MET ARH

06TH INTERNATIONAL SCIENTIFIC CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 6th – 7th December 2018

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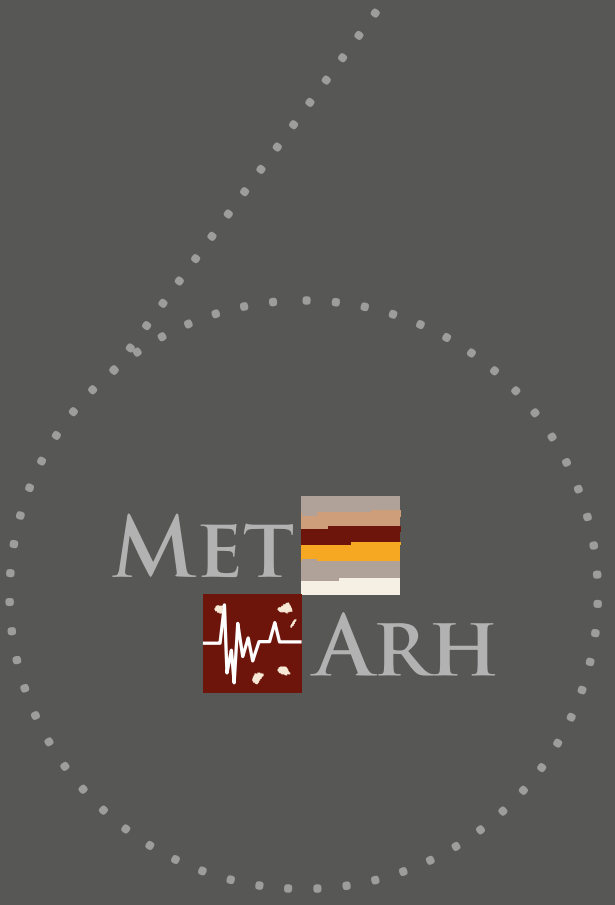
CONTENT


MET
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CONFERENCE METHODOLOGY & ARCHAEOMETRY

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.

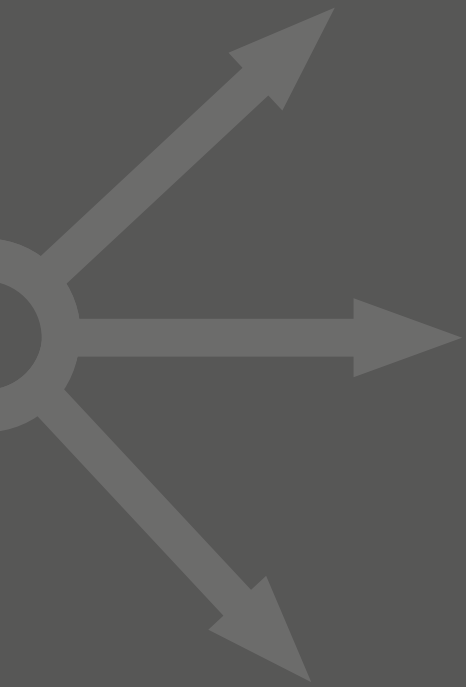
The interdisciplinary character of the conference brings together archaeologists and researchers from other scientific disciplines with whom archaeologists collaborate closely; and who – through their work, projects and ideas – promote new insights about Interpretation of the human life in the past.

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 the past processes and to give more objective and comprehensive picture of the past. Contemporary interpretation tools alleviate and speed the data collection and also provide us with countless possibilities of interpretation, protection and presentation of archaeological sites and the landscapes encompassing them.

Section Archaeometry

Having in mind limited information we obtain from archaeological excavations and from the classification of archaeological material, cooperation with other scientific disciplines becomes unnecessary, to obtain as much information as possible on the conditions and the way in which the humans lived in the past. Contemporary archaeology is a very heterogeneous discipline encompassing interest groups focussed 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 arhaeometrical 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 a continuous cooperation of a specific expert and an archaeologist from sample collection to the final interpretation.



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PROGRAMME

PROGRAMME

Thursday, 6st of December

9:00 – 9:15
Opening

Key-note lecture:
9:15 – 9:45
Dimitrij Mlekuž
ALS and landscape archaeology

Chair: Jacqueline Balen
9:45 – 10:00
Predrag Novaković & Dimitrij Mlekuž
Challenges of Big data in archaeology

10:05 – 10:20
Sara Popović
ArchaeoCulTour project – an integrated approach to landscape study

10:25 – 10:40
Lujana Paraman, Filomena Sirovica & Dinko Tresić Pavičić
Sutilija hill above Trogir: Value loss assessment of the site damaged by contemporary stone exploitation

10:45 – 11:00
Branko Mušič, Igor Medarić, Barbara Horn, Petra Basar, Hrvoje Potrebica, Igor Vukmanić, Ina Miloglav & Rajna Šošić Klindžić
Archaeological geophysics – an overview on experiences from surveys in Slavonia and Baranja

11:05 – 11:35
COFFEE BREAK (Library Foyer)

Chair: Predrag Novaković

11:35 – 11:50
Luka Gruškovnjak
Theoretical models of soil formation and soil geomorphology and their archaeological implications

11:55 - 12:10
Žarko Tankosić
An Approach to Survey Methodology from the Aegean: Norwegian Archaeological Survey in the Karystia

12:15 - 12:30
Rebecca M. Seifried & Helena Tomas
The Trials and Tribulations of Surveying the Cetina River Valley

12:35 - 12:50
Dubravko Gajski & Ana Solter
Spatial accuracy of a photogrammetrically reconstructed archaeological artefacts

12:55 - 13:10
Ivana Ožanić Roguljić, Kristina Turkalj & Kristina Jelinčić Vučković
The database of antique (Greek and Roman) archaeological sites of the Republic of Croatia

13:15 – 13:35
COFFEE BREAK (Library Foyer)

Chair: Rajna Šošić Klindžić

13:35 - 13:50
Dushka Urem-Kotsou
Pottery and cooking practices. An experimental approach to the study of use-alterations related to processing of food

13:55 - 14:10
Andreja Kudelić, Ina Miloglav, Izabela Andrašić, Dalibor Branković, Petra Lacković, Valentina Lončarić, Mia Marijan, Franka Ovčarić & Gabrijela Perhaj
Understanding the complex mechanisms of ceramic production in prehistory – experimental approach

14:15- 14:30
Milica Tapavički-Ilić & Jelena Anđelković Gražar
Storytelling. Is there a better method of archaeological site interpretation?

14:35- 14:50
Katarina Šprem & Ivor Karavanić
Results of a second lithic trampling experiment – some questions and a few answers

14:55 - 15:10
Franka Ovčarić & Branka Tomić
An experimental approach to reconstruction of wool dyeing in archaeology

15:15 - 15:30
Dora Šimić & Slavica Bošnjak
The technology of processing hard animal materials from the Vučedol site

15:35 – 16:30
LUNCH BREAK

16:30 - 17:15
POSTER PRESENTATION in the Library Foyer

Vidan Dimić
In chase for traces-experimental researches of polished stone axes, adzes and chisels and comparative traceological analyses

Katarina Šprem, Robert Matijašić & Rajna Šošić Klindžić
Stone as a resource in prehistory and antiquity

Selena Vitezović
Reconstructing the chaîne opératoire of the prehistoric osseous artefacts

Dragana Antonović, Selena Vitezović & Vidan Dimić
Tracing the evidence of prehistoric copper mining in Serbia

Antonela Barbir, Nikola Vukosavljević & Dario Vujević
Methodological approach to the taphonomic analysis of archaeomalacological assemblages: a case study of Vlakno cave

Viktória Mozgai, Boglárka A. Topa, Tamás G. Weiszburg, Zsolt Mráv & Bernadett Bajnóczi
Study of the niello inlays of a unique late Roman silver augur staff (lituus) from Brigetio, Pannonia (Hungary)

Jugoslav Pendić, Jelena Jovanović, Sofija Stefanović & Jelena Marković
People of Lepenski Vir: first results of developing guidelines for digitalization of osteoarchaeological record

Miroslav Vuković, Helena Tomas, Nikola Vukosavljević & Marcel Burić
Image-based modelling approach to the documentation of Crvenkuša cave site

Igor Kulenović, Šime Vrkić & Neda Kulenović Ocelić
Documenting, analyzing and evaluating a Dinaric karst landscape

Barbara Horn, Branko Mušič, Igor Medarić & Dimitrij Mlekuž
Geophysical and archaeological research of Eneolithic pile dwelling settlement Gornje Mostišče – emphasis on electrical resistivity tomography method

Jasmina Štajdohar, Žiga Kokalj & Ivan Šprajc
Lidar-based volumetric analysis of Maya settlement in the southeastern Campeche, Mexico

Miroslav Vuković, Ina Miloglav & Ivana Ožanić Roguljić
Methodological approach to a digital reconstruction of the Late Antiquity drywall structures from Banjače site (South Croatia)

AFTERNOON PROGRAMME

18:00
Visit to Archaeological Museum in Zagreb- conservation and preparation workshops, Museum depository and permanent exhibitions

20:00
Mingling in Kota café bar, Medulićeva 20.

Friday, 7th of December

Chair: Jacqueline Balen

10:00 - 10:15
Ki Suk Park, Ralf Milke, Erik Rybacki & Sabine Reinhold
Application of image analysis for the identification of ceramic pottery production technologies in the North Caucasus in the Bronze Age and the Iron Age

10:20 - 10:35
Andreja Kudelić, Attila Kreiter & Dinko Tresić Pavičić
Reconstructing the chaîne opératoire of Middle Bronze Age Pannonian Encrusted pottery: a case study of Jagodnjak-Krčevine (NE Croatia)

10:40 - 10:55
Esmeralda Agolli
Classification of Archaeological Ceramics: Insights from a Conceptual and Ideational Perspective

11:00 - 11:15
Sergios Menelaou
Beyond networks and macro-scale analysis: unravelling local micro-histories of pottery through an integrated methodology

11:20 - 11:35
Rajna Šošić Klindžić
After archaeometry gives us 42, what do we do?

