



<http://www.ffzg.unizg.hr/metarh/>

03RD

SCIENTIFIC
CONFERENCE

METHODOLOGY & ARCHAEOLOGY

Zagreb, 2ND - 3RD December 2015

Department of Archaeology,
Faculty of Humanities and Social Sciences,
University of Zagreb

03RD SCIENTIFIC
CONFERENCE

METHODOLOGY & ARCHAOMETRY

Zagreb, 2ND - 3RD December 2015

IMPRESSUM

PUBLISHER

Hrvatsko arheološko društvo / Croatian Archaeological Society

FOR THE PUBLISHER

Jacqueline Balen

EDITOR

Ina Miloglav

CONFERENCE ORGANISED BY

Odsjek za arheologiju, Filozofski fakultet, Sveučilište u Zagrebu
/ Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb

DESIGN & LAYOUT

Srećko Škrinjarčić

COVER DESIGN

Maja Ukas

PRINTED BY

Tiskara Zelina

PRINT RUN

100 copies

ISBN 978-953-6335-09-1

CIP record 000918017 available in online catalogue of the Zagreb National and University Library.

FINANCIAL SUPPORT

This year's Conference has been financially supported by the Croatian Archaeological Society and the Department of Archaeology, Faculty of Humanities and Social Sciences of the University of Zagreb.

03RD

SCIENTIFIC
CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 2ND - 3RD December 2015



Conference <i>Methodology and Archaeometry</i>	7
List of participants	9
Programme	17
Abstracts	25
Exhibition <i>Tragovi prošlosti / Traces of the past</i>	38
Notes	41
Navigation & General Information	47



CONFERENCE METHODOLOGY & ARCHAEOOMETRY

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 the 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 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 specific artefact or material, various arhaeometrical analysis 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 also demands an additional level of caution when selecting adequate scientific analysis for specific archaeological problem as well as continuous cooperation of the specific expert and archaeologist from collecting the samples to final interpretation.



LIST OF PARTICIPANTS

ALEKSIĆ MARKO

Central Institute for Conservation in Belgrade
Terazije 26, 11000 Belgrade, Serbia
markoaleksic81@gmail.com

BADOVINAC DAVID

Department of Archaeology, Faculty of Arts, University of Ljubljana
Aškerčeva 2, 1000 Ljubljana, Slovenia
david.badovinac@gmail.com

BARBIR ANTONELA

Ambruševa 13/1, 10000 Zagreb, Croatia
antonela.barbir@gmail.com

BAREŠIĆ JADRANKA

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute
Bijenička 54, 10000 Zagreb, Croatia
jbasesic@irb.hr

BIRÓ KATALIN

Department of Archaeology, Hungarian National Museum
Múzeum krt. 14-16., 1088 Budapest, Hungary
tbk@hnm.hu

BORKOVIĆ DAMIR

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute
Bijenička 54, 10000 Zagreb, Croatia
damir.borkovic@irb.hr

CEKOVIĆ MARKO

iGEON programme, University of Lund
Sweden
marko.cekovic@gmail.com

DUBOLNIĆ GLAVAN MARTINA

The Institute for Historical Sciences in Zadar, Croatian Academy of Sciences and Arts
Obala kneza Trpimira 8, 23000 Zadar, Croatia
martina.dubolnic@gmail.com

**FERNANDES M. DANIEL**

School of Archaeology and Earth Institute, University College Dublin

Belfield, Dublin 4, Ireland

Centro de Investigação em Antropologia e Saúde, Department of Life Sciences, University of Coimbra

Calçada Martim de Freitas, 3000-456 Coimbra, Portugal

daniel.fernandes@ucdconnect.ie

GAVRANOVIĆ MARIO

OREA-Abteilung Europa, Institut für Orientalische und Europäische Archäologie,

Österreichische Akademie der Wissenschaften

Fleischmarkt 20-22, A-1010 Wien, Austria

Mario.Gavranovic@oeaw.ac.at

GROSMAN DARJA

Department of Archaeology, Faculty of Arts, University of Ljubljana

Aškerčeva 2, 1000 Ljubljana, Slovenia

darja.grosman@ff.uni-lj.si

HLÁSEK DANIEL

TerraVerita, Mezi Školami 2321 Prague

15800, Praha 5, Czech Republic

hlasda@centrum.cz

HORŇÁK MILAN

VIA MAGNA Ltd.

Martin Nábřežná 2, 038 61 Vrútky, Slovakia

hornak.milan@gmail.com

HORVATINČIĆ NADA

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute

Bijenička 54, 10000 Zagreb, Croatia

Nada.Horvatincic@irb.hr

HRUBÝ JIŘÍ

TerraVerita, Mezi Školami 2321 Prague

15800, Praha 5, Czech Republic

jirhruby@gmail.com

JANKOVIĆ IVOR

Institute for Anthropological Research

Gajeva 32, 10000 Zagreb, Croatia

ivor.jankovic@inantro.hr

KARAVANIĆ IVOR

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb

Ivana Lučića 3, 10000 Zagreb, Croatia

ikaravan@ffzg.hr

***KRAJCAR BRONIĆ INES***

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute
Bijenička 54, 10000 Zagreb, Croatia
krajcar@irb.hr

KUDELIĆ ANDREJA

Institute of Archaeology
Ljudevita Gaja 32, 10000 Zagreb, Croatia
andreja.kudelic@iarh.hr

KULENOVIĆ IGOR

Department of Tourism and Communication Studies, University of Zadar
Franje Tuđmana 24i, 23000, Zadar, Croatia
ikulenovic@unizd.hr

KULENOVIĆ OCELIĆ NEDA

Faculty of Arts, University of Ljubljana
Aškerčeva 2, 1000 Ljubljana, Slovenia
nedaocelic@yahoo.com

LELEKOVIĆ TINO

Archaeology Department, Croatian Academy of Science and Arts
Ante Kovačića 5, 10000 Zagreb, Croatia
lelekovic@hazu.hr

MEHOFER MATHIAS

VIAS Vienna Institute for Archaeological Science, Archäologiezentrum
Franz Klein-Gasse 1, A-1190 Wien, Austria
mathias.mehofer@univie.ac.at

MILEUSNIĆ MARTA

Department of Mineralogy, Petrology and Mineral resources, Faculty of Mining, Geology and Petroleum
Engineering, University of Zagreb
Pierottijeva 6, 10000 Zagreb, Croatia
mmileus@rgn.hr

MILOGLAV INA

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10000 Zagreb, Croatia
imilogla@ffzg.hr

NOVAK MARIO

Institute for Anthropological Research
Gajeva 32, 10000 Zagreb, Croatia
mario.novak@inantro.hr

**NOVAKOVIĆ PREDRAG**

Department of Archaeology, Faculty of Arts, University of Ljubljana
Aškerčeva 2, 1000 Ljubljana, Slovenia
predrag.novakovic@ff.uni-lj.si

OŽANIĆ ROGULJIĆ IVANA

Institute of Archaeology
Ljudevita Gaja 32, 10000 Zagreb, Croatia
iozanic@iarh.hr

PENDIĆ JUGOSLAV

Center for Digital Archaeology, Faculty of Philosophy, University of Belgrade
Čika Ljubina 18-20, 11000 Belgrade, Serbia
vincabear@hotmail.com

PINHASI RON

School of Archaeology and Earth Institute, University College Dublin
Belfield, Dublin 4, Ireland
ron.pinhasi@ucd.ie

