4TH INTERNATIONAL SCIENTIFIC CONFERENCE METHODOLOGY & ARCHAEOMETRY · Zagreb, 1st-2nd December 2016

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04TH SCIENTIFIC CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 1ST - 2ND December 2016

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IMPRESSUM

PUBLISHER
Croatian Archaeological Society

FOR THE PUBLISHER
Jacqueline Balen

EDITOR
Ina Miloglav

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

DESIGN & LAYOUT
Srećko Škrinjarić

MAPS
Arhitektonski studio 113

PRINTED BY
Tiskara Zelina

PRINT RUN
100 copies

ISBN 978-953-6335-10-7

CIP record 000947963 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 Faculty of Humanities and Social Sciences of the University of Zagreb.

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CONTENT

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 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 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, 1st December

9:00 – 9:20
Opening

KEY-NOTE LECTURES

Chair: Ina Miloglav

9:20 – 9:45
Michael Doneus
Aerial reconnaissance of buried and submerged archaeological landscapes

9:50 – 10:15
Dimitrij Mlekuž
Lidar and landscape archaeology

10:20- 10:50
Coffe break (Library Foyer)

Chair: Michael Doneus
10:50- 11:10
Hrvoje Kalafatić & Bartul Šiljeg
The four seasons: advantages of all year round cyclic surveys in aerial archaeology

11:15- 11:35
Hrvoje Potrebica & Miroslav Vuković
Aerial photographs and spatial distribution of prehistoric stone mounds near Lumbarda

11:40- 12:00
Petra Basar, Branko Mušič, Matija Črešnar & Hrvoje Potrebica
Geophysical Prospection with the Low-frequency Electromagnetic Method (CMD- Mini Explorer) and using Integration Analysis of Multidimensional Data

12:05- 12:25
Branko Mušič, Matija Črešnar, Hrvoje Potrebica, Manca Vinazza, Matej Dolenec, Nina Zupančič, Igor Medarič, Barbara Horn, Matjaž Mori & Petra Basar
New developments in integrated studies of the Early Iron Age sites and landscapes in Slovenia and Croatia

12:30- 12:50
Coffe break (Library Foyer)

Chair: Jacqueline Balen

12:50- 13:10
Nera Šegvić
Can computational modeling aid archaeological surveys in mountainous landscapes?

13:15- 13:35
Neda Kulenović Ocelić
Field Survey and Archaeological Record in Karst Landscape

13:40- 14:00
Neda Kulenović Ocelić & Igor Kulenović
The Landscape of Conflict and Materiality of War: Jasenice Survey Project

14:05- 14:25
Dubravko Gajski, Mateja Moslavac & Ana Solter
The impact of omitted control points at the geometrical accuracy of 3D-model reconstructed by SfM-algorithm

14:30: 14:50
Katarzyna Dzięgielewska-Gajski & Dubravko Gajski
Accuracy potential of 3D-reconstruction by use of a smartphone camera

14:55- 16:00
Lunch break (Ground floor- A 018)

16:00- 17:00
Poster presentation in the Library Foyer

Adriana Pavlić, Katarina Šprem, Andreja Kudelić & Ina Miloglav
Experimental pottery production

Zrinka Šimić-Kanaet
Experimental archeology- “Face-pot” from Tilurium

Frane Mihanović, Ivan Jerković, Ivana Kružić, Željana Bašić & Šimun Anđelinović
Application of Multi Slice Computed Tomography in archaeometry: discovering the artifacts beneath St. Paul’s clothes

Tina Berden
Sourcing materials for stone tools manufacture in Prekmurje region with X-ray fluorescence spectroscopy (XRF)

Mirjana Sanader, Ina Miloglav, Mirna Vukov & Domagoj Tončinić
Field survey of the Danube limes in Baranja – Spatial distribution of archaeological material

Afternoon programme:
18:00- Visit to Archaeological Museum in Zagreb- conservation and preparation workshop, musem depository and permanent exhibitions

Friday, 2nd December

Chair: Nikola Vukosavljević

10:00- 10:20
Šime Ivić, Katarina Pavlek, Silvija Lasić, Stjepan Marinković, Rajna Šošić Klindžić & Josip Halamić
Exploring Sources of Knappable Materials as a Starting Point for Locating Pre-Neolithic Open-Air Sites in Dalmatia

10:25- 10:45
Irina Kajtez & Eric M Heffter
Palaeolithic Artefact Scatter Visibility in the Changing Landscapes of the Western Morava and Resava River Valleys (Serbia)

10:50- 11:10
Katarina Šprem, Ivor Karavanić & Rajna Šošić Klindžić
Results of a lithic trampling experiment and its comparison to the Mujina pećina lithic material

11:15- 11:35
Selena Vitezović & Jelena Bulatović
Zooarchaeological and the studies of osseous artefacts: where one ends and another begins?