11:40 - 12:10
COFFEE BREAK (Library Foyer)

Chair: Selena Vitezović

12:10 - 12:25
Viktória Mozgai, Bernadett Bajnóczi, Ernst Pernicka, Zoltán May, István Fórizs, Zsolt Mráv, Marianna Dági & Mária Tóth
Multi-analytical archaeometric investigation of late Roman silver objects from the Pannonian provinces – implications on composition, raw material provenance and technology

12:30 – 12:45
Tomislav Brenko, Sibila Borojević Šoštarić &, Stanko Ružičić
Mineralogical and geochemical characteristics of ore for possible iron production in Podravina region, NE Croatia

12:50 - 13:05
Ivan Jerković, Željana Bašić Ivana Kužić & Šimun Anđelinović
Application of posterior probabilities in osteometric sex estimation: a study on antique and late antique Salona population

13:10 – 13:25
Ante Lozina, Ivana Kružić, Šimun Anđelinović & Željana Bašić
Procedures regarding human osteological remains from excavation to presentation – European experiences

13:30 – 13:45
Goran Tomac
Mesolithic diet in the Žukovica cave (South Dalmatia, Croatia)

13:50 - 14:10
COFFEE BREAK (Library Foyer)

Chair: Nikola Vukosavljević

14:10 – 14:25
Andreja Sironić, Jadranka Barešić & Ines Krajcar Bronić
Bone dating at the Zagreb Radiocarbon laboratory, Croatia

14:30 – 14:45
Ines Krajcar Bronić, Andreja Sironić, Damir Borković & Marno Milotić
Can we determine the age of an old olive tree by the 14C dating method?

14:50 – 15:05
Laura Polonijo, Sara Essert, Andreja Kudelić & Snježana Karavanić
New evidence of nutritional habits during the Late Bronze Age: analysis of the carbonized plant remains from Kalnik-Igrišče

15:10 – 15:25
Luna Pavlović
Archaeobotanical research of the prehistoric site Ripač, Bosnia and Herzegovina

15:30 – 15:45
Petar Gabrić, Marko Banda, Ivor Karavanić & Luka Bulian
Lower and Middle Palaeolithic stone toolmaking and language:
a preliminary experimental archaeological and psycholinguistic study

15:50
CLOSING


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ARH

ABSTRACTS

Dimitrij Mlekuž
Department of Archaeology, Faculty of Arts, University of Ljubljana;
Institute for the Protection of Cultural Heritage of Slovenia, Ljubljana, Slovenia

ALS and landscape archaeology

For the last decade, ALS (Airborne Laser Scanning, or LiDAR) has become a relatively well known and accommodated technology in archaeology. A lot has been said on different technical aspects of ALS, mainly technological, data processing and visualisation challenges, while significantly less discussion was devoted to the impact ALS has on landscape archaeology and archaeology in general. The paper reflects on those issues, mainly: How to meaningfully accommodate ALS in landscape archaeology? What we actually do when we interpret ALS imagery? Which aspects of past landscapes does ALS allow us to see? Which not? What kind of past landscapes does ALS allow us to imagine? What are some challenges in the interpretation of ALS imagery? How to creatively engage with technology to explore new ways of engaging with ALS?

Predrag Novaković[1] & Dimitrij Mlekuž [1,2]
[1]Department of Archaeology, Faculty of Arts, University of Ljubljana;
[2]Institute for the Protection of Cultural Heritage of Slovenia, Ljubljana, Slovenia

Challenges of Big data in archaeology

Archaeology has very ambitious goals – to discover and interpret as many as possible aspects and phenomena of human life and activities in the past in every corner of our world and to assist with its knowledge in heritage protection, presentation and management in our societies. Archaeology is constantly expanding its field of expertise and research, together with its ability to deal with increasing quantity of data. But it is not the sheer quantity of data which requires reconsideration of data management in archaeology, it is the structure of data which is actually causing greater problems. Seeing the increased quantity as the only major problem would lead us to the 'conveyer belt philosophy'; it would suffice to develop appropriately faster and more efficient ways for data retrieval, storage and processing. This is a classical positivist view from which stems that more data means more accurate and better answers. But this ignores basic dialectic of science and research where theory, practice and environment in which science is practised, contrasted to each other, and result in new ideas and concepts. Mayer-Schönberg and Cukier (2013, 13-15) speak of three major shifts associated with Big Data. In the first place, there is a shift from sampling small (and as representative as possible) samples to sampling all. The second shift is from exactitude of data on smaller scales of observation towards their messiness on larger scales which, instead, enables insights at macro levels. And, finally, there is a shift from searching principal causality within data towards revealing correlations within data. Current definitions of Big Data frequently stress 3Vs when describing its nature – Volume, Variety and Velocity. Some add another 2Vs to it – Veracity and Value. Each of the individual Vs brings major changes which are discussed in this paper.

Sara Popović

Centre for Interdisciplinary Research in Landscape Archaeology, Faculty of Humanities, Juraj Dobrila University of Pula, Croatia

ArchaeoCulTour project – an integrated approach to landscape study

ArchaeoCulTour project aims at understanding the historical landscape of Vrsar municipality in Istria and assessing the potential of individual archaeological sites in the development of the cultural tourism of this region. The integrated approach to the research of this 40 km2 area implies a variety of employed techniques and methods. Airborne laser scanning (lidar) was acquired for the whole research area and it has again proved to be an invaluable data set for detection of archaeological features in areas covered with dense Mediterranean forest. Interpretation of lidar data was followed by extensive field reconnaissance of identified features and later targeted small-scale excavations. The results are mapped in GIS which enabled the correlation of this newly gathered data with historical cadastre and aerial imagery. This presentation will focus on the methodology applied and show results at the end of the first year of the project.

Lujana Paraman[1], Filomena Sirovica[2] & Dinko Tresić Pavičić[3]

[1]Trogir City Museum; [2]Archaeological Museum in Zagreb; [3]Kaducej d.o.o., Split, Croatia

Sutilija hill above Trogir: Value Loss Assessment of the Site Damaged by Contemporary Stone Exploitation

Sutilija (St. Elijah's) hill in Seget Gornji above Trogir is an important archaeological site characterised by a complex set of traces of anthropogenic activities from all time periods and marked by Iron Age and Medieval standing structures, as well as quarries that can be dated from Roman Period to Modern Times. As stone mining continues to this day in three active quarries, it is continuously subjected to harmful impacts that resulted in the vast devastation of the landscape, as well as the destruction of the archaeological features (Paraman, Tresić Pavičić 2017).

This was the stimulus for the project focused on monitoring of the site with the objective to document its present state and to collect the data about changes in the landscape. Through comparison of the data collected by geodetic survey and high-resolution 3D photogrammetry of the entire hill and the available spatial data (aerial photographs, cadastral maps etc.) a set of information was obtained that enables analysis of the changes caused by anthropogenic activities in different time periods. Results of this type of analysis are suitable for the valorisation of the site, as well as a value loss assessment through different periods of contemporary stone exploitation. As the collected data enables chronological separation of the harmful impacts, the authors will present a methodological approach to the reconstruction of their effects and the possibilities that this type of analysis has for the assessment of value loss on continuously endangered archaeological sites.

Branko Mušič[1,2], Igor Medarić[1,2], Barbara Horn[1,2], Petra Basar[1], Hrvoje Potrebica[3], Igor Vukmanić[4], Ina Miloglav[3] & Rajna Šošić Klindžić[3]

[1]Department of archaeology, Faculty of Arts, University of Ljubljana, Slovenia; [2]Gearh d.o.o., Maribor, Slovenia; [3]Department of archaeology, University of Zagreb, Croatia; [4]Archaeological museum in Osijek, Croatia

Archaeological geophysics – an overview on experiences from surveys in Slavonia and Baranja

In archaeological geophysics three basic geophysical methods (and their variants) prove to be successful in delineating archaeological structures in various environmental conditions and therefore provide an opportunity for instrumental exploration of archaeological phenomena:

- Magnetic method (Magnetometry and Magnetic susceptibility measurements),

- Electromagnetic method (Low-frequency EM method and Ground penetrating radar-GPR),

- Resistivity method (Resistivity mapping and Electrical resistivity tomography-ERT),

Magnetometry is by far most popular in archaeological prospecting, following by all other – GPR, resistivity and low-frequency EM method. The suitability of individual geophysical methods or combinations of several methods for solving a given problem depends on the contrast of the physical properties of the targeted object with its surrounding media. Since each method measures specific physical properties and also has its advantages and limitations, the most suitable ones in given archaeological, geological, geomorphological and geographical context have to be carefully chosen.

Among the archaeological factors, we consider the type of expected remains (stone-made structures, remains associated with craftwork activities, burned layers, pits, ditches, necropolises with burial mounds and flat cremation graves etc.), size of the site (or area under investigation) and depth of buried structures. Geological factors include the type of rocks or sediments and their physical properties (i.e porosity, moisture content, hardness–loosnes, structure, texture, chemical and magnetic properties etc.) in which archaeological remains are situated. Geographical factors represent latitude, longitude, altitude and consequently climate and weather condition in the region.

Geomorphology is a product of geological and geographical factors, while surface morphology reflects all the factors mentioned above. All factors together form characteristic settings of certain landscape unit. Therefore, archaeogeophysical survey strategy is a rather complex task, since all factors are interrelated and influenced one upon the other. The main focus of the presentation is on evaluating results obtained from several surveys on prehistoric and Roman sites in Slavonia and Baranja.

Luka Gruškovnjak
Department of Archaeology, Faculty of Arts, University of Ljubljana, Slovenia

Theoretical models of soil formation and soil geomorphology and their archaeological implications

The archaeological record, which is encased within the soil, is intimately linked with processes of soil formation and soil geomorphology. Thus, pedogenic and geomorphic processes represent a fundamental part of the archaeological record's formation processes. Therefore, they must be considered in archaeological research and interpretations, which is especially crucial in the case of archaeological field investigations. Because this is not always the case, this presentation will aim to briefly discuss some basic theoretical models of pedogenesis and soil geomorphology and point out their most important implications for archaeology. Firstly, the formation of soil horizons is crucial for archaeological stratigraphy, because the law of superposition does not apply to them. Failure to recognize them and document them as such in the field leads to an erroneous interpretation of the stratigraphic sequence. Secondly, together with soil horizonation the processes of pedoturbation are crucial for our understanding of the integrity and preservation of archaeological contexts and their stratigraphy or lack thereof. Thirdly, understanding the role of topography or landscape positions in geomorphic and pedogenic processes can help archaeologists to make some predictions concerning preservation and integrity of archaeological record in the landscape and help them in the decision making on field methodology and research strategies.

Žarko Tankosić
Norwegian Institute at Athens/Indiana University, Athens, Greece

An Approach to Survey Methodology from the Aegean: Norwegian Archaeological Survey in the Karystia

I present the research methods used during the Norwegian Archaeological Survey in the Karystia (NASK). NASK took place between 2012 and 2016 and was organized by the Norwegian Institute at Athens with the participation of an international group of students and researchers. The survey covered approximately 20 km2 of terrain in an area called the Katsaronio plain in southern Euboea, Greece. We used intensive archaeological surface survey methods trying to achieve several predetermined aims in an area that had not been archaeologically explored before. In the process, we recorded 99 archaeological sites (which we term "findspots") of varying date and size. For this survey, we designed our own methods, based on the modification of the classic so-called Mediterranean survey. We also introduced field recording based on Android tablets. Instead of following the more common plots survey, we adopted an approach that recorded the actual location of each artifact, irrespective of any artificial (and usually modern) land divisions. In this paper, I discuss the NASK survey results as well as the advantages and shortcomings of this methodology in comparison to other surveys in the same region and the wider Aegean.