PREMUŽIĆ ZRINKA

Institute for Anthropological Research
Gajeva 32, 10000 Zagreb, Croatia
zpremuzic@inantro.hr

RADOVIĆ SINIŠA

Institute for Quaternary Palaeontology and Geology, Croatian Academy of Science and Arts
Ante Kovačića 5/II, 10000 Zagreb, Croatia
sradovic@hazu.hr

RAJIĆ ŠIKANJIĆ PETRA

Institute for Anthropological Research
Gajeva 32, 10000 Zagreb, Croatia
petra@inantro.hr

REJDOVIANOVÁ ZUZANA

VIA MAGNA Ltd.
Martin Nábřežná 2, 03861 Vrútky, Slovakia
zuzu.rejdovianova@gmail.com

SIRAK A. KENDRA

Department of Anthropology, Emory University
1557 Dickey Drive, Atlanta, GA 30322, USA
kendra.sirak@emory.edu

**SIRONIĆ ANDREJA**

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute
Bijenička 54, 10000 Zagreb, Croatia
asironic@irb.hr

SIROVICA FILOMENA

Archaeological Museum in Zagreb
Trg Nikole Šubića Zrinskog 19, 10000 Zagreb, Croatia
fsirovica@amz.hr

SKELAC GORAN

Geoarheo d.o.o.
Kneza Mislava 3, 10000 Zagreb, Croatia
goran@geoarheo.hr

SPATARO MICHELA

Department of Conservation and Scientific Research, The British Museum
Great Russell Street, London WC1B 3DG, UK
mspataro@britishmuseum.org

ŠEGVIĆ BRANIMIR

Université de Genève, Section des Sciences de la Terre et de l'environnement
Rue des Maraîchers 13, 1205 Genève, Suisse
Branimir.Segvic@unige.ch

ŠOŠIĆ KLINDŽIĆ RAJNA

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10000 Zagreb, Croatia
rsosic@ffzg.hr

TASIĆ NENAD

Department of Archaeology, Faculty of Philosophy, University of Belgrade
Čika Ljubina 18-20, 11000 Belgrade, Serbia
ntasic@gmail.com

TRESIĆ PAVIČIĆ DINKO

Kaducej d.o.o.
Papandopulova 27, 21 000 Split, Croatia
dtresic@gmail.com

VITEZOVIĆ SELENA

Institute of Archaeology
Kneza Mihaila 35/IV, 11000 Belgrade, Serbia
selenavitezovic@gmail.com

***VUČIČIĆ SANDA***

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10000 Zagreb, Croatia
svucicic@ffzg.hr

VUKOSAVLJEVIĆ NIKOLA

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10000 Zagreb, Croatia
nvukosav@ffzg.hr

VUKOVIĆ JASNA

Department of Archaeology, Faculty of Philosophy, University of Belgrade
Čika Ljubina 18-20, 11000 Belgrade, Serbia
jvukovic@f.bg.ac.rs

VUKOVIĆ MIROSLAV

Department for Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb
Ivana Lučića 3, 10000 Zagreb, Croatia
mivukov@ffzg.hr

ZACHAR JÁN

VIA MAGNA Ltd.,
Martin Nábrežná 2, 03861 Vrútky, Slovakia
jan.zachar@yahoo.com

ŽITŇAN ANDREJ

VIA MAGNA Ltd.
Martin Nábrežná 2, 03861 Vrútky, Slovakia
andrejitnan@gmail.com



PROGRAMME

Wednesday, 2nd December

9:00 – 9:20

Opening

KEY-NOTE LECTURES

Chair: Ina Miloglav

9:20 – 9:40

Marta Mileusnić

Geological materials in archaeological findings

9:45 – 10:05

Michela Spataro

Archaeometric analysis of pottery as a tool for in-depth technological and social-economic insights and changes

10:10 – 10:30

Katalin T. Biró

The case of Databases: Welcome to the jungle

10:35 – 10:55

Coffe break

Chair: Rajna Šošić Klindžić

10:55 – 11:15

Miroslav Vuković

Accuracy of photogrammetric image based 3D models

11:20 – 11:40

Goran Skelac

The results of tests on the precision in using UAVs for 3D scanning and animation of achaeological sites



11:45 – 12:05

David Badovinac

Possibilities of 3D photogrammetry in documenting of archaeological sites

12:10 – 12:30

Jugoslav Pendić, Nenad Tasić, Marko Aleksić, Andrej Žitňan,
Zuzana Rejdovianová, Jiří Hrubý & Daniel Hlášek

Surface reconstruction from images - experience from Neolithic site of Vinča

12:35 – 12:50

Coffe break

12:50 – 13:10

Ján Zachar, Andrej Žitňan & Milan Horňák

Digital methods of documentation of immovable cultural heritage
- limitations and problems

13:15 – 13:35

Andreja Kudelić, Filomena Sirovica, Ina Miloglav & Dinko Tresić Pavičić

Systematic field survey of upper Podravina, Croatia: Methods for collection,
storage and analysis of data

13:40 – 14:10

Martina Dubolnić Glavan, Igor Kulenović & Neda Kulenović Ocelić

Sites Twice Removed – a Case Study From Dalmatia

14:15 – 14:35

Marko Ceković

Building spatial databases with AutoCAD and open source GIS software:
a simple workflow

14:40 – 14:55

Coffe break

Chair: Nikola Vukosavljević

14:55 – 15:15

Ines Krajcar Bronić, Nada Horvatinčić, Jadranka Barešić,
Andreja Sironić & Damir Borković

Radiocarbon dating of paper and parchment

15:20 – 15:40

Antonela Barbir & Ivor Karavanić

Testing natural vs. human modification of lithics



15:45 – 16:05

Mario Gavranović & Mathias Mehofer

Local Forms and regional distributions

- metallurgical analysis of Late Bronze objects from Bosnia

16:10

General discussion

16:30

Predrag Novaković & Darja Grosman

Opening of the exhibition Tragovi prošlosti / Traces of the past

- ArchaeoLandscapes project (ArCLand).

Thursday, 3rd December

Chair: Michela Spataro

10:00 – 10:20

Jasna Vuković

Forming techniques of Early Neolithic pottery:

new evidence from Southern Serbia

10:25 – 10:45

Tino Leleković & Branimir Šegvić

Is archaeometry necessary?

Results of the archaeometrical analysis of the samples of Roman fine pottery from Roman Mursa

10:50 – 11:10

Ivana Ožanić Roguljić

...they eat both barley and millet... (Dio Cassius 49.36, 2–4)

11:15 – 11:35

Andreja Kudelić

Experimental archaeology - pottery production perspective

11:40 – 12:10

Coffe break



Chair: Siniša Radović

12:10 – 12:30

Mario Novak, Daniel M. Fernandes, Kendra A. Sirak & Ron Pinhasi

Improving ancient DNA yields through osteological experimentation:
current trends and future implications

12:35 – 12:55

Ivor Janković

Traditional vs. 3D geometric morphometrics in bioarchaeology:
an alternative or complementary approach

13:00 – 13:20

Sanda Vučićić

Shining a light on death:
Reflectance Transformation Imaging (RTI) relevance to the study
of historical cancer cases

13:25 – 13:45

Petra Rajić Šikanjić & Zrinka Premužić

Human cremated remains: forms for analysis and data collection

13:50 – 14:10

Selena Vitezović

Interpreting the use of artefacts from osseous raw materials:
some methodological considerations

14:15

Closing discussion

Afternoon programme

16:00

Visit to the Archaeological Museum in Zagreb

Conservation & preparation Workshop, Museum depository & Permanent exhibitions



Marta Mileusnić

Department of Mineralogy, Petrology and Mineral resources,
Faculty of Mining University of Zagreb, Croatia

Geological materials in archaeological findings

Geological materials are significant part of archaeological findings. They can be found unchanged or slightly changed (eg. in the form of jewellery, simple tools, pigments). On the other hand, they can be significantly altered forming man-made materials (eg. glass, ceramics).