11:40- 12:10
Coffe break (Library Foyer)

Chair: Jasna Vuković

12:10- 12:30
Esmeralda Agolli & Erinda Ndreçka
From handmade to wheel made: the impact of archaeometric analysis on the understanding of innovation in the pottery production, the case of the prehistoric cave settlement of Tren (Albania)

12:35- 12:55
Maja Miše
Game of numbers: how to define a local ceramic reference group Case study: coarse ware from Pharos and Issa

13:00- 13:20
Valentina Gluščić, Marina Horvatiček, Kristina Jelinčić Vučković & Ivančica Delaš
Total lipid extraction from archaeological samples from Ancient sites on the island of Brač

13:25- 13:45
Andreja Kudelić
Identification of pottery forming techniques- Middle and Late Bronze Age vessels (NW Croatia)

13:50- 14:10
Ana Đuričić
Reconstructing the Technology: Excavation of the Oven from the House 01/06 from Vinča – Belo Brdo and its Experimental Reconstruction

14:15
Final discussion
Closing

ABSTRACTS

Michael Doneus
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Aerial reconnaissance of buried and submerged archaeological landscapes

Over the past decades, landscape archaeology has increasingly gained importance. Despite a large variety of different approaches, a tacit agreement consists in the fact that landscape archaeologists are investigating beyond the individual site, dealing with space at different scales. This has led many archaeologists as well as preservationists to enlarge their field of endeavour from sites towards archaeological landscapes.

Therefore, large-scale application of non-invasive archaeological prospection methods (e.g. aerial archaeology, airborne laser scanning and high-resolution near-surface geophysical prospection) comprise a great potential. They are the most appropriate solution in order to provide both landscape archaeologists and planning authorities with the necessary spatial information at multiple scales, ranging from the archaeological site to the entire archaeological landscape.

The presentation will therefore focus on a range of airborne prospection methods that can be applied on a landscape scale in a variety of environments. It will demonstrate the latest developments in aerial archaeology, airborne laser scanning, airborne imaging spectroscopy, and will finally discuss the possibilities and limitations of bathymetric sensor technique in the attempt to overcome the border between land and water.

Dimitrij Mlekuž
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Lidar and landscape archaeology

Laser scanning describes any technology which accurately and repeatedly measures distance using laser pulse, by precise measurement of time needed for the laser pulse to travel from the object and back, and transforms these measurements into a series of points, or a point cloud, from which information on the morphology of the object being scanned may be derived. Airborne LiDAR (Light Detection And Ranging), ALS or ALSM (Airborne Laser Scanning, Airborne Laser Swath Mapping) is an active remote sensing technique, which records the surface of the earth using laser scanning.

Lidar like photography and other visual technologies — does not produce only pictures, but extends our powers to detect, record and imagine landscapes.

Although topographic survey has a long tradition in archaeology, sheer density and quantity of data that became available with lidar has transformed into new quality. Lidar in contrast to traditional topographic survey, does not map only important places but everything, landscape as a whole. This allows us to see landscape a continuum of traces of daily practices and activities materialised in a landscape. By focusing on the practices and their material traces more attention should be given to the questions of time and temporality of landscape.

Hrvoje Kalafatić & Bartul Šiljeg
Institute of Archaeology, Zagreb, Croatia

The four seasons: advantages of all year round cyclic surveys in aerial archaeology

Aerial archaeology, as any other part of archaeology, has own set of procedures how to obtain optimal results. One of most important parameters is time of the year when survey is done. It is usually considered that optimal timing for survey is a time when the cereal crops ripens and change color from green to yellow. That is period of late spring until beginning of the summer, during May and June. Color contrasts are among highest in all year scale, and position of the Sun is highest above horizon. Size of financial resources also play an important role in the planning of research, often restricts continuous flying over the year and that is also cause for limiting survey on this time of the year only.

Development of low-cost UAVs is gapping the bridge between research and financial costs, and allows continuous research with minimal costs with greatly improved planning for more costly plane flights. Our paper will show advantages in this approach. We will cover and compare visibility of earthworks and archaeological features from period of early germination of grain and development of crops till harvest. Results will be integrated with soilmark and snowmark recordings obtained during winter.

Hrvoje Potrebica & Miroslav Vuković
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Aerial photographs and spatial distribution of prehistoric stone mounds near Lumbarda

Stone mounds are a distinct feature of karst landscapes. Their formation can be caused by land clearance or stone quarrying, but they can also be formed intentionally as border markers, or in the case of prehistoric mounds, as burial places. The fact that they are essentially large mounds of stone, makes them easily visible from the air while their visibility from the ground can be extremely bad due to the dense karst vegetation. Since they can originate from different time periods and their original purpose varies, a field survey is necessary to confirm their archaeological potential. Systematic mapping of these prehistoric monuments is crucial for their protection and conservation. This is especially true for those mounds which are close to roads and villages as they tend to be dismantled for building material. This paper will present the methods used to survey and map the prehistoric stone mounds near Lumbarda, and the conclusions regarding the spatial distribution of the mounds in this prehistoric landscape on the eastern part of the island of Korčula.

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Geophysical Prospection with the Low-frequency Electromagnetic Method (CMD- Mini Explorer) and using Integration Analysis of Multidimensional Data

The CMD Mini Explorer (GF Instruments) is a a multi-coil, multi-depth, low-frequency electromagnetic (EM) system that is recently being used as a part of an extensive geophysical survey at several Slovenian and Croatian Iron Age sites (Poštela, Cvinger pri Dolenjskih Toplicah, Kaptol and Kagovac).

The instrument uses alternating current, which passes through the transmitter coil, inducing a primary magnetic field through the ground. When the primary field encounters changes in the soil´s conductivity or magnetic susceptibility, a secondary magnetic field is produced. The resulting electromagnetic field is measured by three receiver coils, which are spaced differently from the transmitter coil (acquiring data on three depth levels). The depth range can be influenced by switching the coil arrangement (Hi depth or Lo depth). The maximum depth while measuring is estimated at 1.8 meters. The CMD calibrates automatically before each survey, thus avoiding instrument drift, which often occurs while using older EM devices, due to moisture sensitivity and temperature changes in the surrounding.