Rebecca M. Seifried[1] & Helena Tomas[2]

[1]Institute for Mediterranean Studies, Foundation for Research and Technology, Crete, Greece; [2]Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb, Croatia

The Trials and Tribulations of Surveying the Cetina River Valley

This paper reports the results of experiments in field survey methodology and the interpretation of collected data from the 2015-2018 seasons of the Cetina Valley Survey. The Cetina River Valley in Dalmatia is the epicenter of the Early Bronze Age Cetina Culture. Much of what archaeologists know about the culture comes from excavated tumuli and cave sites. To date, only a handful of open-air settlements have been identified. In 2015, Dr Helena Tomas launched the Cetina Valley Survey in order to investigate the river valley and its connections with the Aegean world in the Bronze Age. One of the project's main goals was to conduct an intensive field survey along the course of the river with the hopes of locating additional open-air settlements dated to the Early Bronze Age.

Initially, the project followed the standard methods of the intensive survey as often employed throughout the Mediterranean Basin: tracts were defined as groups of agricultural fields, and teams of 4–5 people walked each tract at 15-meter spacing, counting all finds and collecting diagnostic material. After three seasons of fieldwork (2015, 2016, and 2017), two methodological problems became apparent. First, the team had identified only two open-air sites in a total walked area of 6.5 square kilometers- both later than the Early Bronze Age- suggesting that alluviation might be masking earlier sites. Second, the division of land into narrow strips cultivated on different schedules meant that 90-100% of a 'tract' might be unplowed or lying fallow, making it impossible to see the soil surface. In the 2018 season, the team attempted to mitigate these problems through a geomorphological study to trace changes in alluviation and the adoption of a survey methodology that targeted plowed fields with near-100% visibility.

Dubravko Gajski[1] & Ana Solter[2]

[1]Chair for Photogrammetry & Remote Sensing, Faculty of Geodesy University of Zagreb; [2]Archaeological Museum in Zagreb, Croatia

Spatial accuracy of a photogrammetrically reconstructed archaeological artefacts

The fully automatic photogrammetric reconstruction is one of the recent methods used widely for 3D-digitalisation of archaeological artefacts. The fast and simple data acquisition (taking photos by affordable cameras) as well as a straightforward data processing to reach photo-textured 3D-models, make this technology the most appropriate one in 3D-digitalisation. Although the photo-textured 3D-models of archaeological artefacts are generally employed for the promotion of exhibitions and to propel the audience to visit the museum they have even bigger potential to be utilized as an important component of the qualified documentation of virtually reconstructed artefact. In that case, the quality of 3D-model is of the highest importance. In this presentation, the spatial accuracy of photogrammetrically reconstructed 3D-model will be analyzed and dis-

cussed, focused on Structure-from-Motion (SfM) and Multi-View Stereo (MVS) methods. The results of scanning and Photogrammetry of archaeological artefacts will be compared and discussed, emphasizing the advantages and disadvantages of both methods.

Ivana Ožanić Roguljić, Kristina Turkalj & Kristina Jelinčić Vučković
Institute of Archaeology, Zagreb, Croatia

The database of antique (Greek and Roman) archaeological sites of the Republic of Croatia

The project The database of antique archaeological sites of the Republic of Croatia of the Institute of Archeology (BAZA) has been online since 24th May 2018 when it was set on the website of the Institute (http://baza.iarh.hr/public/locality/map). As a source of data, the available literature is used together with knowledge gathered from the Institute's scientific activities and data stored in the archives of the Institute of Archeology. The aim of the project is creating a database of Greek and Roman archaeological sites as the foundation for science, culture, preservation of Croatian heritage, as well as the presentation of cultural tourism. BAZA is based on archaeological sites in Croatia that are either known from the literature or by field research, with the aim of creating tools that provide easier access to the data needed for future scientific research, heritage management and the creation of professional and scientific projects that fundamentally represent archaeological heritage. The database is enriched with information about archaeological sites that are attractive enough to become a tourist destination. During the presentation of BAZA, we will show its structure and administrative part and how it is used in public search.

Dushka Urem-Kotsou
Department of History and Ethnology, Democritus University of Thrace, Komotini, Greece

Pottery and cooking practices. An experimental approach to the study of use-alterations related to the processing of food

This paper presents the results of an experimental study on ceramic cooking vessels and the use-alteration traces that different cooking techniques leave on internal vessels' walls. Experimental vessels were used for boiling variety of food of plant and animal origin, either separately or together, for baking bread and for parching cereals. In addition, soot depositions on the vessels' external walls produced by fuel were also monitored in order to approach the variability in temperatures the vessels were exposed and thus the food was cooked. The experimental study aims at better understanding of cooking practices in prehistoric periods when ceramic vessels begun to be used for processing of food.

Andreja Kudelić[1], Ina Miloglav[2], Izabela Andrašić[2], Dalibor Branković[2], Petra Lacković[2], Valentina Lončarić[2], Mia Marijan[2], Franka Ovčarić[2] & Gabrijela Perhaj[2]

[1]Institute of archaeology, Zagreb; [2]Department of Archaeology, Faculty of Humanities and Social Sciences University of Zagreb, Croatia

Understanding the complex mechanisms of ceramic production in prehistory – experimental approach

Within the program, Prehistoric Pottery: Interdisciplinarity and Experiment, a series of archaeological experiments were carried out with the purpose of a more comprehensive understanding of the prehistoric pottery production mechanisms during the Copper and Bronze Age. The program contains an educational-research and popular part and is intended primarily for students of archaeology with the aim of studying the pottery through the prism of technological, functional and social aspects. Such complex mechanisms should be considered from the perspective of different disciplines, namely geology, ethnology, and archaeology, which form an integral part of the presented program. The focus of the educational-research part of the program is an artefact, which includes getting acquainted with ceramic techno-functional characteristics. By replicating the assumed production processes throughout the established segments of the chain operations, and using different variables (different raw material, various types of temper material, different building and surface treatment techniques as well as used tools and various firing techniques), a reference collection is established. One of the aims is to describe the methodological procedure, the documenting principle, and how to properly set up an experiment in accordance with the scientific issues. Preliminary results have indicated that a very complex set of data was collected. In a relation to the set of research questions, the answers should be considered on the basis of detailed data processing and repetition and modification of individual experiments. The process of designing and conducting the experiment has also shown that the research questions, as well as the dynamics of deliberate and controlled experiments, have become more and more complex, ultimately leading to the archaeological interpretations that move within technical, technological, and economic aspects.

Milica Tapavički-Ilić & Jelena Anđelković Grašar

Institute of Archaeology, Belgrade, Serbia

Storytelling. Is there a better method of archaeological site interpretation?

Viminacium is a well-known Roman site in eastern Serbia, positioned on the right Danube bank. During Roman times, it was the capital of the Roman province Moesia Superior. Its wider area includes almost 450 hectares and it has been excavated for more than a century. The latest excavation phase was initiated at the beginning of this century. Several archaeological complexes were unearthed and also covered with protective constructions.

However, for a long time, the site was systematically destroyed. It was a victim of looting, done by professional treasure-hunters who looked for gold and other precious items. On the other hand, it was a victim of local farmers, who systematically destroyed architectural

remains and tombstones, taking useful materials home and re-using them. Finally, on the eastern end of the site, there is a strip mine that represented a permanent threat to the site.

At this crucial point, an idea was born to establish an archaeological park, actually, an open-air museum that would bring visitors to the site. It took several years and finally, in 2006, it was officially opened. Interpretations of archaeological finds and structures were offered to the public. In order to make these easily understandable, a narrative based on storytelling was designed. The authentic location surely offered a good basis that could easily help the narrative develop and grow. Eventually, the always growing number of visitors and their presence at the site lead to the always reducing number of looters and treasure hunters. Soon enough, they stopped looting. And soon enough, it was possible to evaluate the results of storytelling and visitors' impressions. Some of these impressions shall be presented in this paper, but also a short movie (5 minutes) that addresses all of the facts mentioned above.

Katarina Šprem[1] & Ivor Karavanić[2]

[1]Centre for Interdisciplinary Research in Landscape Archaeology, Faculty of Humanities, Juraj Dobrila University of Pula; [2]Department of Archaeology, Faculty of Humanities and Social Sciences University of Zagreb, Croatia

Results of a second lithic trampling experiment – some questions and a few answers

Following the interesting results of a trampling experiment done in 2016, a new trampling experiment was devised with a slightly altered methodology. The 2016 experiment consisted of 40 pieces of experimentally made lithic artifacts which were buried 15 cm deep on the heavily trodden path, trampled for 7 months, then carefully excavated, washed, and analyzed using a system developed by P. Villa and M. Soressi. (Vila and Soressi 2000). This year's experiment was done by trampling the artifacts placed on the surface in a 30-minute duration. The methodology and results of the experiment will be presented at this conference.

Franka Ovčarić[1] & Branka Tomić[2]

[1]Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb; [2]Department of Textile Chemistry and Ecology, Faculty of Textile Technology, University of Zagreb, Croatia

An experimental approach to reconstruction of wool dyeing in archaeology

Textile in archaeology has long been seen as an unreliable source of data due to the lack of methods that deal with the processing of such findings. Only during the last decade, serious analyses have begun to take place and have been an indispensable incentive for an interdisciplinary approach.

It was often possible to reconstruct the look of fabrics and decorative objects, while

searching for colour traces in which the fibers have been dyed has rarely been done. Textile colours and dyes are very important indicators of communication and connections of prehistoric communities.

Since the first traces of dyed textiles were found, the process itself had already been developed yet the experimental stage of selection and development of the dyeing process was unknown. In that case, answers to a variety of questions can be offered by experimental archaeology. This paper will present an experiment that was conducted from January to May 2018 through the cooperation of Department of Archaeology, Faculty of Humanities and Social Sciences in Zagreb and Department of Textile Chemistry and Ecology, Faculty of Textile Technology in Zagreb. With the use of literature, experts advice and ethnological sources, a wool dyeing process was carefully planned. It took several steps, such as collecting and processing wool, selecting natural dyes based on the ethnological sources, dyeing the wool and analyzing the samples obtained. This experiment represents the starting point for all future studies of dyed textiles in archaeology An important aspect of experimental archaeology lies in encouraging and nurturing of interdisciplinarity which offers new methods that are not a standard part of the archaeological profession. In collaboration with other branches of natural and human sciences, information about the past becomes more complete, and the interpretation itself more accurate.