The main goals of this presentation are: (1) to classify different geological materials such as minerals, rocks, soils, sediments and ores, and present their usage in ancient times; (2) to describe their occurrences and availability in the nature with emphasis on the area of today's Croatia and south-eastern Europe; (3) to describe their characteristics which made them raw materials, as well as their changes during technological processes; and (4) to describe tools for provenance determinations.

Purpose of the presentation is to acquaint archaeological audience with the possibilities and problems of provenance analysis.

Michela Spataro

Department of Conservation and Scientific Research, The British Museum, London, UK

Archaeometric analysis of pottery as a tool for in-depth technological and social-economic insights and changes

Archaeometric analyses of ceramics, such as thin-section petrography, are used to answer both practical and theoretical archaeological research questions. Various types of qualitative and quantitative data can be obtained by different techniques. In this paper the importance of visual data, beyond macroscopic examination with the naked eye, will be discussed. Micro-visual data are essential to the understanding of ceramic technology, e.g. the use of scanning electron microscopy (SEM) images allows us to examine the microstructure of the ceramic paste, which is too fine to be identified using simple optical microscopy with a polarised microscope. This type of examination will provide information on firing temperature, interlayers and interfaces present in the ceramic body, which cannot be visualised using other chemical techniques. In addition, the option to analyse quantitatively regions of a sample that can be selected visually provides a more complete understanding of the archaeological material. The accuracy and precision of quantitative analytical data is essential.



In this talk, the combined use of analytical techniques offers us the tools to solve questions related to provenance, technological choices (the different steps of the chaîne opératoire) and more theoretical aspects related to cultural boundaries, cultural transmission, influences and innovations. Different case-studies from the Neolithic up to New Kingdom Egypt will be presented, focusing on different technologies that serve as markers of cultural identity, and innovative traditions which influence neighbouring communities, or create desirable products which are copied or imported. Comparative data sets obtained using different techniques will be discussed.

Katalin T. Biró

Department of Archaeology, Hungarian National Museum, Budapest, Hungary

The case of Databases: Welcome to the jungle

Databases are obviously indispensable in archaeometry – as well as any other field of science. Like it or not, databases are everywhere, in civil life, administration, libraries, museums and last but not least, science. Some of them are private, even confidential, at least, sensitive. The situation was sort of easy with stand-alone personal databases and public databases provided „as it is”; by now, it is much more complicated. Databases are born, fostered and die daily. Typically, any project brings to life a database (one at least) that are left orphaned with the end of project and funds. Long established cataloguing functions are at the mercy of new platforms and uncontrolled changes in software background. Clones and redundant databases crop up everywhere while the data that we really need are always somewhere else.

Last but not least: copyright issues. Who owns the data in a database? After 200 years of cataloguing tradition? And who is entitled to change/modify wisdom and folly of centuries? This short communication will obviously not solve the problem but at least hope to bring some awareness concerning our difficulties.

Miroslav Vuković

Department of Archaeology, Faculty of Humanities and Social Sciences,
University of Zagreb, Croatia

Accuracy of photogrammetric image based 3D models

The documental value of image based models has been proven in numerous cases. But the photogrammetric aspect of the model still inspires some heated debates. As there are numerous ways of referencing an imaged based model, the goal of this paper was to test them all out and to gain an insight into the exact accuracy of each method of reference. Some methods of reference require expensive geodesic equipment



and complex webs of ground control points, while others are conducted by using a small number of ground control points and a simple measuring tape. Depending on the object or site, the method for referencing an image based model should be different. While documenting single objects, millimeter point accuracy is extremely important, in documentation of larger sites centimeter point accuracy is usually more than enough. Deviations in accuracy should be acceptable up to the point where they can in no way interfere with the archaeological interpretation. Depending on the object or the complexity of the site different methods and approaches can be used for the accurate referencing of 3D models. How accurate do these models need to be, and how much will this level of accuracy affect the documentational value of the archaeological excavations, are just some of the questions which this paper aims to answer.

Goran Skelac

Geoarheo d.o.o., Zagreb, Croatia

The results of tests on the precision in using UAVs for 3D scanning and animation of archaeological sites

In the last 5 years the use of Unmanned aerial vehicles (UAVs or multirotors) for the documentation of archaeological sites has become a useful tool or a technological innovation that has become almost unavoidable for many archaeological purposes.

In this presentation are the results of tests and research of two UAV platforms after the different sets of data were collected at the same site. Field tests and postprocessing is carried out on: a) the ability of UAVs to plan flight routes (way points) for capturing photo and video; b) degree of geodetic precision of flying and capturing; c) resolutions of photos on the ground; d) the degree of precision in making 3D or elevation models. Number of processing capabilities of the results for making animation of archaeological sites are tested. At the end, a brief overview of the current state of the regulations for flying drones and taking aerial photography is commented.

David Badovinac

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

Possibilities of 3D photogrammetry in documenting of archaeological sites

Paper explores the possibilities of documenting archaeological stratigraphic elements with the help of three dimensional models, derived from methods of 3D photogrammetry namely technique of structure from motion (S.f.M.). The paper proposes SfM as the main documenting tool of archaeological excavations which builds a large dataset



of all excavated layers and then uses the 3D surfaces, firstly for extracting traditional documentation (drawings, photo mosaic and measurements of features), secondly for recreating 3d textured models of excavated volumes and finally explores the impact of proposed documentation for presentation, publishing and archiving.

The paper also compares and presents the difference in terms of excavation effectiveness and costs of the traditional documenting with the new that derives all the data from post-processing and compares the results in terms of data accuracy and density.

Jugoslav Pendić¹, Nenad Tasić², Marko Aleksić³, Andrej Žitňan⁴, Zuzana Rejdovianová⁵, Jiří Hrubý⁶ & Daniel Hlášek⁷

¹Center for Digital Archaeology, Faculty of Philosophy, University of Belgrade, Serbia,

²Department of Archaeology, Faculty of Philosophy, University of Belgrade, Serbia,

³Central Institute for Conservation in Belgrade, Serbia, ^{4,5} VIA MAGNA, Martin, Slovakia,

^{6,7} TerraVerita, Prague, Czech Republic

Surface reconstruction from images - experience from Neolithic site of Vinča

Growing field of 3D reconstruction and modeling of features in and outside of excavation trenches has been present in archaeological methodology as an active factor for several years now. As it became more and more available and affordable, practitioners of this approach started to face with questions revolving possibilities of use, reliability of reconstruction, production of stable and standardized workflow and organizing and sharing of the data produced in such manner.