The instrument successfully detects archaeological features, such as highly conductive layers (e.g. ditches), structures built from high resistivity materials (e.g. remains of burial chambers or houses) and ferromagnetic anomalies (e.g. smelting furnaces, metal objects, pottery, cremation graves). Furthermore, a test-polygon is being created in order to investigate how various materials, objects, layers and structures can produce changes in geophysical signals. The CMD simultaneously collects data for two soil properties on each coil, which makes a total of 12 data sets (if measuring with the Hi depth and the Lo depth way of acquisition). Results from different receiver coils can be integrated by using an open source Geographic Information System (qGIS). Integrating multidimensional geophysical data allows us to observe a more coherent depiction of the situation by eliminating noise and enhancing the signals originating from buried archaeological features.

Branko Mušič[1], Matija Črešnar[2], Hrvoje Potrebica[3], Manca Vinazza[4], Matej Dolenec[5], Nina Zupančič[6], Igor Medarič[7], Barbara Horn[8], Matjaž Mori[9] & Petra Basar[10]

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New developments in integrated studies of the Early Iron Age sites and landscapes in Slovenia and Croatia

The colourful pallet or research methods integrated in the investigations of Early Iron Age sites and landscapes has in the recent years witnessed a tremendous upswing. Archaeology has thus become a melting pot for diverse disciplines, which in a way also met their borders in complex conditions of prehistoric settlements and their landscapes.

However, our primal goal was not to pile vast amounts of data nor to understand one feature, one site, or one region, but to develop a 'methodical toolbox', which could be, due to its systematic nature, applied (almost) anywhere.

The first research step was always aimed at the understanding the basic geology of the area, which was studied with the help of ALS derived data. The next step we took was a geological and geomorphological field survey, whereas selected crucial areas were researched also with various geophysical methods.

The ground truthing of the identified features, natural or anthropological, was then conducted to determine the areas for intensive geophysical surveys, using a range of different techniques and analytical methods, covering wide areas of settlements and their surroundings, including iron working areas, flat cremation cemeteries or barrow cemeteries. Our survey incorporated the magnetic method using measurements of total magnetic field by applying corrections of diurnal variations using base station as well as magnetic prospection in gradient mode, GPR method from very low to high frequencies (50–400 MHz), low frequency EM method and measurements of top soil magnetic susceptibility. Furthermore, we have introduced the electrical resistivity tomography (ERT) that adds another dimension to our investigation (similar to GPR) and reveals/identifies underground structures not detectable with other geophysical methods for various reasons, e.g. internal structures of barrow cemeteries/tumuli and deeper buried high resistivity archaeological and geological structures.

With the next step, the geochemical mapping with a pXRF, which we have carried out on one settlement so far, Poštela near Maribor, has invited also chemistry into the circle of disciplines, creating the integrated maps of the researched sites. Preliminary conclusions on archaeologically relevant correlations between different data sets are based on multivariate statistical analyses adopted to specific natural settings on metamorphic rocks.

As the last field research step, we have applied low- or medium-invasive archaeological methods as drilling or test-trenching.

The wide range of data, gathered by the use of our 'toolbox', which was created by applying different methods deriving from various disciplines, has 'forced' us into not only interdisciplinary but rather transdisciplinary research. Under such circumstances, scientists from various disciplines can not only do their research, but have to combine and intertwine it with others to produce common results, which are not a sum of the included data, but its multiplied product.

Nera Šegvić

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Can computational modeling aid archaeological surveys in mountainous landscapes?

Archaeological surveys in mountainous areas are usually accompanied by a specific set of hindrances. Mountainous landscapes are often densely vegetated, uncultivated and/or under-populated areas where archaeological features remain hidden due to intact flora and limited collective memory. Normally, a very detailed survey including large survey teams would be costly and potentially unproductive. Can GIS play a part in archaeological surveys and pinpoint the locations which can be thoroughly surveyed by few archaeologists?

Least cost analysis is one of the standard practices of GIS in archaeological research, largely used to model possible historical pathways or site interconnectivity. However, the use of this kind of analysis as a survey method has been less studied. For this reason, a case study was undertaken in the medieval southwest Greenland. The areas colonized by Norse at the end of Viking Age were characterized by the North Atlantic setup of transhumance that a permanently occupied farmstead had a seasonally occupied shieling which enabled the continuation of economic activities during summer.

Furthermore, theories suggest the Norse subsistence economy on Greenland manifested itself through an increased level of connection in the community and that a mutual exploit of pastoral resources was undertaken through organised labour involving several farmsteads. This assumption was evaluated in GIS, using least cost analysis, thus building a potential communication network between farmsteads. The communication routes were verified against the positions of known shielings as archaeological evidences of economic pursuits and evaluated for their feasibility during the subsequent field survey.

As the field survey resulted with several new ruins along the routes thus confirming the feasibility of the paths and the likelihood of being used by the Norse, these outcomes suggest least cost analysis can have real applications for archaeological surveys in densely covered and remote mountainous landscapes.

