training data.

All of the participants of the MAIA action are divided into four groups, according to their respective skills, fields of research and interests. The first group deals with the state of the art in the relationship between AI and archaeology. Members of the second group tend to build digital comparative collections and AI training data for archaeology, while the third group examines the connection between AI and archaeological research. The fourth group will be working on dissemination and communication.

RECENT EXHIBITION

13TH

ABOUT THE EXHIBITION

The exhibition ***Archaeology and Popular Culture*** explores how archaeology has influenced diverse media and been represented through various forms of artistic and cultural expression – visual arts, literature, theatre, film, comics, music, toys, board games, and the gaming industry.

It also offers different perspectives on how artists, from the 15th – 16th centuries to the present day, have been inspired – sometimes even obsessed – by archaeology and archaeological sites, as well as how archaeology and archaeologists appear in today's popular culture.

October, 2nd 2025 – February, 1st 2026

ARCHEOLOGICAL MUSEUM IN ZAGREB

19 Nikola Subić Zrinski Square

1st floor

WORKING HOURS

Tuesday – Friday 10 am – 6 pm

Saturday 10 am – 8 pm

Sunday 10 am – 1 pm

MORE ABOUT THE EXHIBITION

<https://www.amz.hr/en/exhibitions/archaeology-and-popular-culture/>

arheologija
i popularna
kultura

archaeology
& pop
culture

2.10.2025. —
— 1.2.2026.



arheološki
muzej
u zagrebu

archaeological
museum
in zagreb

TRG NIKOLE ŠUBIĆA ZRINSKOG 19, ZAGREB

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Jutarnji list



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PUBLICATIONS





Papers from the 1st and 2nd conference *Methodology and Archaeometry* are published in the Journal *Opuscula Archaeologica* 39/40, Department of Archaeology, Faculty of Humanities and Social Sciences of the University of Zagreb, Zagreb, 2018.

https://hrcak.srce.hr/index.php?show=toc&id_broj=17098

Papers from the 3rd and 4th conference *Methodology and Archaeometry* are published in a book *Recent Developments in Archaeometry and Archaeological Methodology in Southeastern Europe*, Cambridge Scholars Publishing, Cambridge, 2020.

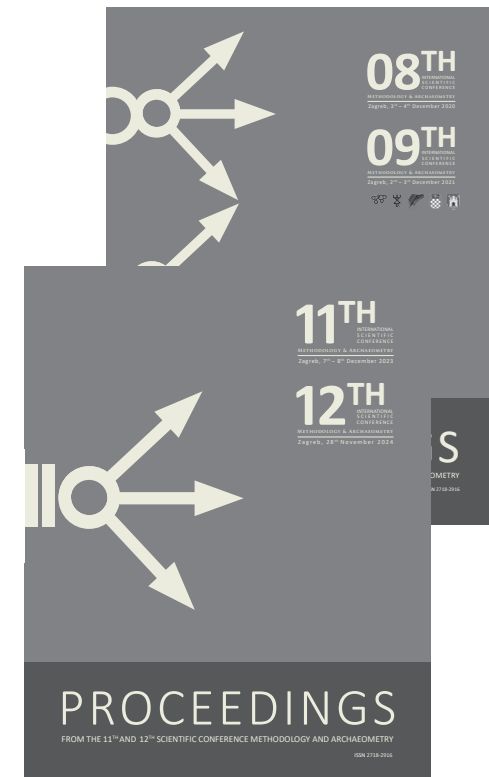
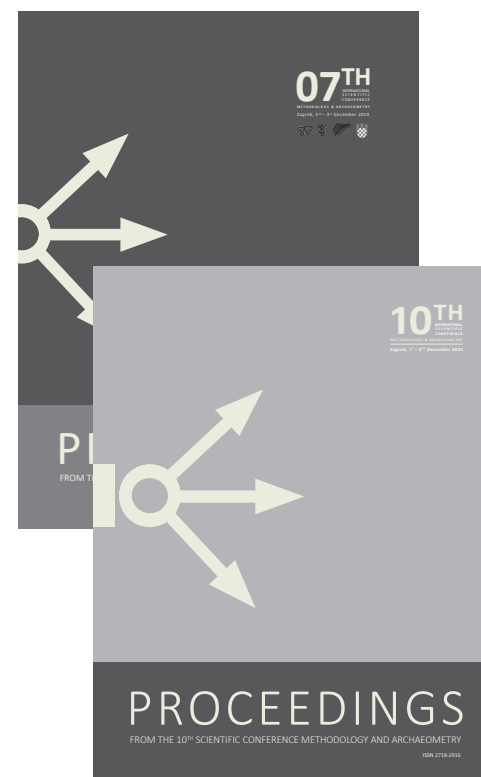
https://www.cambridgescholars.com/recent-developments-in-archaeometry-and-archaeological-methodology-in-south-eastern-europe?fbclid=iwar0nmmpb4m_uizm6gsxwiqdi-422ursres9oy0owlrp9gyjm3r316dghchas