Dora Šimić[1] & Slavica Bošnjak[2]

[1]Naumovac 25a, Zagreb; [2]Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb, Croatia

The technology of processing hard animal materials from the Vučedol site

Systematic and rescue excavations of the Vučedol site were conducted by Department of Archeology, Faculty of Humanities and Social Sciences from Zagreb in cooperation with Vukovar Municipal Museum since 1981. and Vučedol Culture Museum from 2012. Bone material that includes bones, teeth and horns comprises 1/3 of the overall findings on the site. It mechanical, physical and chemical properties make it a good material for tool production and other various uses. Research of bone industry and technology is becoming more important in the interpretation of archaeological context. Experiments are a key factor in studying traces of processing and use, visible in various archaeological artefacts, in this case, hard animal material. These facts prompted us to further study the technology of their making and implementation of the experiment.

The experiment will present different techniques of bone material processing, that is, dividing it into smaller segments (débitage). This will include using techniques like breaking, direct and indirect percussion, cutting, sawing etc. Experimental traces will be compared with the findings and samples from the past and recent excavations of the Vučedol site. The goal is to determine the techniques and tools used by prehistoric communities and to observe technological progress on the Vučedol site.

Ki Suk Park[1], Ralf Milke[1], Erik Rybacki[2] & Sabine Reinhold[3]

[1]Institut für Geologische Wissenschaften, Freie Universität Berlin; [2]Deutsches GeoForschungs Zentrum GFZ, Section 3.2, Potsdam; [3]Deutsches Archäologisches Institut, Berlin, Germany

Application of image analysis for the identification of ceramic pottery production technologies in the North Caucasus (Russia) in the Bronze Age and the Iron Age

The ceramic pottery production techniques were investigated by Matlab based 2D and 3D image analysis. Shape parameters of coarse sand grains (>250μm) and shaping techniques of the ceramic body were compared to each other. 70 ceramic pottery sherds in this study were excavated at Ransyrt 1, an archaeological site from the Middle-Late Bronze Age in the North Caucasian mountains, Russia and Kabardinka 2, located in the lower plateau in the same mountains (Late Bronze/ Early Iron Age) were compared to those of the samples excavated at the Mius peninsular and its near environment in Russia (Late/Final Bronze Age), in order to show chronological and regional changes of production techniques.

For the image analysis, 2D images of the heterogeneous ceramic composite materials were acquired by the polarized light microscopy and 3D images by the micro-computed tomography (3D-μ-CT). The calculation was performed for the whole sample area, in order to get the representativity for each sample. Together with the mineralogical/chemical composition of the sand grains within the ceramics, the shape parameters such as the size distribution, circularity and sphericity reflect differences in the preparation of ceramic pastes according to the sites. At the same time, these parameters show several groups within the same site, indicating different recipes in this preparation step. From the alignment of processing pores and sand grains, it is possible to identify shaping techniques of the ceramic body. The results from image analysis will be combined with the firing conditions for the ceramic pottery production reconstructed by scanning electron microscopy coupled with energy/wavelength-dispersive spectroscopy (SEM-EDS/WDS), X-ray diffractometry (XRD) and Fourier Transform Infrared spectrometry (FT-IR) from a parallel study, in order to unravel various technological styles that reflect the ancient potter's practical choices.

Andreja Kudelić[1], Attila Kreiter[2] & Dinko Tresić Pavičić[3]

[1]Institute of Archaeology, Zagreb, Croatia; [2]Hungarian National Museum, Budapest, Hungary; [3]Kaducej Ltd., Split, Croatia

Reconstructing the chaîne opératoire of Middle Bronze Age Pannonian Encrusted pottery: a case study of Jagodnjak-Krčevine (NE Croatia)

This presentation provides the first results of thin section petrographic analysis of Middle Bronze Age Encrusted pottery from the site Jagodnjak-Krčevine, which represent part of a broader data collection deriving from the research project concerning pottery technology during the Bronze Age in northern Croatia. The samples were selected according to the different typological groups of ceramic vessels and they originate mainly from graves. During sample selection, the different decoration styles characteristic of Pannonian Encrusted and Litzen/Kisapostag pottery were also considered. The main goal of this

study is to determine the characteristics of raw materials and ceramic pastes used by the potters as well as features of the firing methods. Another aim is to determine whether there are some indications of certain ceramic technological practices related to individual graves. An important objective of this research is to determine whether there are certain patterns in the selection of added tempering materials and how specific technological choices may be interpreted within the framework of economic and social aspects of society.

The results of the study show the utilisation of several different kinds of raw materials tempered with grog and rocks. The preliminary results seem to suggest that the selection of clay, as well as the added tempering material, are closely related to vessel forms, the function of the vessels and the decorating techniques applied. We also discuss potters' selection mechanisms of raw materials (potter's perception of raw materials) aiming to highlight the social nature of technological choices and consider that functional choices cannot be separated from the social milieu in which the vessels were made.

Esmeralda Agolli

Department of Archaeology and Culture Heritage, Faculty of History and Philology, Tirana, Albania

Classification of Archaeological Ceramics: Insights from a Conceptual and Ideational Perspective

The classification of the archaeological data has been the subject of a controversial discussion concerning the theoretical and methodological perspectives. The nonlinear concepts of evolutionary theory has greatly influenced the conceptual understanding of the methodology of classification of archaeological data and especially that of pottery. In this paper, through closer consideration of the production process and especially the concepts involved with artifact formation, particularly I focus on the ceramics classification and typology attempting to highlight the process of production through four stages: material selection, form, surface, and decoration. I argue that this understanding provides a rational avenue not only for the exploration of the physical choices made in the production system but also considers the conceptual choices embodied to the material. This approach passed over the terms of culture, focusing rather on the ways artifact classification reflects either common or individual choices of the artisans and how they fit to a general system of social values. Indeed, this strategy facilitates extensively any further analysis to ceramic data.

Sergios Menelaou

Research Center for Anatolian Civilizations, Koç University, Istanbul, Turkey

Beyond networks and macro-scale analysis: unravelling local micro-histories of pottery through an integrated methodology

The study of pottery has historically served as a testing ground for archaeological theories, both due to its abundance in the archaeological record and its multifaceted use in the development of various methodological tools for the investigation of issues of exchange and external influence, technological tradition, social organisation,

economic trends and other cultural associations in past societies. Although the study of pottery has largely extended the range of tools and techniques beyond traditional approaches that focus on stylistic, morphological and typological attributes aiming at constructing chronological sequences or reconstructing large-scale networks of interaction, recent years in Aegean studies have witnessed an increasing concern towards the technological significance of pottery and its social context from a rather scientific-processual perspective. Despite the ever-growing amount of data and new projects in both the prehistoric Aegean and Anatolia, these in many cases failed to characterise technological practices or changes/continuities that go beyond vessel form and surface finish or even to integrate archaeometric techniques in a meaningful way.

The project of Early Bronze Age Heraion on Samos Island, east Aegean (Greece) has successfully demonstrated that questions of production, consumption, and distribution of pottery can be meaningfully approached and old assumptions should be challenged through new studies of archaeological material. The almost complete absence of such work at the eastern Aegean has impeded a better understanding of the islands often thought of as intermediaries in the transmission of finished products, ideas, and people towards west. This has been achieved through typological study, phasing, and contextual analysis for the entire ceramic assemblages covering the third millennium BC, with the integrated study of macroscopic analysis, thin section petrography and microstructural analysis. This is supplemented by consideration of the local geology, ceramic resources and ethnography. Following a chaîne opératoire approach, the stages of manufacture have been reconstructed from a „bottom-up" perspective and a more detailed view of local developments has been gained.

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After archaeometry gives us 42, what do we do?

It is almost impossible to perform any archaeological research without using some method from other disciplines. We rely on data provided by archaeometrical methods to make our research more specific, more valid, more valuable.

Lithic raw material provenance is regarded as an important source of information about technological and social practices of prehistoric communities as well as a possible indicator of their complexities. Therefore archaeologists try with help of geologists to pinpoint the locations of the raw material extraction in hope to find answers about their habits and mutual connections. But what happens when we succeed? When in vast areas of possibilities for obtaining simple and similar raw material we really find the one prehistoric people preferred? We know now when, we know where, even how, but the main question remains. Why? We, archaeologists, deploy more and more various scientific methods, but our main goal remains the same. At that main goal is historical- knowledge about people in the past. So, solid and scientific valid evidence provided by archaeometrical methods are only the raw data, the beginning of archaeological interpretation. In this presentation I will reflect on my own research, present conclusions I tried to drawn and methods I will test to try to construct a valid archaeological explanation of irrational behaviour in the

supply of everyday common necessities that archaeometrical analysis detected. In order to investigate human behaviour in the past, we have to turn existing human behaviour and research of social networks to try to understand the complexities of decision making.

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Multi-analytical archaeometric investigation of late Roman silver objects from the Pannonian provinces – implications on composition, raw material provenance and technology

The Seuso Treasure, one of the most significant silver treasures of Late Roman Imperial Age, and the late Roman silver folding stand (quadripus) from Kőszárhegy (near Polgárdi, Hungary), which has close connections to the Seuso Treasure, were analysed using (geo)chemical methods in order to determine their elemental composition, provenance of raw material and production technology. Both are dated to the 4th century AD. Handheld X-ray fluorescence analysis was first applied to analyse the objects non-destructively and systematically along a pre-designed grid at several points. In order to determine the bulk chemical and lead isotopic composition of the objects and to verify the handheld XRF results, very small metal samples taken from the different parts of the objects were analysed by using LA-QICP-MS and MC-ICP-MS.

The analysed objects consist of rather pure silver (88–98 wt% Ag) intentionally alloyed with copper. The copper content is different in the various parts of the composite objects. Gold, lead and bismuth, the most important trace elements in the silver objects, also show various concentrations among the artefacts suggesting the use of different raw materials. Gold and lead contents of the objects (typically below 1 wt%) indicate that not reused or remelted, but primary, cupelled silver was used for manufacturing the artefacts. The different trace elemental composition (Bi, Au, Pb) of the different parts of the quadripus indicates the use of different silver ingots. In addition, the same parts of the two original feet are very similar regarding their trace element content, therefore series production is supposed. Based on the lead isotopic composition, the raw material of the objects could come from the Balkan area.