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Field Survey and Archaeological Record in Karst Landscape

Archaeological research in Dalmatian hinterland is still largely lacking. This is especially true for Jasenice area (Zadar region, Croatia) framed by Velebit mountain, the Novigrad sea and karst plateau of the Zrmanja river. A field survey project was started in the spring of 2016. The area surveyed included mostly karst plateau of the Zrmanja river. The survey recorded various archaeological features such as burial mounds, enclosures, hillforts, roman villa, medieval and early modern settlement features, pottery scatters, military structures etc.

Karst areas are characterized by mostly excellent and almost permanent preservation of human material practices. Apart from permanent preservation, another important trait of karst areas is the preservation of long-term material practices as well as the short-term material traces of human action. Thus, material practices have become a permanent presence in landscape micro-topography, preserved and visible as surface stone structures. Accordingly, the karst landscape provides a suitable context for studying intertwined long-term material practices and the ''nature'' of archaeological record.

Archaeological record is commonly understood through notions of cultural and non-cultural formation and transformation processes. The lack of soil in a typically karst landscape provide a context for conceptualizing archaeological record as hybrid. The purpose of this presentation is to demonstrate the constitution of archeological record as hybrid relations through examples provided by field survey.

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The Landscape of Conflict and Materiality of War: Jasenice Survey Project

Over the past few decades archaeology has been profoundly transformed, including ever new perspectives, research agendas and subject matters. The discipline is struggling to find its place among the social sciences. Perhaps now, more than ever before, archaeology is less the study of the distant past and more the study of the material. Archaeological elaborations of contemporary themes are substantially increasing. Contested landscapes and landscapes of conflict are an integral part of archaeological studies for quite some time now and those include not only battlefield archaeology but a whole array of discussions regarding various aspects of materiality of conflict.

The project we are presenting is a move in that direction. A systematic field survey commenced during the spring of 2016 at Jasenice municipality area, covering roughly 20km2. This is a typical Dinaric karst landscape where the preservation of human practices in the form of surface stone structures is excellent. The historic event, which has left a truly lasting mark in the landscape, is War in Croatia (1991 – 1995). Various sorts of military structures which constitute a battle line positively dominate the landscape and their presence is quiet staggering. The line stretches in the north-south direction, beginning at the Zrmanja canyon, spreading over the Obrovac – Zrmanja plain and terminates at Velebit peak zone. The structures were built by adding or subtracting the material and as such they are a permanent part of the landscape micro – topography.

The recording and subsequent analysis is enabled by structures preservation, at the level of the individual structure, as well as at the level of the whole complex. Roughly 5% of the battle line was documented during survey.

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The impact of omitted control points at the geometrical accuracy of 3D-model reconstructed by SfM-algorithm

The recent archaeometric technologies in obtaining the reliable and detailed 3D-geometry from the surface of an archeological artefact or site mostly rely on the use of photogrammetric technologies implementing the Structure from Motion - algorithm. Although it is possible and even desirable to include a reliable calibration field (that consists of a set of well-situated and spatial determined control points) in the process of photogrammetric imaging, very often from practical reasons, it is omitted. However, the scale of the 3D-model, reconstructed by photogrammetry can be determined by use of camera data stored together with every image. In this paper, the geometrical accuracy of 3D-model, achieved by use of SfM algorithm and without use any of control points, is compared to geometrical accuracy of 3D-model, achieved by precise 3D-laser-scanning of the archaeological artefact.

All investigations were done by scanning and photographing of the ancient Roman statue (torso of a Roman Emperor, Vis, marble), kept and exposed in the Lapidarium of Archaeological Museum in Zagreb. The impact of the use of control points on the accuracy of 3D-reconstruction is evaluated and presented. Finally, the necessity of use of control points is discussed.

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Accuracy potential of 3D-reconstruction by use of a smartphone camera

The contemporary smartphones have the built-in cameras of geometric features comparable to digital cameras. Overall, an image quality of smartphone cameras suffers first of all because of a small imaging sensor and a simple objective lens. Although the digital cameras are commonly used for archaeometric tasks, there are situations where the digital cameras are not accessible in-situ at the right moment.

The smartphone is easy to find in almost every pocket. That is why photogrammetric abilities of the smartphone cameras were explored.

During the international workshop of fortification architecture on the island of Brijuni Minor (in organisation of the Ministry of Culture, the Republic of Croatia, supported by ICOMOS, and the National Park "Brijuni"), a torpedo house has been chosen to produce relevant documentation for 3D-reconstruction and conservation purposes. It has been photographed by advanced digital photogrammetric equipment (NIKON D800E + SIGMA RF20). At the same time, images of the same object were taken by built-in smartphone camera (SAMSUNG S4). From every image set, the 3D-model of the torpedo house was reconstructed by means of "Structure from Motion" algorithm. Both models were oriented to the common coordinate system, and their spatial accuracy as well as level-of-details were compared and discussed.

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Exploring Sources of Knappable Materials as a Starting Point for Locating Pre-Neolithic Open-Air Sites in Dalmatia

Even though Neolithic sites around Šibenik have been relatively well studied, reports about sources of rocks suitable for making stone tools in that area were practically nonexistent. Several of such sources were discovered during the summer of 2016, all of them different in terms of quality and geological age. The finds include chert nodules embedded in Eocene foraminifera limestone on slopes around the Danilo field, bedded Jurassic cherts in the village of Baljci near the spring of the river Čikola, lenses of chert and silicified tuff at Zelovske staje on the eastern slopes of Mt. Svilaja, and also chert fragments in the Krka riverbed as an indicator of a primary rock source further upstream. Besides the possibility of comparing the raw material with known lithic assemblages, these finds also provide an opportunity for locating pre-Neolithic open-air sites, often situated very close to sources of knappable stone. Such sources, along with other natural factors on which people depended in this period (bodies of fresh water, terrain, geological and pedological substrate, karst landforms, e.g. caves, rock-shelters, sinkholes etc.) can be spatially analyzed to highlight areas favourable for concentration of human activity over time.