Vinča project has a long tradition in use of advanced technologies for 3D recording. For the last several campaigns of excavation and site activities related to further advancement of our understanding of the site and improvement of our methodological approach, research time was invested into 3-dimensional feature reconstruction from images, both from archive imagery and from images collected with predesigned intention to be used in such manner. Thus created reconstructions were combined and compared with active sensor collected data, in order to estimate pros and cons of all methods.

Huge part of these works were done with expert evaluation and cooperation of EU funded project of CONPRA - Contributing Preventive Archaeology. Here we aim to present a portion of results of these joint works, having in mind to address issues that rise from this particular part of fieldwork methodology.



Ján Zachar, Andrej Žitňan & Milan Horňák

VIA MAGNA, Martin, Slovakia

Digital methods of documentation of immovable cultural heritage - limitations and problems

Progressive methods using digital means with an increasing intensity and accuracy are currently leading tools which could be used for the documentation of historic buildings, archaeological sites and urban structures. Their benefits tend to be accentuated, which include non-destructive measurement and high efficiency especially in the case of quick record of an endangered object. Beside the application of terrestrial laser scanning the recent boom of computer vision programs that combine a Structure from Motion (SfM) approach with dense Multi-View Stereo (MVS) algorithms makes the extraction of 3D data from photographs accessible for non-professional photogrammetrists. Because of their straightforward workflow and moderate cost, these SfM+MVS packages do not require extensive photogrammetric and computer vision knowledge of the user nor the geometrical properties of the scenes. As such, they became a common part of the documentation practice in many research and commercial fields, including cultural heritage monitoring and preservation.

Presented paper aims at pointing out particular problems by image based modeling documentation. Especially issues of flat surface 3D photogrammetry is presented. The authors demonstrate the issue on several case studies focusing upon architectural features, especially walls covered with fine one color plaster. The question is treated within different SW environments. Possible solutions are presented as well. Furthermore limitations and errors in workflow from in-situ capture through post-processing using various software to the sometimes illogical choice of final output are given in the fewer cases.

Andreja Kudelić¹, Filomena Sirovica², Ina Miloglav³ & Dinko Tresić Pavičić⁴

¹ Institute of Archaeology, Zagreb, ² Archaeological Museum in Zagreb, ³ Department of Archaeology, Faculty of Humanities and Social Sciences University of Zagreb, ⁴ Kaducej d.o.o., Split, Croatia

Systematic field survey of upper Podravina, Croatia: Methods for collection, storage and analysis of data

During the last decades, a large quantity of archaeological material was collected and documented in the region of upper Podravina, Croatia. The amount and distribution of finds represent the evidence of intensive inhabitation of this area in all time periods. However, previous studies were mostly focused on topographically significant locations, which opened a need for upgrading the existing data and widening the understanding of their spatio-temporal interrelations in the landscape. For this reason, systematic field survey of the area was carried out during the fall of 2014 and 2015, with the objective



to collect a wide range of data on spatial distribution of surface archaeological material. As such studies generate a large amount of digital data, modern methods of their storage and processing, strengthened by the research power of computer systems for spatial data management, can enable various studies of material distribution and thus provide enough data for a detailed analysis of regional land-use patterns in all represented periods.

Martina Dubolnić Glavan¹, Igor Kulenović² & Neda Kulenović Ocelić³

¹ Croatian Academy of Sciences and Arts, The Institute for Historical Sciences in Zadar, Croatia, ² Department of Tourism and Communication Studies University of Zadar, Croatia

³ Faculty of Arts University of Ljubljana, Slovenia

Sites Twice Removed – a Case Study From Dalmatia

Field survey has become a standard nondestructive method in archaeological research. The purpose of this type of research is not just to discover or merely record new sites.

It is a field method by which data is collected for a vast variety of analytical procedures. Field survey is commonly carried out in cultivated areas, which allows for good visibility of archaeological sites. What if a field survey is carried out in an area which is no longer cultivated? Is it even possible to discern archaeological sites in such conditions? The specific Mediterranean land use and land division both enable and constrain visibility of archaeological sites in areas which are no longer under cultivation. The kind of visibility we faced is not the kind one would expect in a “conventional” field survey. This specific land use and land division includes field clearance and depositing various materials on plot boundaries. Field clearance and the deposition of the material result in the construction of dry stone boundary walls and clearance cairns. Archaeological finds are treated in the same manner as the rest of the material being deposited on boundary walls and clearance cairns and as such they are part and parcel of these structures. These specific agricultural practices, on the one hand, facilitate visibility and detection of archaeological sites in areas which are no longer cultivated.

At the same time the very same agricultural practices produce a tertiary archaeological context which generates specific issues in data analysis and data interpretation. The specific nature of the site formation and archaeological record required a formulation of analytical procedures aimed at “translating” traditional agricultural practices into archaeological sites with their designated attributes such as size, type etc.



Marko Ceković

iGEON programme, University of Lund, Sweden

Building spatial databases with AutoCAD and open source GIS software: a simple workflow

The use of CAD software for the purpose of archaeological documentation has become so prevalent that the programs like Autodesk's AutoCAD have become almost a universal standard. Even though documenting spatial data with AutoCAD has its advantages the program doesn't work well with the large quantities of attribute data that archaeological excavations produce and is not ideal for building a comprehensive spatial database. AutoCAD Map 3D is a better option for combining the two datasets but because of its complicated workflow and steep learning curve it is not the best option for the average user.

In recent years the use of open source GIS software has become more and more common, as archaeologists try to avoid the problems associated with proprietary software and data formats. Presented here is a simple workflow for building a spatial database from existing AutoCAD drawing files using tools and additional plugins available in the QunatumGIS software package. Special attention will be brought to cleaning and converting vector data, transforming the data to the new HTRS96/TM reference coordinate system and combining it with external relational databases.

Ines Krajcar Bronić, Nada Horvatinčić, Jadranka Barešić, Andreja Sironić & Damir Borković

Laboratory for Low-level Radioactivities, Division of Experimental Physics, Ruđer Bošković Institute, Zagreb, Croatia

Radiocarbon dating of paper and parchment

Absolute dating of object of cultural heritage and art is one of the most important issues in art history studies and in archaeology. Accurate dating is essential for valuation of original objects of arts, for differentiation between the original works and later imitations and/or frauds and for recognition of reparation and restauration works. Radiocarbon dating (^{14}C dating) method can be applied for dating materials of biogenic origin, such as wood, charcoal, bones, grains, paper, parchment, textile, etc. The range of ^{14}C age determination spans from 19th century up to ~60,000 years in the past. Even the anthropogenic influence on the natural ^{14}C distribution during 20th century can be used for recognition of frauds.

Due to very low natural ^{14}C concentration the radiocarbon dating method requires special techniques for chemical preparation of samples and measurement of ^{14}C . Particular care has to be taken for sample collection and/or storage as well as during sample pretreatment and chemical preparation. The accelerator mass spectrometry (AMS) measurement



technique enables analysis of very small amount of samples, e.g. micro-sized samples containing a few milligrams of carbon, or less, and is therefore applicable to various objects of cultural heritage.

Here we present several results of ^{14}C dating of paper from Ahdnama document and from manuscript Fojnica Armorial (*Fojnički grbovnik*) from the Franciscan Monastery in Fojnica, Bosnia and Herzegovina, and parchment fragments of two manuscripts with liturgical texts in Latin from the Archives of Vojvodina, Novi Sad, Serbia. Special attention will be paid to the interpretation of calibrated ages and the meaning of the radiocarbon dates. One has to keep in mind that radiocarbon dating gives the age of material and not the time of the creation of the art work, and that the creation of the art work cannot precede the formation of the material.