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Mineralogical and geochemical characteristics of ore for possible iron production in Podravina region, NE Croatia

The main goal of this study was to determine mineralogical and geochemical characteristics of possible bog iron ore samples found during geological investigations in the vicinity of Molve area. Based on numerous iron processing smelting workshops found throughout Podravina region, and on similar case studies in various archaeological sites in southern Hungary, it is believed that this type of ore was used for iron production from late antiquity up to Middle Ages in NE part of Croatia. Samples were found on the surface and several meters below the surface, with the largest sample weighing over 2 kilograms. In order to better understand bog iron ore and its formation mechanism, several laboratory methods have been performed. X-ray powder diffraction (XRD) was used to determine the mineralogical composition of samples. Detail geochemical characterization of two samples was performed using inductively coupled plasma mass spectroscopy (ICP-MS). Scanning electron microscopy with adjoining energy-dispersive X-ray spectroscopy (SEM-EDS) was used in order to better understand the distribution of mineral phases and geochemical components. The main mineralogical components of analyzed samples were quartz, goethite, feldspars and amorphic matter. Samples showed variable concentrations of Fe2O3 (37.86–39.06 wt.%) and MnO (19.17–27.42 wt.%). SEM-EDS analysis enabled characterization on the micromorphological scale, providing information on iron and manganese elemental distribution and possible formation mechanisms. Two different phases were detected, one being crystallized phase composed of iron and manganese minerals and second, amorphous phase, showing slightly different chemical composition with an elevated concentration of barium in the manganese phase. Based on mineralogical and geochemical characteristics, studied ore samples indicate the possibility of bog iron ore formation in Podravina region and its use for iron smelting and production.

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Application of posterior probabilities in osteometric sex estimation: a study on antique and late antique Salona population

Osteometric sex estimation via linear discriminant analysis is one of the most common and the most reliable osteological approaches for sexing skeletal remains applicable also on less preserved skeletons. However, as extrapelvic skeletal dimensions are population specific, discriminant functions need to be developed for each population separately. One of the major drawbacks of this method is also a high degree of overlapping values between male and female measurements that impact sex estimation accuracy. As previous research pointed out to the application of posterior probabilities as a solution, the aim of the present study was to test that approach on the archaeological

population and compare accuracy rates of discriminant functions developed by traditional and the novel approach.

The sample comprised 207 skeletons from Salona necropoles dated from 1st to 6th century. We estimated sex using pelvic measurements by DSP software and took 70 postcranial measurements. We analyzed sexual dimorphism using ANOVA and selected 10% of measurements that exhibited the highest degree of sexual dimorphism. For those measurements, we developed univariate and multivariate discriminant functions and calculated accuracy using traditional approach and posterior probability threshold set at 0,90.

The accuracy of traditionally developed discriminant functions ranged from 83 to 93% while discriminant functions with posterior probability threshold reached accuracy rates ≥ 95% independent of variables that were used. Nevertheless, as the all skeletons could not meet the demanded posterior probability level, the proportion of skeletons that could not be sexed ranged from 15 to 60%.

The study confirmed that application of posterior probabilities produces the highest accuracy rate acceptable not only in archaeological context but also in forensic cases. That approach also creates a certain proportion of skeletons for which sex cannot be estimated, which is why researchers, depending on research type must compromise between accuracy and proportion of sexed skeletons.

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Procedures regarding human osteological remains from excavation to presentation – European experiences

European Union member states have a vast experience regarding the world of archaeology and bioarchaeology. In the last few decades, the well worth significance is given to the human osteological remains, which transforms them from silent findings of ancient times to active witnesses of the past. The data obtained by research on human osteological remains ensures insight on diseases within certain social groups, as well as the context of their genesis and spreading throughout the course of history, but also on dietary habits of the population, level of economic development, certain traumas, occurrence of war, conflicts and violence inside the communities and migrations of larger ethnic groups. Approach to bioarchaeological research in the EU member states, for now, has no attribute of homogeneity and unification, although all the EU member states share certain similarities in processes of excavation, preservation, presentation, transportation, non-destructive and destructive procedures on human osteological material and in other processes correlated with handling human skeletal remains.

Goal of this research is, by comparing experiences of different EU member states, to determine the actual level of codification of procedures that deal with human skeletal remains, through research of the legislative framework in EU member states, to explore in which amount laws attribute to quality solutions regarding dealing with human osteological remains, and to provide guidelines for improving methods of researching human remains on basis of positive examples in EU countries.

The measure in which legal systems of certain countries give importance to osteological material in relationship to other archaeological findings will be taken into consideration, as well as the defining the differences between forensic and archaeological osteological findings, necessity of presence of archaeologist during the excavation process, taking osteological material out of EU member state for further scientific research, and also other issues of relevance for topic of researching human osteological material.

Goran Tomac
Trebevićka 28, Zagreb, Croatia

Mesolithic diet in the Žukovica cave (South Dalmatia, Croatia)

The presentation provides the results of the zooarchaeological analysis of macromammal remains from Mesolithic layers of the Žukovica cave on the island of Korčula. The layers, which were dated to Mesolithic on the basis of complete lack of ceramic products, were excavated in 2014 as part of the multi-year project aiming to research the prehistoric sites on the island, while the author analysed the faunal remains for his Master's degree thesis. In addition to the most significant information on natural and cultural background, the research history of the site, excavation methods, description of the material and its processing, the author shall present the acquired data on the identified animal taxa, quantitative details and the results of the taphonomy analysis. By comparing the results, the presentation will deal with the questions regarding animal carcass processing methods in the cave and its vicinity, whether its inhabitants hunted those species for food or some other reason, how often and during which season they visited the cave, whether it served as a residential or hunting camp, etc. By synthesizing the obtained data, the author will try to partially reconstruct the image of the island's Mesolithic inhabitants' every-day life and compare the subsistence strategies of Mesolithic hunters from Žukovica with those from the other contemporary sites along the eastern Adriatic coast.

Andreja Sironić, Jadranka Barešić & Ines Krajcar Bronić
Ruđer Bošković Institute, Zagreb, Croatia

Bone dating at the Zagreb Radiocarbon laboratory, Croatia

Bone is a biogenic material composed of a soft organic (collagen) and a mineral (bioapatite) tissue. During an organism's life span, 14C concentration in both bone tissues is equivalent to the atmospheric one. After the death of the organism, 14C concentration starts to decrease due to 14C radioactive decay, thus enabling carbon dating.

The bioapatite part of the bone is quite porous and susceptible to diagenesis, i.e., some carbon from the bone carbonate can be dissolved, and the carbonate from the environment can precipitate. On the other hand, collagen is a very long and stabile organic molecule. For this reason, when bones are dated, usually the collagen is extracted and used as a representative bone constituent. Collagen is usually well preserved in humid conditions, while at arid regions, it can be completely degraded.

In cremated bone, due to the very high temperature involved in cremation, all of the collagen is lost, but also the bone bioapatite restructures to a denser composition and prevents environmental carbonate to precipitate inside the bone structure. The carbon of the carbonate left in the cremated bone originates from structural carbonate in bioapatite, from burned collagen and from wood used as fuel for burning. Only, in this case, the apatite can be used as a reliable bone constituent for dating.

Accelerator mass spectrometry (AMS) 14C dating technique enables dating of quite small bone fragments. The 14C AMS was introduced in the Zagreb Radiocarbon laboratory almost 11 years ago. Here we will present some dates of apatite and collagen part of the bones and procedures for their 14C AMS analyses. Also, how to decide when the bone is well preserved, how to select the reliable part of non–cremated bone and how to recognize the reliable cremated bone will be discussed.

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Can we determine the age of an old olive tree by the 14C dating method?

Radiocarbon (14C) dating is a convenient and accurate method of absolute dating of organic materials. By measuring the 14C remained in the organic material we can determine the time elapsed since the death of the organism. Wood is a very reliable material for 14C dating and the calibration curves were obtained by precise dating of tree rings up to 12,000 years old. However, olive trees represent a kind of tree that does not save the oldest tree rings- the inner and oldest part of the trunk in olive trees usually rots, making the radiocarbon analysis of material from the first years of the life of the tree impossible.

The Old olive tree (Olea europaea L.) on the Veli Brijun Island, National Park Brijuni, Istria, Croatia, was expected to be 1600 years old. The inside of the Old olive tree was hollow so that the central, older wood was missing. Five samples were taken from the inner side of the trunk. All the results were obtained by AMS (accelerator mass spectrometry) measurement technique that enables analysis of very small samples containing a few milligrams of carbon. The conventional radiocarbon age expressed in years Before Present (BP) were calibrated by OxCal software using the IntCal13 calibration curve. The calibrated ages and age spans are expressed as “cal AD”. Four samples resulted in conventional radiocarbon ages of up to 150 BP. After calibration, it was found that the wood was not older than 300 years. This is in agreement with most other radiocarbon dates of internal wood from living olive trees, rarely older than 300 years. The last sample clearly indicated a younger branch dated to the period cal AD 1979 – 1981, showing thus the complexity of the olive trunk structure.

Laura Polonijo[1], Sara Essert[2], Andreja Kudelić[3] & Snježana Karavanić[3]

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New evidence of nutritional habits during the Late Bronze Age: analysis of the carbonized plant remains from Kalnik-Igrišče

The paper presents the preliminary results of archaeobotanical analysis of carbonised plant remains discovered inside the house dated to the Late Bronze Age. The samples have been collected at the archaeological site Kalnik-Igrišče during excavation campaigns 2016 and 2017. The plant remains were discovered inside the well-preserved remains of the house which was divided into three units. The spatial distribution of the archaeological findings and their characteristics seem to indicate a different function of each unit. The main objective of the research is to determine which types of carbonized plant macrofossils are present in the object and to establish whether there is any regularity in their appearance in relation to the position inside the house and in relation to other archaeological finds (eg. hearth area, area of deposited pottery remains, area of organic residues). The aim is also to compare the new data set with the results of the already conducted archaeobotanical research done on the sample from the nearby object that dates to the same archaeological period.

A total of 54 samples was analysed containing 7417 carbonized plant macrofossils. The most numerous were the findings of barley, millet, wheat, faba bean and oak. The results of the archaeobotanical analysis show that the inhabitants of Kalnik-Igrišče consumed cultivated plants (cereals and legumes) and collected various edible fruits from nature. The comparison with the previous archaeobotanical researches of the same site shows that the plant species and their frequencies are quite similar, however, some other species as well as carbonized thermally processed food remains have been recorded also.