Known open-air sites can also be spatially analyzed by the same principle to ascertain which factors determined the position of these areas the most. Since known sites are most obviously linked to sources of raw materials, the existence of surface finds is also expected in the surroundings of the Danilo field. In case a Mesolithic assemblage is discovered, a comparison could be made with the local Neolithic stone tool industry in a non-cave context.

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Palaeolithic Artefact Scatter Visibility in the Changing Landscapes of the Western Morava and Resava River Valleys (Serbia)

Lithic surface scatters are perhaps one of the most numerous but underappreciated sources of archaeological data. While lithic surface finds were integral for developing Palaeolithic Stone Tool Typologies throughout Europe, they have been displaced in importance by site-specific archaeological excavations. However, in certain areas (such as the Republic of Serbia), work on finding and identifying lithic surface scatters and associated Palaeolithic stone tool industries has been a minor part of archaeological research until recently. This lack of previous research provides us with the opportunity to collect and record high resolution data on Palaeolithic surface scatters with technology not available to prior generations of researchers. Our presentation focuses on two major themes.

We begin by describing potential sources of bias (such as differences in geology, raw material availability and anthropogenic activity) that impact the visibility of lithic surface scatters. Next, we present specific examples of these biases acting on two surveyed areas in Serbia: the Western Morava and Resava River Valleys. Of particular interest in these two valleys is the role that raw material availability may have on the density of lithic surface finds and our corresponding views on landscape usage intensity by hominins in the past.

Katarina Šprem, Ivor Karavanić & Rajna Šošić Klindžić
Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb

Results of a lithic trampling experiment and its comparison to the Mujina pećina lithic material

Stone tools can, apart from man-made retouch, exhibit traces of damage due to post depositional processes. As a result of post depositional factors, whether animal, human or natural in origin, this damage can sometimes be interpreted as man-made retouch, even though it is actually the so called pseudo-retouch. Due to the problems arising in differentiating these two wholly opposite things, the last few decades have shown an increase in trampling experiments the goal of which was to separate and recognize real retouch from pseudo-retouch.

This lecture is going to present one such experiment done in 2015/2016, its methodology and results, and the comparison to the results of the pseudo-retouch analysis done on lithic finds from the levels E1 and E2 of Mujina pećina. The experiment consisted of 40 pieces of experimentally made lithic artifacts which were buried 15 cm deep on a path in the vicinity of the Faculty of Humanities and Social Sciences. After being in the sediment for 6 months, these lithic artifacts were then carefully excavated and analyzed using a system developed by P. Villa and M. Soressi (Villa i Soressi 2000).

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Zooarchaeological and the studies of osseous artefacts: where one ends and another begins?

The borders between subdisciplines and disciplines should be blurred in modern scientific research, and interdisciplinary and multidisciplinary approaches are more and more encouraged in all scientific fields, both of natural sciences and humanities. However, mutual relations and interconnections of diverse fields of research are much more complex in practice, as every discipline has not only different goals but very often also completely different methods and even worldviews.

In this paper, we will analyse the relations between zooarchaeological and the studies of osseous artefacts. Osseous artefacts are sometimes completely separated from zooarchaeology and beautiful, complete objects are analysed from morphological viewpoint, while manufacture debris remains unrecognized in the faunal assemblage. Purely zooarchaeological analysis cannot yield information on technology, usage, typology, nor relations of osseous industry with other industries and production of other objects (stone, ceramic...). Complementary analyses are also important for the exact and precise identification and interpretation of every trace that may be found on bones.

Esmeralda Agolli & Erinda Ndreçka

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From handmade to wheel made: the impact of archaeometric analysis on the understanding of innovation in the pottery production, the case of the prehistoric cave settlement of Tren (Albania)

In the pottery studies, the transition from handmade to wheel-made production comprises an insightful subject matter that contributes a great deal on crucial issues related to the social, cultural and economic premises.

Due to the lack of data or applications of the appropriate methodology, in the Albanian studies this question yet remains peripheral and not fully addressed. Recent excavations in the multilayer cave settlement of Tren (southeast Albania) have yielded a unique assemblage of handmade and wheel-made matt-painted pottery dated to the Early Iron Age cultural horizons.

By taking into advantage this unique context, the analysis focus on the examination of composition on fabric and decorative pigment. An amount of 11 samples, seven handmade and five wheel-made matt-painted pottery sherds are subject of this investigation.

Fabric is examined with the EDXRF analysis. The sherds were first cleaned from depositions, dried overnight at 1050 °C then grinded in a mixer/mill for 15 min. The fine powder (<200 mesh) is converted to a pellet by pressing at 25 T. Fresh cross sections of a selection of sherds (handmade and wheelmade) were polished and used for micro XRF examinations.