Antonela Barbir ¹ & Ivor Karavanić ²

¹ Ambruševa 13/1, Zagreb, Croatia, ² Department of Archaeology, Faculty of Humanities and Social Sciences University of Zagreb, Croatia

Testing natural vs. human modification of lithics

This paper offers a discussion of criteria for lithic attributes that distinguish between human and natural causes of chert modification. The approach is based on various criteria, including technological properties, metric data, and microscopic analysis of damage patterns, among others. Emphasis is made on measurements of sphericity and roundness, as these have proved to have a great potential in distinguishing natural and human modifications. Comparison between open-air, underwater, and cave sites allows an insight into differential natural factors that could affect damage patterns.

Mario Gavranović ¹ & Mathias Mehofer ²

¹ Institut für Orientalische und Europäische Archäologie, Österreichische Akademie der Wissenschaften, Wien, Austria, ² Vienna Institute for Archaeological Science, Archäologiezentrum, Wien, Austria

Local Forms and regional distributions - metallurgical analysis of Late Bronze objects from Bosnia

Examining the Late Bronze Age find spectra in Bosnia-Herzegovina it becomes obvious, that the archaeological indicators (e.g. the number of casting moulds or the appearance of the local forms) are suggesting a strong increase of bronze production. However systematic archeometallurgical analysis were hitherto lacking. Therefore the main objective of the project is to examine and establish possible connections between



local copper ore sources and domestic bronze metallurgy by analytical means. The first data set involved 91 samples of bronze objects, ingots and local copper ores, including material from transregional, regional and local distributions. They were found in three different contexts (settlements, graves and hoards), dating between the 12th and 9th century BC. After a first analysis using a scanning electron microscope (SEM), a group of 30 archeologically and metallurgically significant samples was selected and additionally examined by EDXRF analyses to determine the trace element composition of each single artefact. Based on the so gained results, lead isotope analyses will be carried out on selected artefacts at the Curt Engelhorn Centre for Archaeometry Mannheim, to get a deeper insight into the provenance of the metal used. As a first conclusion we can postulate, that dominantly chalcopiritic ores were processed to produce the copper used. Furthermore it is visible that the tin concentration is changing over time. The results indicate several groups in terms of chemical compositions, which will be discussed in the lecture.

It is the first time that such systematic investigations have been conducted on Late Bronze Age artefacts from Bosnia-Herzegovina. The paper will present the first results of this analyses conducted in a cooperation between VIAS (Vienna Institute for Archaeological Science, University Vienna), OREA (Institute for Oriental and European Archaeology, Austrian Academy of Sciences) and regional museums in Dobož and Travnik (Bosnia-Herzegovina).

Jasna Vuković

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

Forming techniques of Early Neolithic pottery: New Evidence from Southern Serbia

Forming sequence of the Early Neolithic (Starčevo) pottery is still unknown. Therefore, considerations about the shaping of the vessels are scarce and usually based only on assumptions that simple techniques were employed. Analyses of pottery assemblage from the site Kovačke Njive (Southern Serbia), however, may shed some new light on two aspects of Early Neolithic pottery forming sequence: 1. shaping, and 2. execution of decoration. Textile impressions on the interior surfaces of potsherds indicate usage of textiles as a parting agent in mold-shaping techniques. On the other hand, analyses of fragments with so-called *impresso*-decoration revealed possibility that this kind of surface texturing/ornamentation was not executed by impressing fingertips and fingernails into the plastic clay, but by using different kinds of tools.



Tino Leleković¹ & Branimir Šegvić²

¹ Croatian Academy of Science and Arts, Archaeology Department, Croatia, ² Université de Genève, Section des Sciences de la Terre et de l'environnement, Genève, Suisse

Is archaeometry necessity?

Results of the archaeometrical analysis of the samples of Roman fine pottery from Roman Mursa.

This paper will present the result of the study of pottery group dispersed in the Roman province of Pannonia, defined by local imitations of terra sigillata dishes, known as *Pannonische Glanztonware*. Comprehensive study of this material has been done in past five years, mostly based on the finds discovered in clear archaeological context on the territory of roman town Mursa.

Taking into account the particularities of recovered pottery, selected finds were subjected to chemical analyses in order to relate its composition with the related typological and morphological characteristics thus inferring more (1) on the potential origin of ceramic material, (2) type of the raw material used, and (3) eventual grouping within the ceramic dataset and establishing ratio behind. In this stage of the project focus was on imitations of Italian-style and Gallic-style sigillata.

A dataset of 34 ceramic potsherds was examined by XRF. Results gained by archaeometrical analysis are not corresponding with the division and understanding of this material based on standard typological-morphological approach. This paper will show how this is so, and in which amount the combination of standard archaeological methods and those provided by archaeometry has to be combine to get accurate and valid study of certain groups of archaeological material.

Ivana Ožanić Roguljić

Institute of Archaeology, Zagreb, Croatia

...they eat both barley and millet...
(Dio Cassius 49.36, 2–4)

In this paper we will discuss archaeological evidence of barley and millet in Roman Pannonia according to statement of Dio Cassius that those are most commonly used grains. According to Dio Cassius they used as food and as beverage. Until now we have several evidence of their consumption in Croatian part of Pannonia. Barley is found in the village Virovitica Kiškoriya south and in grave in Ilok (*Cuccium*), while millet is found in graves in Ilok and Ščitarjevo and villages Kiškoriya south and Šepkovčica. Barley and millet could be prepared as various pulses or bread, or fermented to become a beer. Some of this food will be presented as part of the project of experimental Roman cooking.



Andreja Kudelić

Institute for Archaeology, Zagreb, Croatia

Experimental Archaeology – pottery production perspective

Experimental archaeology serves as one of the most practical methods of archaeological interpretation which in addition also aids in understanding of pottery making practices. Experiment in archaeology has been used in this region for many years, however, the publications on the topic are extremely rare.

The course of experimental research on pottery production technology of the Bronze Age will be presented in this study. The research has been systematically carried out since 2012, and although it research is still ongoing, preliminary results of certain segments of production will be presented. The research subject is pottery from the Bronze Age settlements and archaeological records which can be related to the potter's activity. The Bronze Age site Kurilovec-Belinščica is particularly significant for these studies. The research objective is to determine the composition and properties of the clay, preparation of temper, and to identify forming techniques, surface treatments, vessels forms and decorations. According to the whole operational sequence (the stages performed by the potter), firing techniques as a particularly demanding segment of the research were also tested. Several functional aspects of certain vessel forms and clay mixture from which they were made were also tested. Entire series of experiments were required in order to gain reliable results of such research. An overview of current research and several preliminary results will be presented according to the conducted research.

Mario Novak ¹, Daniel M. Fernandes ^{2,3}, Kendra A. Sirak ⁴, Ron Pinhasi ²

¹Institute for Anthropological Research, Zagreb, Croatia, ²School of Archaeology and Earth Institute, University College Dublin, Ireland, ³Centro de Investigação em Antropologia e Saúde, Department of Life Sciences, University of Coimbra, Portugal, ⁴Department of Anthropology, Emory University, Atlanta, USA

Improving ancient DNA yields through osteological experimentation: current trends and future implications

The introduction of next generation sequencing technologies dramatically transformed studies of DNA obtained from ancient bones, allowing significantly faster and more cost-effective sequencing of entire genomes. Despite this rapid improvement, ancient DNA (aDNA) analysis still confronts challenges associated with modern DNA contamination as well as low (~ 1% or less) percentages of endogenous DNA contained in fossil specimens.