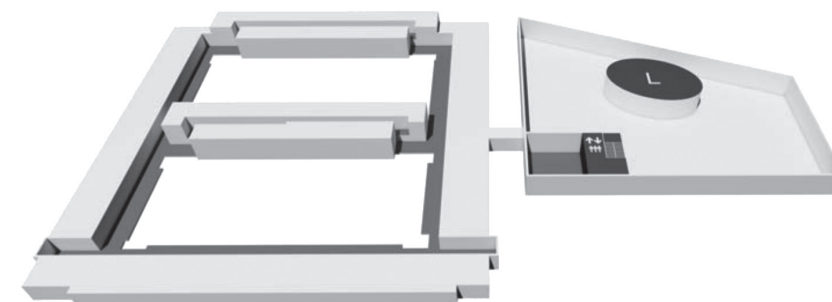
Since 2019 papers from the conference are published in the *Proceedings from the scientific conference Methodology and Archaeometry* on a platform for open access books of the Faculty of Humanities and Social Sciences, University of Zagreb (FF Open Press).

Proceedings are available on:

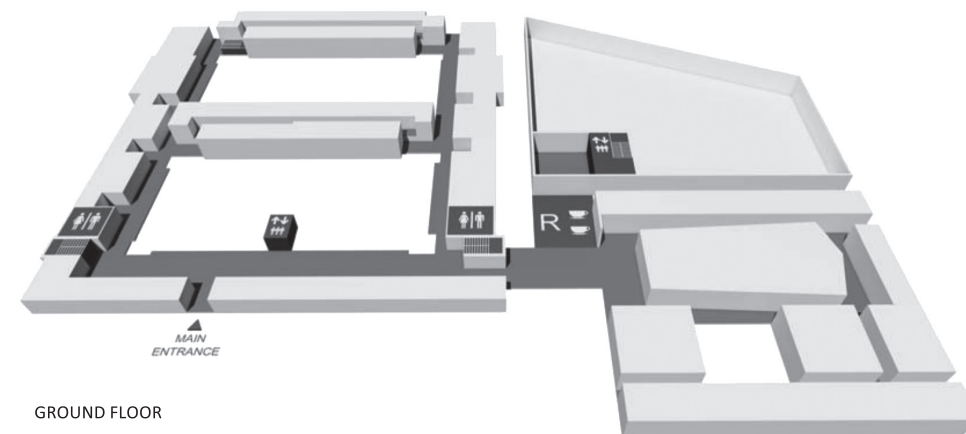
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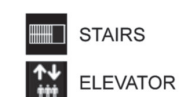
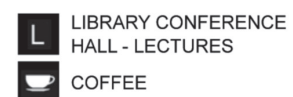
Faculty of Humanities and Social Sciences of the University of Zagreb GROUND PLAN



2ND FLOOR



GROUND FLOOR



The lectures will be held at the Conference hall on the 2nd floor of the Faculty Library (on the right of the main entrance of the Faculty building).