Pigment is analyzed using the transportable Micro – XRF spectrometer ARTAX 800 (Bruker Gmbh) composed of low power (30 W; max HV- 50 kV). The spectrometer allows single point measurements as well as line and/or area scans (variation of the elemental intensities along a line or an area of the sample). The elemental distribution maps of the painted ceramic surface with a spatial resolution in the sub-mm range are prepared by collecting X-ray spectrum for 30s in each pixel and the resulting peak areas of the elements were further converted to a three-dimensional matrix (X-pixels, Y-pixels, I-elements) and plotted in intensity readouts graphs.

We attempt obtain an understanding on the extent to which the introduction of a new tradition in the pottery technology transforms the choices of the artisan. Are the properties of the wheel made pottery distinctively different from the handmade counterparts? Does the new technology imply an innovative process of production or its implication does not convey drastic changes to the existing tradition of the pottery production?

Maja Miše

Department of Geosciences – Archaeometry, University of Fribourg, Switzerland

Game of numbers: how to define a local ceramic reference group. Case study: coarse ware from Pharos and Issa

Studies of ancient ceramics productions comprises of descriptive and analytical approaches; archaeological stylistic and morphological analysis, and petrographic and geochemical analysis. Sometimes, if not often, an interpretation of analytical results can confirm archaeological hypothesis of local ceramic production, but sometime it cannot. This could be the outcome of missteps in the final phase of the analysis - the interpretation of the analytical results. Using the different multivariable statistical analysis not only facilitate to identify local productions more clearly and set a reference groups, but also helps to identify imported ware.

Following the archaeological hypothesis for the local ceramic production in Issa (on the island of Vis) and Pharos (on the island of Hvar) - Greek settlements on the Central Dalmatian islands - with analytical analysis we were able to confirm their existence. Even more so, we were able to determine that both Greek settlements produced coarse and fine ware, but with different types of geological clays.

In this paper, the author will present the results of comparative multivariable statistical analysis of geochemical results of coarse ware from Issa and Pharos; the local production of different types of amphorae, pithoi and kitchen ware, respectively. The aim of this paper is to show the importance of this approach in identifying local production and local reference groups.

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Total lipid extraction from archaeological samples from Ancient sites on the island of Brač

During archaeological survey of Ancient sites on the island of Brač, fragments of different amphorae types were found. Preliminary results of amphorae samples analyses are presented, types Tripolitana II, Tripolitana III, Tripolitana III (late) and Keay 59/Bonifay 37 from sites of Njivice Selca, Luke Škrip, Mladinje Brdo Pučišća and Bunje Novo Selo. Typological analyzes and bibliography suggest that in the found amphorae oil was transported or/and kept. Due to these facts in this preliminary research we determine total lipids content to confirm the function of these amphorae as olive oil containers.

Samples of different types of amphorae where analysed: V3 (Tripolitana II, site: Njivice Selca) , V4 (Tripolitana III, site: Luke Škrip), V5 (Tripolitana III, (late), site: Mladinje Brdo Pučišća) and V13 (type of amphora:Keay 59/Bonifay 37, site: Bunje Novo Selo). They were taken from necks or inner lip side. Traces of adsorbed lipids resin were present in all sample extracts.

The extraction of total lipids from 4 samples is done according to method Mottram et all. (1999). The extraction was performed with different solvent mixtures of chloroform and methanol in different rate. Fatty acids methyl esters (FAME) analysis is performed on gas chromatograph with flame ionization detection.

In two extracts of Amphora sample type Tripolitana III qualitative analysis was performed and compounds of fatty acids was identified. These types of amphora were used for storage of vegetable olive oil. In these samples we have confirmed the presence of these fatty acids: C10:0, C11:0, C13:0, C15:0, C15:1, C16:0, C18:0, C20:0, C20:5, C24:1. Chromatogram of sample Tripolitana II identified small abundance of fatty acids: C20:0, C21:0, C20:4. In extract of sample Keay 59/ Bonifay 37 it was identified presence of: C10:0, C11:0, C15:0, C15:1, C16:0, C18:0, C20:0, C20:4, C20:5, C24:1. It is also known that this type of amphora was used for storage and transport of oil.

The presence of oleic fatty acid, C18:1, as biomarker for olive oil residues in our samples isn't confirmed. This compound as other mono-,di- and triunsaturated C18 fatty acids are prone to oxidation processes and are poorly preserved in archaeological samples.

Porous amphorae material adsorbs lipids into the matrix and reduces the exposure to oxygen, air, sunlight and heat that cause decomposition process. Palmitic (C16:0) and stearic (C18:0) fatty acids are present in all samples in higher abundance. Presence of long chain fatty acids such as C20:0, C21:0, C22:0 and C24:0 could be related with the presence of waxes. Presence of C22:0 also indicated the presence of plant oils in residues.

Due to small abundances of fatty acids in our samples we cannot confirm with certainty presence of olive oil in these amphorae. So in further research and analysis of archaeological samples we suggest applying different sample preparation method.

Andreja Kudelić
Institute of Archaeology, Zagreb, Croatia

Identification of pottery forming techniques - Middle and Late Bronze Age vessels (NW Croatia)

Pottery production process can be identified on the basis of macroscopic and archaeometric analysis of their fragments or complete and partially complete vessels, and considering the results of these studies it enable us to discuss about their significance in the context of a society or culture. The pottery forming techniques are directly related to potters decisions on the selection of specific techniques that are often culturally conditioned and are directly related to the tradition. The paper will present the results of the pottery forming techniques analysis conducted on the vessel samples of cultural group Virovitica that is by relative chronology dated to the end of a Middle and the beginning of the Late Bronze Age.