Luna Pavlović

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Archaeobotanical research of the prehistoric site Ripač in Bosnia and Herzegovina

The archaeological site of Ripač is the first discovered prehistoric pile-dwelling settlement in Bosnia and Herzegovina. It is situated in the village of Ripač which lies on river Una in the southeastern part of the Bihać plain. The settlement extended along the Una River between and on Velika and Mala otoka (river eyots) as well as on two smaller islands. The prehistoric remains belong to the material culture of Illyrian tribe Japodes. The settlement had been inhabited during the Iron age as well as the Antics and the Middle Ages. The site was investigated several times but first investigations conducted by Radimský, Fiala, and Ćurčić during the period from 1893 until 1897 were the most extensive ones. Part of the material found at that time was analyzed and processed but a large part of the unexamined material can be found in the National Museum in Sarajevo. The unexamined plant material was brought from Sarajevo to Division of Botany of the Faculty of Science in Zagreb. I analyzed that material and revised smaller part of material

previously examined in the late 19th century. I used a dry sieving method as well as the Grid-method for sub-sampling since the sample amount was large. The sample contained mostly carbonized cereal grains which are preserved excellent so the determination of species was really successful. The results showed that the most common cereal found was Emmer wheat (Triticum dicoccon Schrank; grain, fragments of grain, spikelet fork), other wheat species are less present. Barley (Hordeum vulgare L.), millet (Panicum miliaceum L.), oat (Avena sativa L.) as well as legumes and different seeds of wild fruit and weeds were also found. This kind of research provides insight into the life of prehistoric inhabitants, above all their diet, farming, and environmental impact.

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Lower and Middle Palaeolithic stone toolmaking and language: a preliminary experimental archaeological and psycholinguistic study

Many authors suggest that there is a co-evolutionary relationship between Palaeolithic stone toolmaking and language. This assumption is, firstly, supported by experimental studies showing positive effects of verbal compared to a non-verbal demonstration during stone toolmaking acquisition in present-day humans. Secondly, it is backed by neurophysiological studies which demonstrate that both toolmaking and language activate overlapping brain regions and that they exhibit similar hemodynamic lateralization patterns in present-day humans. These studies have mainly been focused on Oldowan flaking and Acheulean handaxe manufacture. Studies on the effects of the verbal and non-verbal transmission modes currently suggest that both Oldowan and Acheulean acquisition are facilitated by non-linguistic gestures rather than purely spoken language. Furthermore, neuroimaging studies have found that the prefrontal cortex, an area typically associated with executive functioning, and the temporal cortex are activated more during Acheulean compared to Oldowan tasks.

We recruited twelve Croatian-speaking subjects with no prior experience in knapping. Subjects were taught the Oldowan chopper and Mousterian sidescraper manufacture in a verbal teaching and non-verbal basic teaching condition. Tool quality was assessed by measurements of various physical attributes and a subjective evaluation by two assessors on a 5-point scale. Subjects were also tested on a neuropsychological battery assessing visual attention, verbal working memory, visuospatial processing, planning, cognitive flexibility, general executive functioning and lexical-semantic processing. We hypothesize that there will be no significant differences between the verbal and non-verbal groups in the chopper manufacture task and that the verbal group will perform significantly better compared to the non-verbal group in the sidescraper manufacture task. Additionally, we hypothesize that chopper manufacture will be significantly positively correlated only with the visual processing tasks, while sidescraper manufacture will also be significantly positively correlated with the prefrontal functioning tasks. The obtained results will be interpreted within the framework of current evolutionary and cognitive theories.

POSTERS

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In chase for traces - experimental researches of polished stone axes, adzes and chisels and comparative traceological analyses

Until the end of the 80s, the general knowledge about ground stone edge-cutting tools in the Neolithic of Central Balkan was limited. In various publications, this important category of archaeological material was most often presented in form of cataloging, followed by descriptive and typological determinants, while the function of this tool was completely ignored or it was attributed according to very subjective typology. All tools with the cutting edge were interpreted as different types of axes (battle axes, wedge-axes, tongue and mould axes, miniature axes, etc.) while the adzes and chisels were not recognized in the archaeological material. Such a practice, based on subjective observations of the form without detailed analysis, led to errors in the general interpretation. This situation changed considerably, with the work by D. Antonović and by a radical change in the methodology of exploring this category of stone tools. A different focus of research and incorporation of functional-typological and petrological analyses led to the creation of a significantly larger data pool. Also, new research questions emerged. One of these, not completely solved problems at the global level, is the use-wear on these tools, that is, traceological markers that clearly separate axes, adzes and chisels, as well as markers that are formed on these tools individually in performing various tasks including different factors. There are still no sufficient publications regarding the occurrence and development of these specific damages. Therefore, the author's doctoral dissertation will focus on the exploration of the traces of the production and use of the mentioned tools through the archaeological experiment. The aim of the research is to form a comprehensive reference database of traceological markers through experimental archaeology as a supporting research method, through which, in the future, a comparison and functional determination of original polished stone tools with a cutting edge would be made.

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Stone as a resource in prehistory and antiquity

It can be argued that stone has been one of the most important kinds of raw material during most of human existence. Even though the information about provenance or source location of raw stone material found on archaeological sites can tell us a lot about societies and economies of the time period in question, this type of research isn't often in the focus of archaeology. We propose to sample quarry sites, as well as other pri-

mary and secondary deposits of different raw material in the Northern Adriatic that may have been used in prehistory and antiquity of Istria to obtain a relevant reference base for provenance studies. Istria is a geographically relatively enclosed region with geological surface deposits that allow for different raw stone material exploitation. Depending on the stone raw material, different macroscopic and microscopic analyses will be used.

Selena Vitezović
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Reconstructing the chaîne opératoire of the prehistoric osseous artefacts

The bone industry was an important segment of prehistoric industries; osseous raw materials were widely used for everyday tools, weapons and ornaments, along with wood and stone. Reconstruction of the manufacturing procedures is important for analyses of the organisation of production, technological know-how and in general the importance of this craft for the given prehistoric community. Traces of manufacture are often covered by use wear traces; however, they are sometimes partially preserved on the finished objects. Combined analyses of manufacture debris, semi-finished items and traces still visible on used objects can provide the reconstruction of the manufacturing procedures. In this poster will be presented several examples of reconstructing the production sequence for some Neolithic artefacts, using macro- and microscopic observations and interpreted after the experimental results of different authors.

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Tracing the evidence of prehistoric copper mining in Serbia

Mining of metallic raw materials and the knowledge of the ore processing technology represent one of the key turning points in human history, which changed dramatically not only the economy of the prehistoric societies but also worldviews in general. Relatively frequent finds of malachite lumps and beads, discovered at several Mesolithic and Early Neolithic sites across Serbia show that the prehistoric artisans were already familiar with the technical traits of these raw materials.

Prehistoric metallurgy was invented in the Late Neolithic Vinča culture in Serbia, c. 5000 BC. The first exploitation of the carbonate copper ores (malachite, azurite) is confirmed on the prehistoric mine of Rudna Glava near Majdanpek. The production of copper and later bronze objects gradually increased through the Eneolithic and the Bronze Age. This increase in the production of objects must have been followed by an increase in ore exploitation. However, it is still unknown which mines were active during the post-Vinča metal ages.

In this poster will be presented the methodological framework for a multi-disciplinary approach to the search of the traces of prehistoric copper mining on the territory of Serbia and some of the preliminary results.

In order to reconstruct the system of the copper ore acquiring, a detailed survey of all so far known copper sources on the territory of Serbia is needed. Beside ground-field survey, the studies should include the use of the LIDAR technology. This method already provided positive results in finding the traces of early mining activities in Bulgaria. The next step is creating the comprehensive database which will enable correlating diverse analyses of prehistoric copper and bronze objects from one side and samples obtained from the mines from the other.

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Methodological approach to taphonomic analysis of archaeomalacological assemblages: case study of Vlakno cave

Shells of marine and land mollusc exploited by prehistoric humans contain archives of palaeoecological and palaeoclimatic data, as well as of human behaviour in coastal settings. Here we present a method for studying archaeomalacological assemblages from cave sites and describe an application of this method in the analysis of remains recovered from systematic excavations at Vlakno cave (Dugi island, Croatia). The study was based on marine gastropods, marine bivalves and terrestrial gastropods from late Pleistocene and early Holocene layers. In that period, a significant paleogeographic and palaeoecological changes occurred, mostly visible in the Adriatic area through flooding of the north Adriatic lowland by increasing sea level. Taphonomic studies have an important role in the identification of agents that modify shells and of processes that affect shell midden formation. This study contributes to enhanced interpretations of human activities and paleoenvironmental and paleoecological reconstructions of eastern Adriatic coast.

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Study of the niello inlays of a unique late Roman silver augur staff (lituus) from Brigetio, Pannonia (Hungary)

Niello, a bluish black metal sulphide, which was widely used for decoration of metal objects in the Roman Empire. However, our knowledge concerning the exact Roman-period niello technique, the appearance of binary silver-copper sulphide niello decorated silver objects is very obscure. An extensively nielloed silver augur staff (lituus), the only one known from the Roman Empire, was analysed non-destructively

with SEM-EDS and micro-X-ray diffraction techniques. Five niello types were identified, their chemical compositions range from silver sulphide (Ag2S, acanthite) to binary silver-copper sulphide of Ag:Cu ratio 1:1 (stromeyerite). The augur staff is the first object ever analysed, which is decorated with such heterogeneous niello inlays. Mineralogical and archaeological arguments indicate that the niello heterogeneity is connected to the primary production of the object rather than to any post-production repair. Texture-related mineral phase observations allow closer insight into Roman niello technology. The variable copper content does not represent any technological innovation. The silversmith simply used not only, silver but also differently debased silver, possibly scrap materials for producing niello. Both production (260–280s AD) and burial (early 4th century AD) periods of the lituus are well-dated and the object was excavated from an undisturbed sarcophagus. Therefore, our data imply that silver-copper sulphide niello reaching even the composition of stromeyerite was used by the Roman craftsmen two hundred years earlier than previous studies indicated.

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People of Lepenski Vir: first results of developing guidelines for digitalization of osteo-archaeological record

The success in adoption and overall enthusiasm of the archaeologist with the process of 3d scanning of artefacts and contexts has been on the rise in the past years. This could be easily explained: the requirements for doing a quality 3D information capture plummeted with the appearance of the novel and general- public based approach to data acquisition. The IBM (Image Based Modelling) on it's basic levels required only a camera and some overcast sky or studio light, to have your site, your trench or a newly uncovered artifact, preserved as accurately scaled digital copy, for as long as the storage units would hold the data. There is a flaw, however, present in the fact that this technology has been majorly promoted for use in documenting the very special, beautiful and exquisite of the archaeological record – which is only a small portion of its extent in totality. The mundane and unattractive artefacts and remains of past populations remain untreated, as the process is biasing against the ordinary. In this poster, we present preliminary results of the project "People of Lepenski Vir: protocols for digitalization of bioarchaeological heritage", supported by the Serbian Ministry of Culture and Information, that targets the obfuscated material, the unattractive, but still well known for its importance.