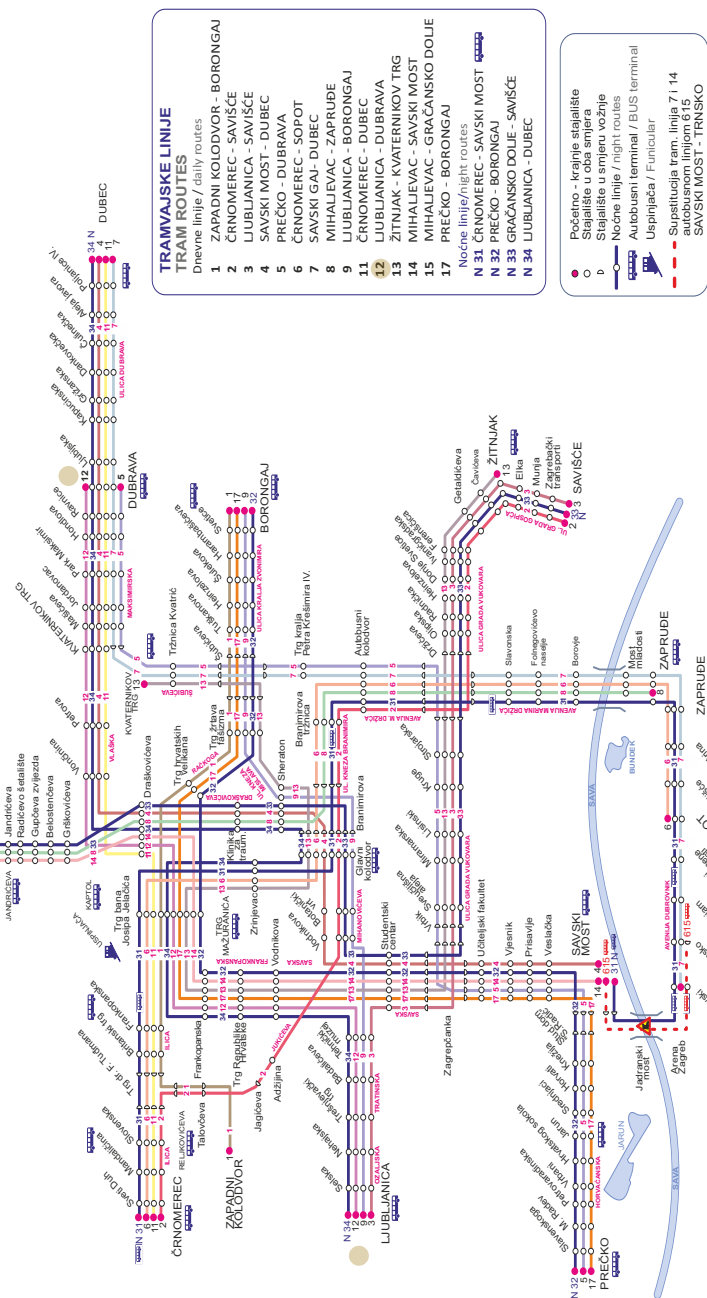


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Podrška korisnicima 072 500 400
www.zet.hr e-mail: javnost@zet.hr

TRAM SCHEDULE: <https://www.zet.hr/tram-lines/daytime-lines/591>



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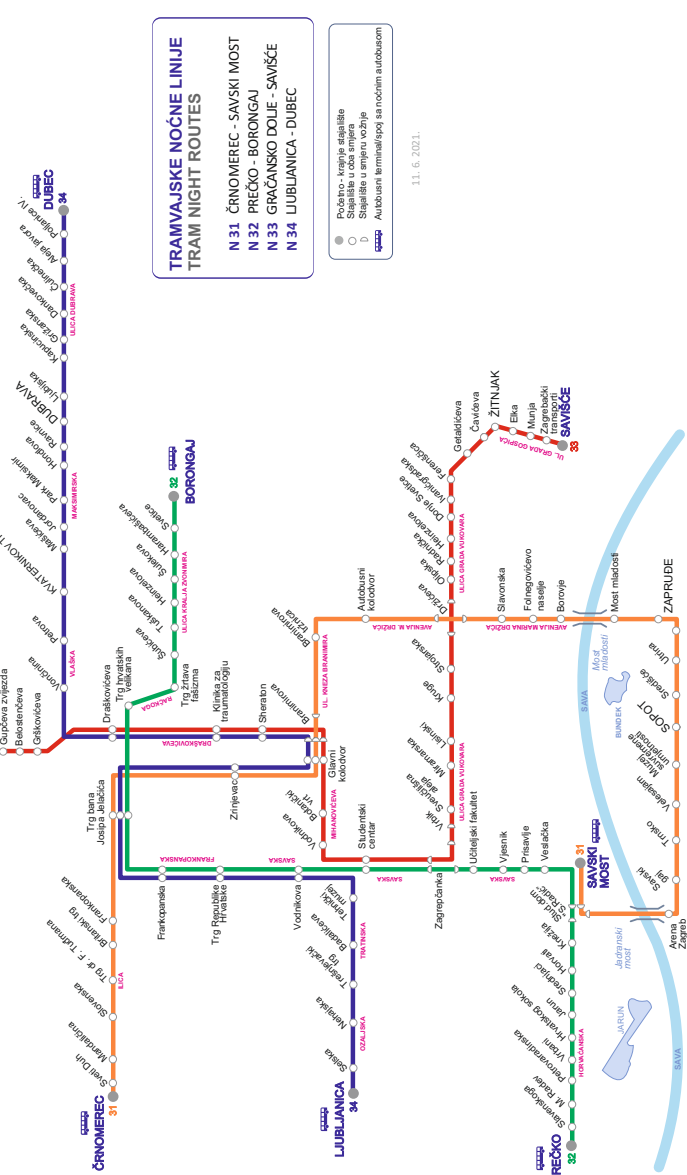


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