The study was conducted on samples from several archaeological sites of two micro-regions (Turopolje and Podravina) in the area of northwestern Croatian. The analysis included forming techniques, surface treatments, methods of decoration, and methods of firing.

The analysis revealed that variety of techniques were applied in forming and finishing treatment, but there are also indications of certain innovations and local specific selection during the final processing of the vessel. Such differences in technological choices were observed depending on micro-region of the same cultural characteristics.

Ana Đuričić
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Reconstructing the Technology: Excavation of the Oven from the House 01/06 from Vinča – Belo Brdo and its Experimental Reconstruction

Ovens are often found at the Vinča culture sites. Sadly, these fire installations are frequently preserved only at the floor level (firebed), while parts of the upper structure are almost always missing. At the beginning of the XX century, at the site of Vinča – Belo Brdo, several fully preserved ovens were found. Even though those examples are extremely valuable, they do not offer a lot of information about the technology of their construction. Later on, the examples from ethnology were taken, in order to explain the construction process. Luckily, in the year of 2006, at the site of Vinča – Belo Brdo, a fully preserved oven was found in the house 01/06. It was partly excavated in the spring of 2015, in order to gather data about the technology of its construction. Dome fragments were carefully removed and examined so that braking patterns can be determined. Inner surface of the dome was closely observed to determine presence or absence of a wooden frame. By not cutting through it, but removing dome fragments piece by piece, we were able to determine the exact construction technique, previously not taken into consideration by other authors. For the sake of testing the theory, an experimental oven was constructed. Later on, the experimental oven was taken apart. The experimental wall fragments had the exact breaking patterns and shapes as the original oven, confirming the supposed method of construction.

POSTERS

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Experimental pottery production

In the period between 2013 and 2016, a series of lectures and experiments was carried out within a programme called Through experimental archaeology to the technology of pottery production in prehistory. They were targeted towards the students of the Department of Archaeology in Zagreb, and devised by the Centre for Experimental Archaeology, Department of Archaeology in Zagreb at the Faculty of Humanities and Social Sciences, and Institute of Archaeology in Zagreb. The aim of the programme was to transfer the basic theoretical and practical knowledge regarding the methods of pottery production. The lectures and experiments comprised the whole procedure of pottery production – from the acquisition of raw material and preparation of tempers, making of different paste recipes, forming techniques, surface treatments, testing different methods of decoration, and methods of firing. The poster will present some of the results of the experiments, with the emphasis on reduction firing process.

Zrinka Šimić-Kanaet

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

Experimental archeology - “Face-pot” from Tilurium

Face pots can be found all over the Roman Empire and they are connected to Roman army. One of such fragment (Gar 10; 899) was found on archaeological site Tilurium, which was a Roman military camp where VII Roman legion was stationed during the early 1st century. The archaeological finds confirm that other military units were stationed there as well, of which the last one was the VIII voluntary Roman cohort residing in Tilurium as a permanent military unit from the 2nd to 3rd century. Roman pottery from Tilurium consists of standard pottery assemblage characteristic of the period of the Early Empire which was used in other military camps.

In this paper the reconstruction of process production of “Face-pots” will be shown.

The process of production was reconstructed and adapted to contemporary technological conditions. The experimental reconstruction and the firing determined the possible process of production of “Face-pots” as well as their possible origin.

Frane Mihanović[1], Ivan Jerković[2], Ivana Kružić[3], Željana Bašić[4] & Šimun Anđelinović[5]

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Application of Multi Slice Computed Tomography in archaeometry: discovering the artifacts beneath St. Paul’s clothes

The remains of Saint Paul - archbishop of Constantinople which are kept in Vodnjan parish church were virtually analyzed. Beneath the bishop’s robe, besides the skeletal remains, various artifacts were found.

The casket containing remains of the saint was imaged by Multi Slice Computed Tomography (MSCT) device, Somatom 16 (Siemens, Erlangen, Germany), with 16 rows of detectors and the spatial resolution of 30 lp/mm. Scanning parameters were: 120 kVp, 162 mA, protocol – Body Angio Routine, Convolutional Kernel B30f. The slice thickness for the acquisition was 16×0.75 mm and 3 mm for image reconstruction. 2D images were post-processed by Multiplanar Reconstruction (MPR), Volume Rendering Techniques (VRT), and Maximum Intensity Projection (MIP) using software DICOM viewer, Osirix v.3.9.4 (Pixmeo, Geneva, Switzerland).

The examination of the nonskeletal material beneath the clothing revealed the unknown object. First, Hounsfield (HU) values of attenuation coefficients were examined to determine the material of which it was made. Afterward, the 3D model was made, and we concluded that the unknown object was a glass object shaped as a vial. The dimensions of this vial were measured using software Osirix, in VRT view. The vial was compared with previously analyzed vials from the chest found in the same parish church. The aim of this comparison was to determine the resemblance in material, size, shape, and to discuss its purpose.

Tina Berden

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Sourcing materials for stone tools manufacture in Prekmurje region with X-ray fluorescence spectroscopy (XRF)

This paper presents the analyses of stone tools from four prehistoric archaeological sites in north-eastern Slovenia (the Prekmurje region) - Pod Kotom-sever pri Krogu, Kalinovnjek pri Turnišču, Gornje njive pri Dolgi vasi 2 and Pod Grunti-Pince - that I have carried out during the writing of my master’s thesis and in collaboration with the University of Ljubljana, Faculty of Arts, Department of Archaeology and the University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology.