The project aims to create a digitalized archive of the important anthropological collection from Đerdap gorge, dated to Mesolithic and Neolithic period, providing open access to digitalized 3D models. With use of computed tomography and IBM, remains of individuals that were living during one of the most extraordinary periods of human history will be made accessible to a wide audience, retaining metric data and possibility to be analyzed online, while at the same time allowing for the real remains to stay out of exposure and potential harm done during handling.

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Image-based modelling approach to the documentation of Crvenkuša cave site

Archaeological excavations at the cave complex Crvenkuša – Tamnica – jama Suhi Rumin were conducted in the fall of 2018 as part of the HRZZ funded project „Where East Meets West – the Cetina River Valley as an Ancient Pathway of Communication (Cetina Valley Survey)", led by prof. dr. sc. Helena Tomas. Although surface pottery was identified as dating back to the early Neolithic impresso culture, subsequent excavation has shown a mixture of archaeological material from various time periods, which points to the secondary context of the finds.

The documentation process regarding cave sites follows an established practice where the location of the trench is shown in both a topographical ground plan of the cave and a cross-section for the visualization of elevations. The metric data needed for the generation of these plans is usually collected using simple laser distance meters or tape measures, with the level of detail determined by the surveyor, who takes measurements at a smaller or a bigger interval. The resulting two-dimensional documentation is therefore to some extent subjective, as the person recording the data determines the level of detail needed.

3D recording of cave sites provides a much more objective dataset for the reproduction of plans but has until recently been limited to the use of terrestrial laser scanners which by the nature of their design work very well in low light environments. On the other hand, the use of image-based modelling is heavily dependable on the amount of light available inside the caves. In our case study, a combination of natural light and minor artificial light sources provided us with nearly ideal conditions to test out the utility of photogrammetric 3D models for the documentation of cave excavations. The results of our case study will be presented in the context of past documentation methods and potential problems regarding documentation of cave sites using image-based modelling.

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[1]Gearh d.o.o., Maribor; [2]Department for Archaeology, Faculty of Arts, University of Ljubljana; [3]Institute for the Protection of Cultural Heritage of Slovenia, Ljubljana, Slovenia

Geophysical and archaeological research of Eneolithic pile dwelling settlement Gornje Mostišče – emphasis on electrical resistivity tomography method

Based on lidar images analysis an area of 100 x 44 m with topographical relief up to 0.6 m above the terrace was discovered on the Iščica river modern floodplain, located at the SE part of Ljubljana Moor. Three test excavation trenches at the south side of the area, named Gornje Mostišče, had unravelled mostly burnt cultural horizons (dated ~5040 BP) with preserved wooden construction (plateau) underneath.

Further non-destructive multi-method geophysical approach was applied in a wider area, providing horizontal and vertical levels of distinct information significant for each method. Results of geophysical research with magnetometry, ground penetrating radar and earth resistance mapping have outlined the horizontal layout of the settlement area within its immediate natural environment composed of mostly fine-grained quaternary sediments. Inside the settlement also individual dwellings are discernable to a certain extent.

The emphasis of this work is put on the results of the electrical resistivity tomography (hereafter ERT) method, which was applied in selected areas for further detailed investigation. Results of ERT method are of quantitative nature, providing not only lateral dimensions of archaeological and/or geological structures but also depths of buried horizons with distinctable resistivity, i.e. stratigraphy of archaeological sites. Therefore a detailed quantitative analysis of 2D and 3D ERT subsurface models is provided, which explains and outlines archaeological and geological horizons. Integrated results of ERT method with archaeological, lidar and other geophysical data have to lead to a better understanding of the settlement dynamics and surrounding geoarchaeological and palaeoenvironmental context.

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Airborne laser scanning-based volumetric analysis of Maya settlement in the southeastern Campeche, Mexico

Since 1996 eleven field surveys have been conducted in the southeastern Campeche in the central parts of the Yucatán peninsula – the area once occupied by the Maya. Various archaeological sites were recorded during the archaeological reconnaissance, including large centres with monumental architecture. Until recently, archaeological research of this area depended mainly on the field surveys and aerial photos. Airborne laser scanning of the area was commissioned by the Research Centre of the Slovenian Academy of Sciences and Arts in 2016. The derived elevation visualizations revealed extensive anthropogenic modifications hidden under the dense canopy of broad-leafed, semi-deciduous tropical forest. Various archaeological features were recognized. The most prevalent are residential and non-residential buildings, pyramidal structures, ball courts, sacbeob, plazas, quarries, terraces, stone walls, water canals, and aguadas. Through visual inspection of lidar-derived visualizations, we identified and polygonised buildings, platforms, and aguadas and assessed their volumes. Our analysis focuses on the distribution of volume across the area and the poster outlines preliminary results.

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[1]Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb; [2]Institute of Archaeology, Zagreb, Croatia

Methodological approach to a digital reconstruction of the Late Antiquity drywall structures from Banjače site (South Dalmatia, Croatia)

The archaeological site Banjače, in the vicinity of Split in Croatia, was excavated by the Department of Archaeology of the Faculty of Humanities and Social Sciences during rescue excavations conducted along the route of the Adriatic freeway. The results of excavations and wider area field surveys revealed a rural settlement or an agricultural complex dating back to the beginning of the 5th century. Two drywall structures were excavated, containing numerous archaeological finds (ceramic, metal finds, bronze coins, glass, loom weights etc.) Both structures were heavily deteriorated, and only low walls were preserved. The whole site was also covered with tegulae suggesting that both objects had a roof. Based on their size and position, the presence of a fence and a cattle pen, it can be concluded that both structures were used as working, and not living areas and that the settlement was utilized for sheep herding, among other uses. This type of drywall construction as an architectural model of housing is traditionally very recognizable in the landscape on the eastern Adriatic coast.

For presentational purposes, we decided to create a digital reconstruction of the site as it might have looked like in the beginning of the 5th century. The primary source of information were the results of the archaeological excavations, but since the structures were in a bad state of preservation we also used ethnological publications dealing with the topic of rural drywall structures on the eastern Adriatic coast. Since our conclusions regarding the reconstruction came from multiple sources it was also necessary to outline the consistency criteria used in the process. Various stages of the 3D modelling process will be presented along with our workflow within the open source software Blender. The poster will also present the sources and information we used in the 3D modelling process and outline our methodological approach to the digital reconstruction of an archaeological site.

M1:1

06TH INTERNATIONAL SCIENTIFIC CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 6th – 7th December 2018

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Ministarstvo znanosti i obrazovanja

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ODSJEK ZA ARHEOLOGIJU FF SVEUČILIŠTA U ZAGREBU
DEPARTMENT OF ARCHAEOLOGY FACULTY OF HUMANITIES AND SOCIAL SCIENCES, UNIVERSITY OF ZAGREB
Ivana Lučića 3
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Trg Nikole Šubića Zrinskog 19
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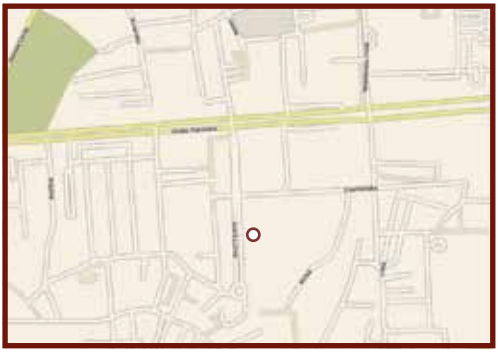
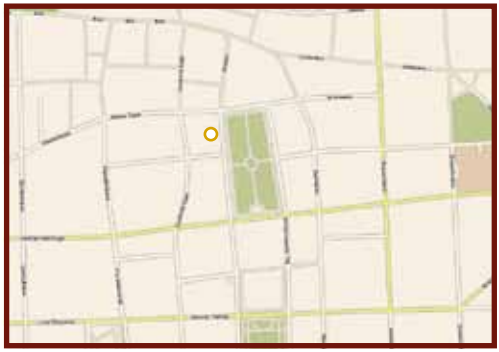
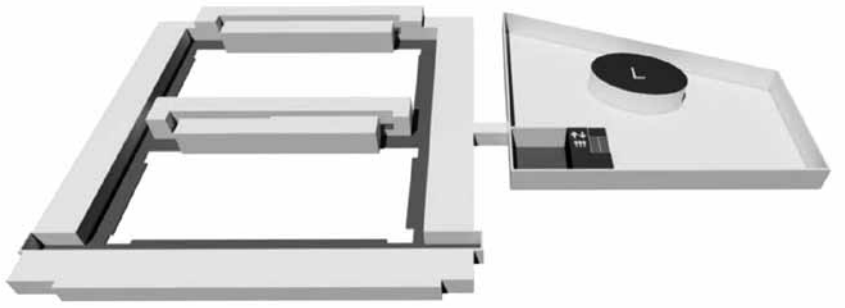
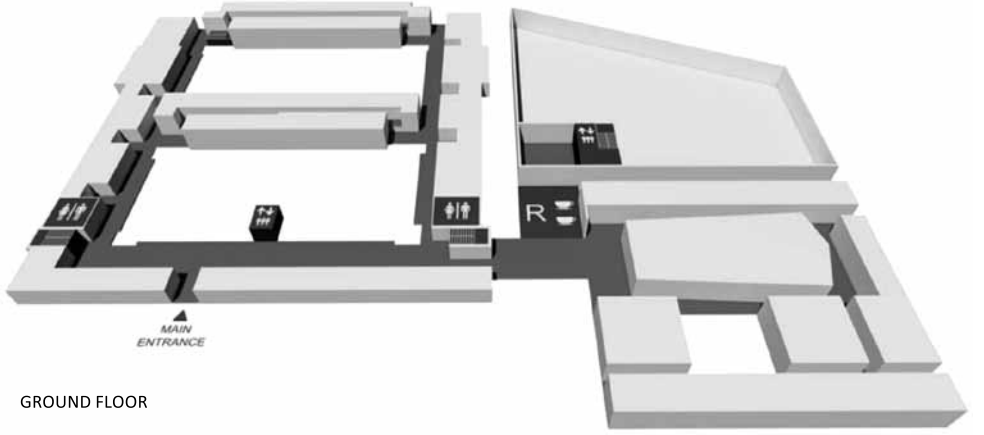