Historically, both forensic geneticists and aDNA specialists considered femur and teeth to be the most appropriate locations from which to extract DNA. However, the endogenous yields, especially in case of aDNA, proved to be unsatisfactory. In order to try to increase



human aDNA yields, we took into consideration different skeletal and dental elements retrieved from various archaeological contexts. Preliminary results from a series of experiments conducted in aDNA-dedicated facilities at University College Dublin suggested that the petrous part of the temporal bone might be especially suited for this type of research. Therefore, we carried out intra-petrous comparisons for ten petrous bones from archaeological contexts across Eurasia dated between 10,000 and 1,800 years BP. Shotgun DNA sequences were obtained from three distinct areas within the petrous: a spongy part of trabecular bone, the dense part of cortical bone encircling the osseous inner ear (otic capsule), and the dense part within the otic capsule. Our results confirm that the dense part within the otic capsule can provide significantly higher endogenous aDNA yields in comparison with the other two areas within the petrous. Additionally, these results also confirm significantly higher endogenous aDNA yields (up to 535X) obtained from this region of the petrous bone when compared with other skeletal and dental elements commonly used.

Ivor Janković

Institute for Anthropological Research, Zagreb, Croatia

Traditional vs. 3D geometric morphometrics in bioarchaeology: an alternative or complementary approach

The paper discusses main differences between the so-called traditional morphometrics and geometric morphometric approaches. Further, 3D geometric approach is discussed to exemplify how geometric morphometrics can add to our understanding of various issues that are difficult and sometimes impossible to address through standard methods used in bioarchaeological and anthropological research. However, the 3D geometric morphometrics should not be considered an alternative, rather an important addition to the traditional morphometric approach.

Sanda Vučićić

Department of Archaeology, Faculty of Humanities and Social Sciences
University of Zagreb, Croatia

Shining a light on death: Reflectance Transformation Imaging (RTI) relevance to the study of historical cancer cases

Computer aided technologies are slowly starting to spread throughout different branches of archaeology. Osteology is not an exception in this trend. Although most osteologists still prefer personal contact in bone analysis, possibilities that new technologies offer in the study of human remains cannot be ignored. One such possibility was



presented in the form of Reflectance Transformation Imaging (RTI), technique that uses different light angles to enhance surface details. Taking into the account successfulness of the RTI application on archaeological artefacts, it was decided to conduct a small research that would test software usability for the study of human bones. The goal was to assess advantages and disadvantages of RTI usage in determining and analysing surface bone pathologies. To achieve this goal one case study focused on human cranium, showing distinctive pathological trauma, was elected. The results and conclusions regarding RTI's usefulness for osteology shall be discussed in the course of this lecture.

Petra Rajić Šikanjić & Zrinka Premužić

Institute for Anthropological Research, Zagreb, Croatia

Human cremated remains: forms for analysis and data collection

Cremation as a burial practice was present in different time periods and geographic regions since the prehistory. In certain periods it was standard or dominant way for disposal of the deceased. Despite the large number of cremation burials in the archaeological record, analyses of human skeletal remains have been somewhat neglected. Human remains from archaeological context offer unique insights about life, health and diseases of our ancestors. Essential part of this research is the systematic data collection, which is the basis for all further analyses and comparisons. Here we propose a set of forms created specifically for anthropological analysis of cremated bones. The set consists of four forms: (1) macroscopic characteristics of the bones, (2) skeletal inventory, (3) dental inventory, (4) demographic and palaeopathological information. Use of these forms is the initial step in the analysis of biological features of the individual. In addition, they also provide otherwise unobtainable information about burial practices of the community. Standardized data collection is a prerequisite for successful comparisons between samples from various sites, especially those analysed by different scientists. We hope that the proposed forms will be applied more widely in the future analyses of human cremated remains.

Selena Vitezović

Institute of Archaeology, Belgrade, Serbia

Interpreting the use of artefacts from osseous raw materials: some methodological considerations

Prehistoric communities used a variety of raw materials, stone, flint, bone, wood, clay ect. for a variety of purposes. The exact mode of use is the most fascinating, yet most difficult part of their analyses is interpreting their function. Microscopic usewear analyses, developed since mid-20th century, represent in modern archaeology an essential

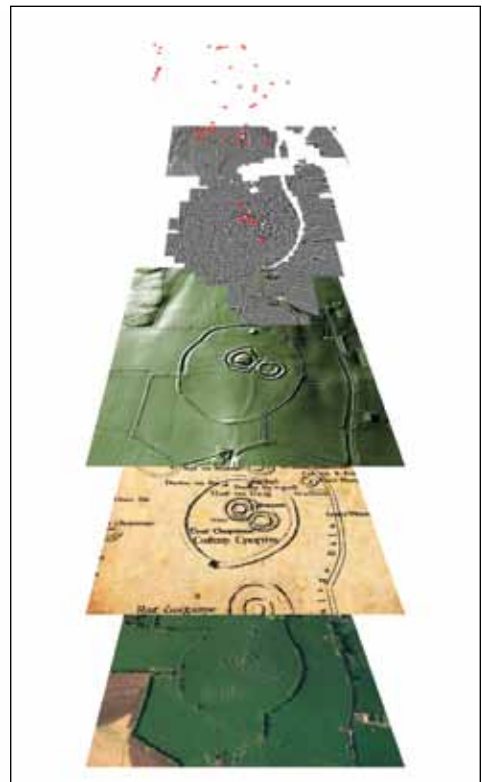


part of functional investigations. The methodology and technology applied are constantly improving and a wide range of diverse analyses conducted so far changed significantly our knowledge on various activities practiced by prehistoric communities. However, practical and financial problems – availability of adequate equipment, transport and manipulation of badly preserved artefacts, time-consuming nature of microscopic research – restrict the use of microscopes for selected items only. However, this must not mean that the analysis should end with typological classification. Low magnification observations should be applied on all artefacts and may be particularly useful for more accurate identification of use, recognition of new possible tools, and for selecting adequate samples for microscopic analysis. In this paper, several case studies related to prehistoric bone artefacts will be presented.

During the Conference the exhibition panels of the *ArchaeoLandscapes project (ArLand) Tragovi prošlosti / Traces of the past* will be display in the hallway on the ground floor of the Faculty building, from the 2nd to the 7th December 2015

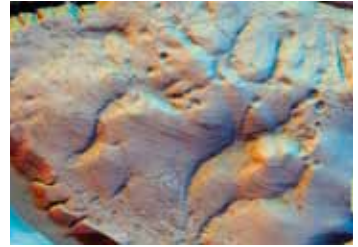
The aim of the ArchaeoLandscapes project (co-funded by the Culture 2007 Programme) is to address the existing imbalances in the use of modern surveying and remote sensing techniques and to create conditions for their regular across Europe as a whole.

Archaeological prospection in its various forms has always been one of the major sources for archaeological knowledge. Especially aerial archeology, airborne laser scanning (LIDAR), geophysics and many others more have brought to light more new archaeological sites than any other technique that archaeologists have available in their toolbox. But as in many other aspects as well, the knowledge and the use of these high tech methods are not evenly accepted and distributed all over Europe – nor beyond its borders.



Exhibition includes different topics:

- *Aerial photography*
- *Aerial Archives*
- *Lidar*
- *Multispectral images*
- *Geophysics*
- *Integration & Access*



To the existing exhibition new panels are added - CONPRA Project and Croatian experiences.





NAVIGATION

○ ODSJEK ZA ARHEOLOGIJU FF SVEUČILIŠTA U ZAGREBU

DEPARTMENT OF ARCHAEOLOGY
FACULTY OF HUMANITIES AND SOCIAL SCIENCES,
UNIVERSITY OF ZAGREB

Ivana Lučića 3

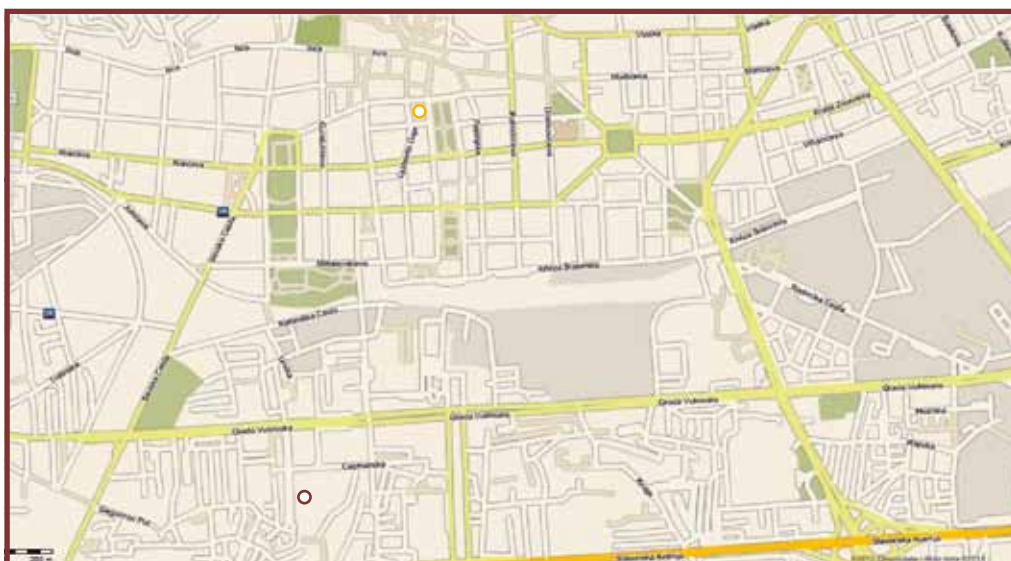
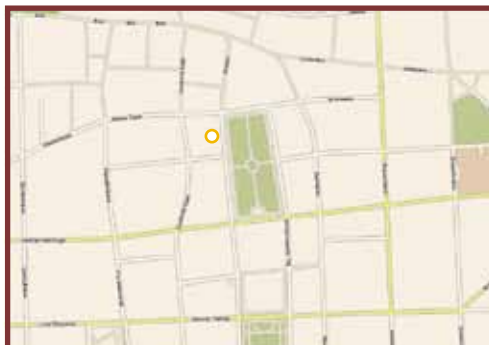
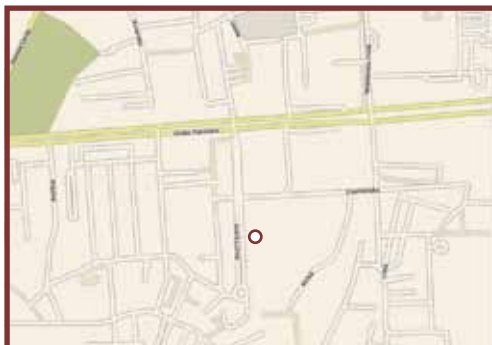
www.ffzg.unizg.hr/arheo/

○ ARHEOLOŠKI MUZEJ U ZAGREBU

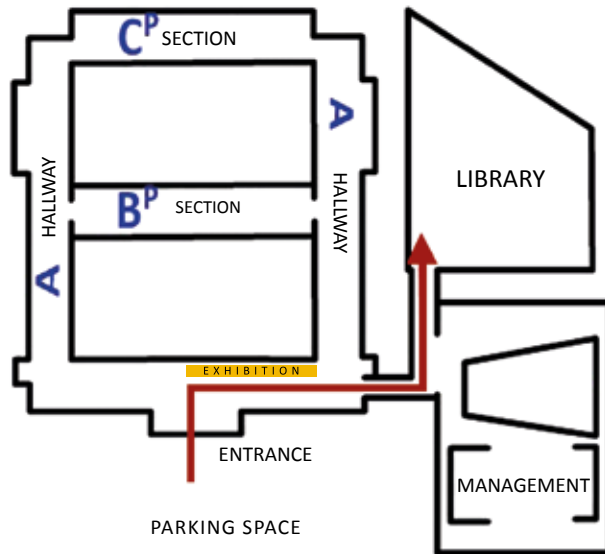
ARCHAEOLOGICAL MUSEUM IN ZAGREB

Trg Nikole Šubića Zrinskog 19

www.amz.hr

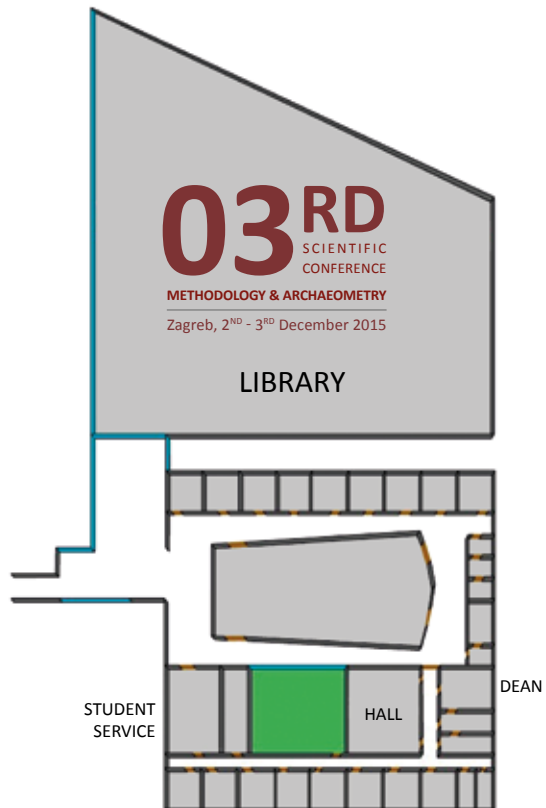


GROUND PLAN



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).

Panels of the exhibition *Tragovi prošlosti / Traces of the past* are at display in the hallway on the ground floor of the Faculty building.