GROUND PLAN



2ND FLOOR



GROUND FLOOR

L LIBRARY CONFERENCE HALL - LECTURES
COFFEE
R REGISTRATION
TOILET
STAIRS
ELEVATOR

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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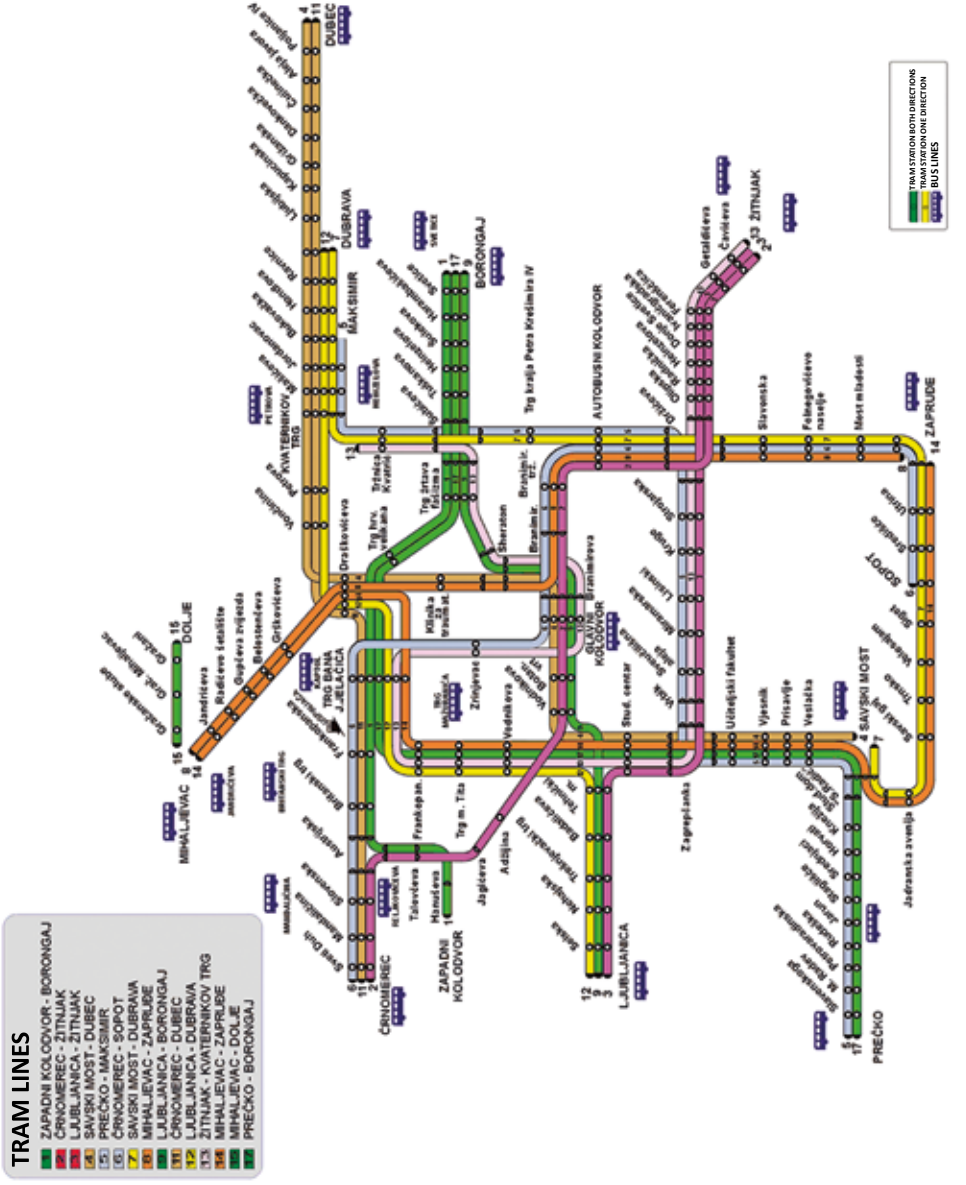
http://www.zet.hr/



TRAM SCHEDULE

LINE NUMBER	TERMINAL	DEPARTURE TIME								
		MONDAY - FRIDAY			SATURDAY			SUNDAY		
		FIRST	LAST	EVERY	FIRST	LAST	EVERY	FIRST	LAST	EVERY
1	Zapadni kolodvor	4:42	23:29	12 - 19						
	Borongaj	4:51	23:20	min						
2	Črnomerec	4:42	23:20	8 - 13	4:44	23:15	10 - 16	5:33	23:29	15 - 20
	Savišče	4:44	23:30	min	4:49	23:32	min	5:40	23:37	min
3	Ljubljanica	4:03	23:30	12 - 16						
	Savišče	4:50	00:16	min						
4	Savski most	4:49	23:26	9 - 14	4:52	23:43	9 - 15	5:41	23:29	12 - 19
	Dubec	4:38	23:26	min	4:30	23:20	min	5:42	23:11	min
5	Prečko	4:48	23:28	10 - 15	4:55	23:21	11 - 15	5:46	23:18	12 - 16
	Maksimir	4:51	23:31	min	4:56	23:22	min	5:39	23:11	min
6	Črnomerec	4:44	23:30	6 - 13	4:44	23:23	8 - 13	5:40	23:24	9 - 17
	Sopot	4:49	23:29	min	4:48	23:28	min	5:47	23:14	min
7	Savski most	4:49	00:19	7 - 12	4:48	00:12	9 - 15	5:47	00:11	11 - 16
	Dubrava	3:56	23:26	min	3:57	23:20	min	4:56	23:21	min
8	Mihaljevac	4:42	23:20	15 - 17						
	Zaprude	4:42	23:20	min						
9	Ljubljanica	4:07	23:25	8 - 14	4:09	23:26	9 - 17	5:06	23:30	10 - 17
	Borongaj	4:41	23:57	min	4:43	00:00	min	5:40	00:05	min
11	Črnomerec	4:38	23:38	6 - 12	4:45	23:21	8 - 17	5:39	23:23	11 - 17
	Dubec	4:43	23:18	min	4:45	23:25	min	5:40	23:22	min
12	Ljubljanica	3:56	23:28	7 - 11	4:02	23:20	8 - 15	5:02	23:16	9 - 17
	Dubrava	4:39	00:12	min	4:46	00:04	min	5:46	00:00	min
13	Žitnjak	4:52	23:53	12 - 19	4:41	23:24	11 - 22	5:45	23:21	12 - 18
	Kvaternikov trg	4:32	23:35	min	4:52	23:23	min	5:45	23:22	min
14	Mihaljevac	4:40	23:30	8 - 14	4:40	23:20	7 - 12	5:40	23:32	8 - 12
	Zaprude	4:37	23:33	min	4:45	23:19	min	5:45	23:07	min
15	Mihaljevac	4:30	23:23	11 - 12	4:30	23:23	11 - 12	5:38	23:23	11 - 12
	Dolje	4:41	23:34	min	4:41	23:34	min	5:50	23:34	min
17	Prečko	4:46	23:15	7 - 12	4:45	23:17	9 - 15	5:42	23:18	9 - 15
	Borongaj	4:43	23:23	min	4:53	23:25	min	5:50	23:26	min

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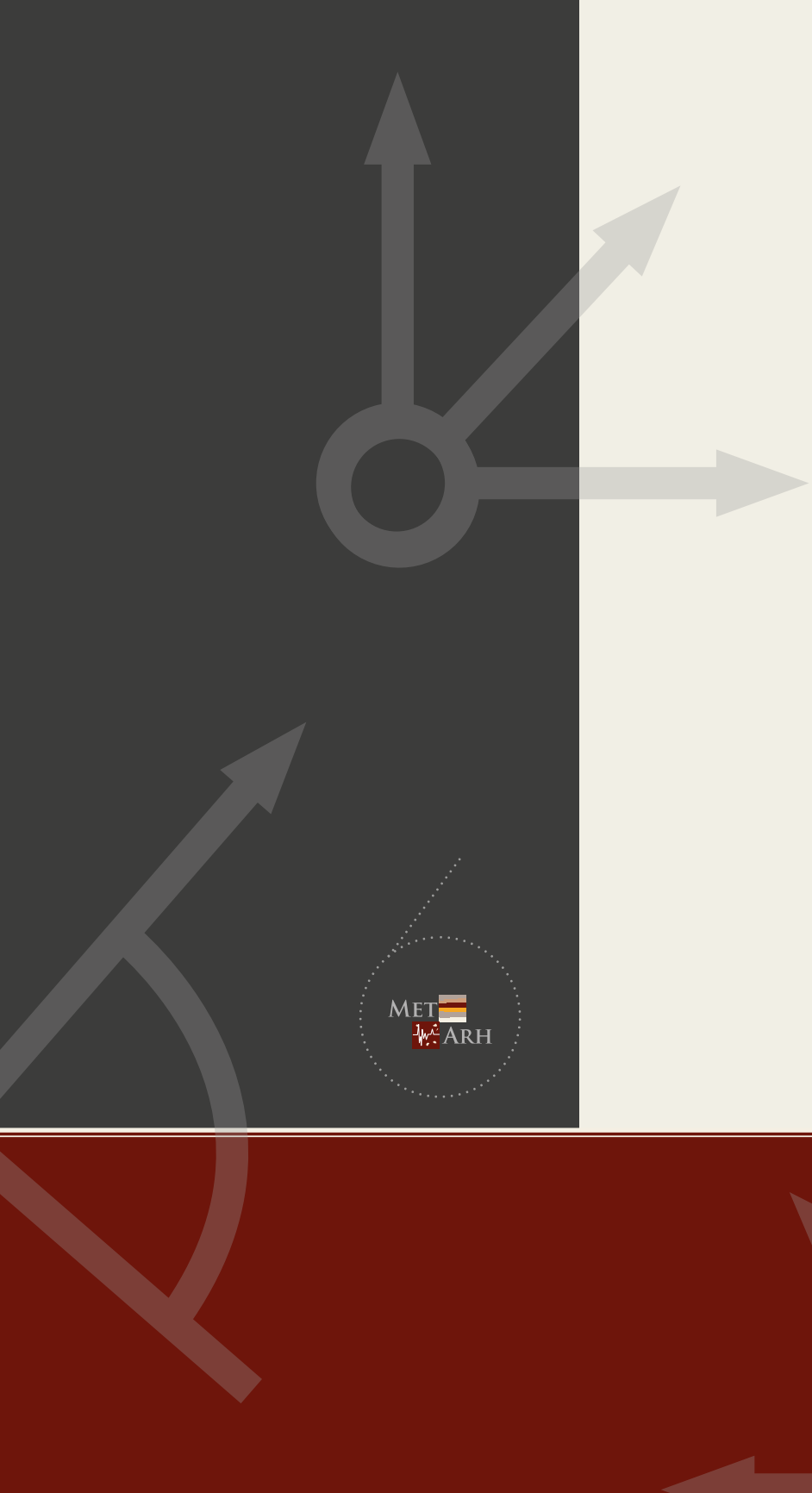
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