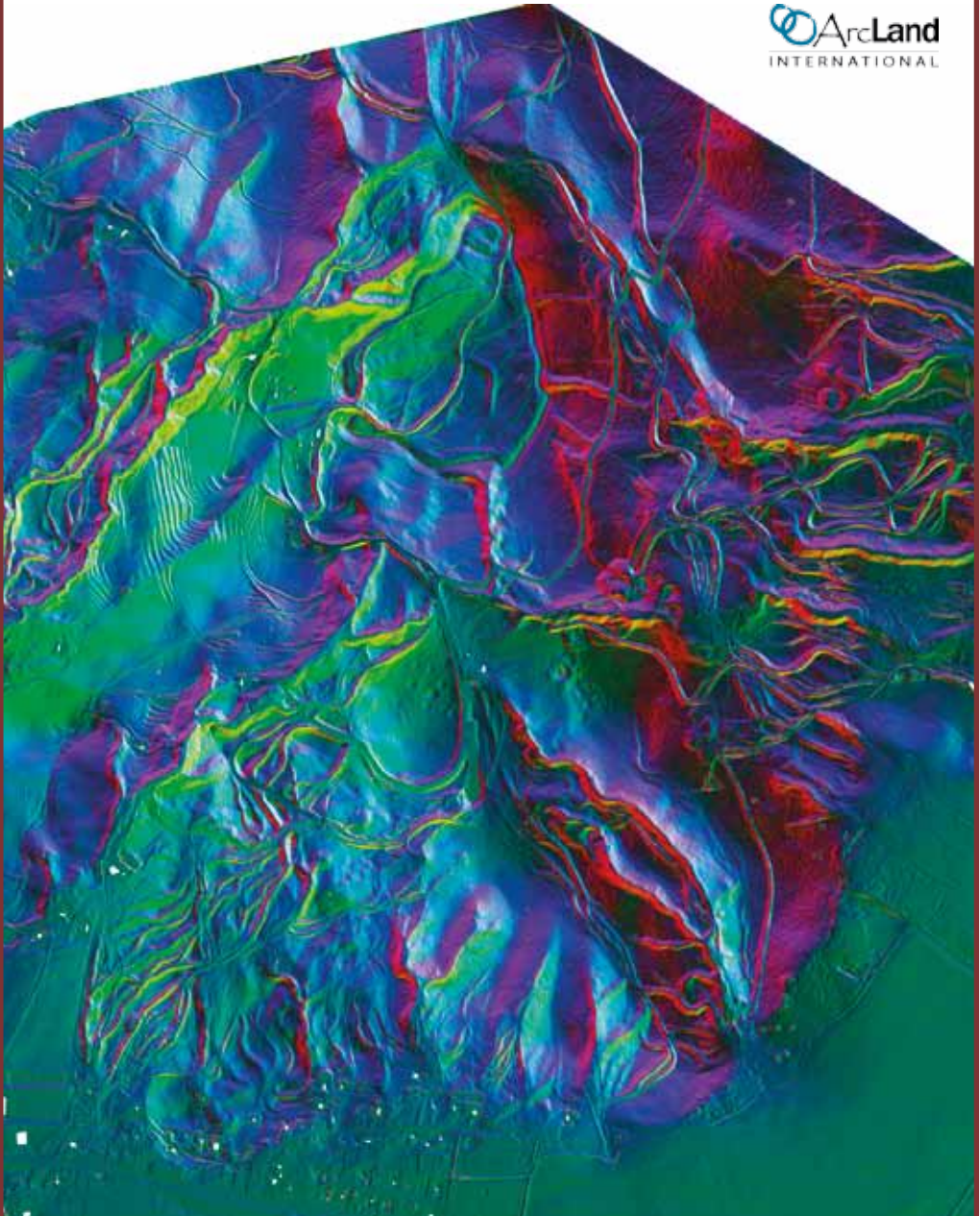


TRAGOVI PROŠLOSTI / TRACES OF THE PAST

PANELS OF THE ARCHAEOLANDSCAPES PROJECT (ArcLand)

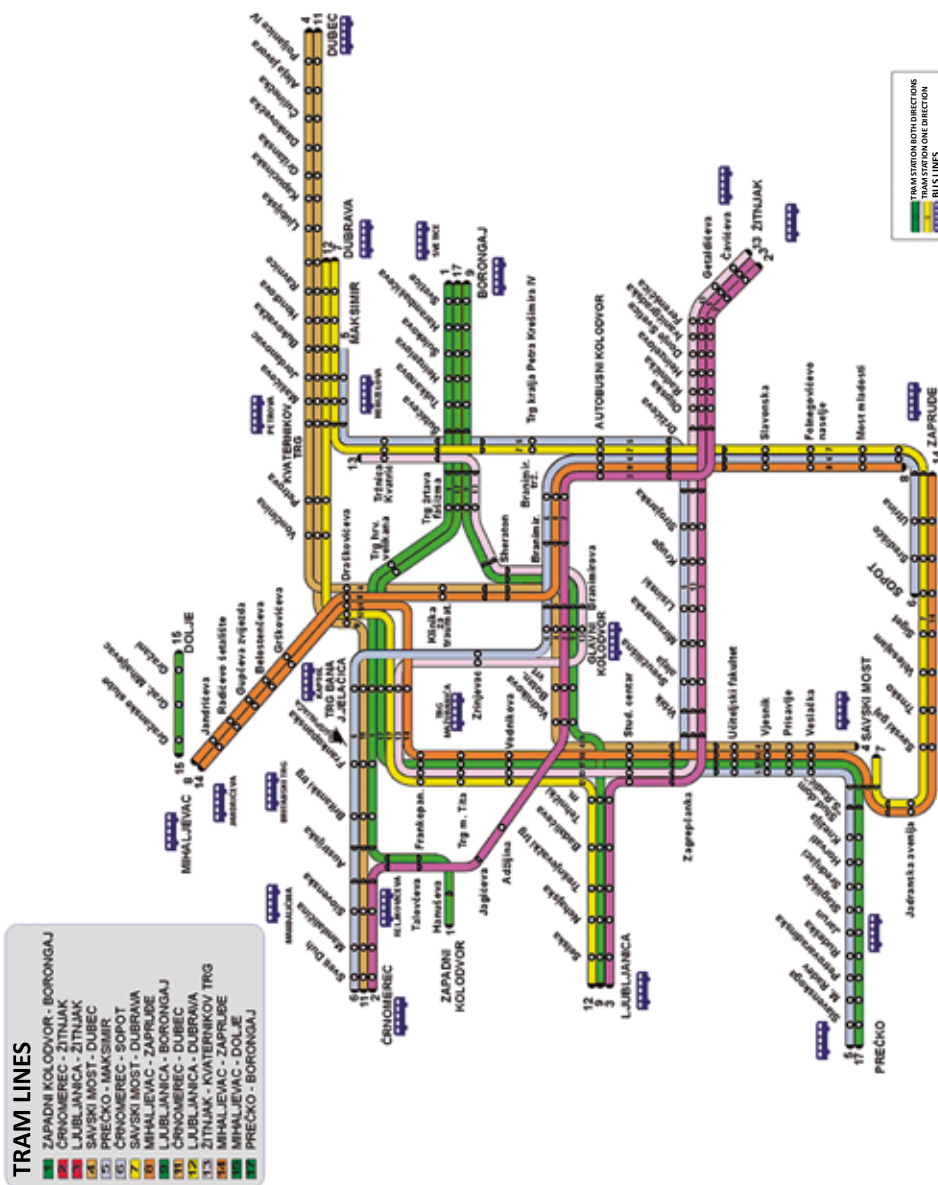
Faculty of Humanities and Social Sciences, Zagreb, 2nd – 7th December 2015

 ArcLand
INTERNATIONAL



ZAGREB MUNICIPAL TRANSIT SYSTEM (ZET)

<http://www.zet.hr/>





TRAM SCHEDULE

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

03RD SCIENTIFIC
CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 2ND - 3RD December 2015