274 chipped and polished stone tools were analysed with X-ray fluorescence spectroscopy (XRF) and statistically analysed data with the program Statistica 10.

Ten different types of raw materials were identified which were used for manufacturing stone tools - cherts, obsidian, metamorphosed quartzes, serpentinites, diabases, amphibolites, limonite sandstones, high-silica tuffs, quartzites and phyllites.

We conclude that the inhabitants of this area had intensive contacts with the Pannonian Plain, from where the highest quality of raw materials for manufacturing stone tools came to the region in the period from the Middle Copper Age to the Late Bronze Age. They occasionally supplemented the existing sources of raw materials with regional and local raw materials of lower quality. The inhabitants of the province were using the same sources of raw materials over longer periods of time, indicating to the existence of a stable and well-developed social and/or trading network, responsible for supplying raw materials required for manufacturing stone tools at least in the area between the river Mura and the Carpathian Mountains.

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Field survey of the Danube limes in Baranja – Spatial distribution of archaeological material

As part of the Croatian Science Foundation project 6505 Between the Danube and the Mediterranean. Exploring the role of Roman military in the mobility of people and goods in Croatia during the Roman Era (RoMiCRO) in 2014 and 2015 systematic field survey of the Croatian part of the Danube limes in Baranja was conducted.

The aim of the systematic field survey was to establish locations which are connected with the presence of military activity in this area. The methodology of systematic field survey included the distribution of a wide spatial pattern into smaller units in the landscape which define the units of survey (Location).

The aim of the survey was to gain all the relevant information about spatial distribution and density of the collected surface archaeological material into the data base (GIS) in order to supply the data about settlement patterns of the area of Baranja through time. The poster will present preliminary results of systematic field survey in the certain parts of the Osijek-Baranja County and established methodology which can provide data about patterns of landscape usage through different periods of human activity in the past.

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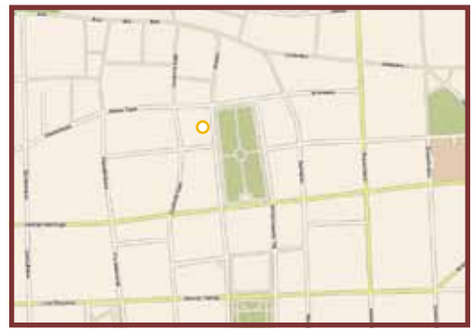

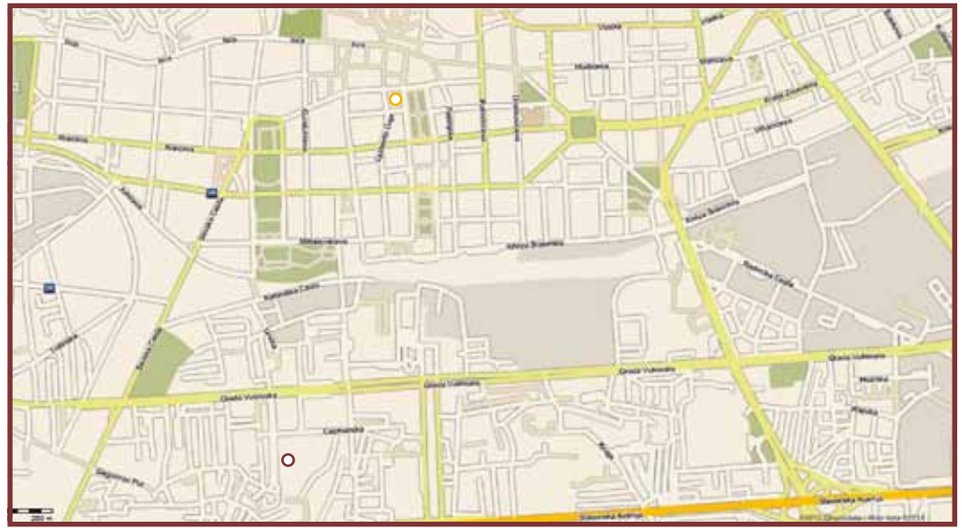

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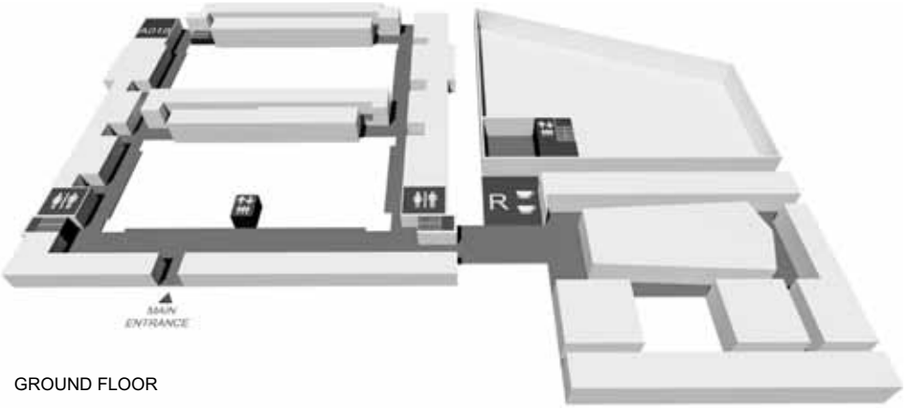

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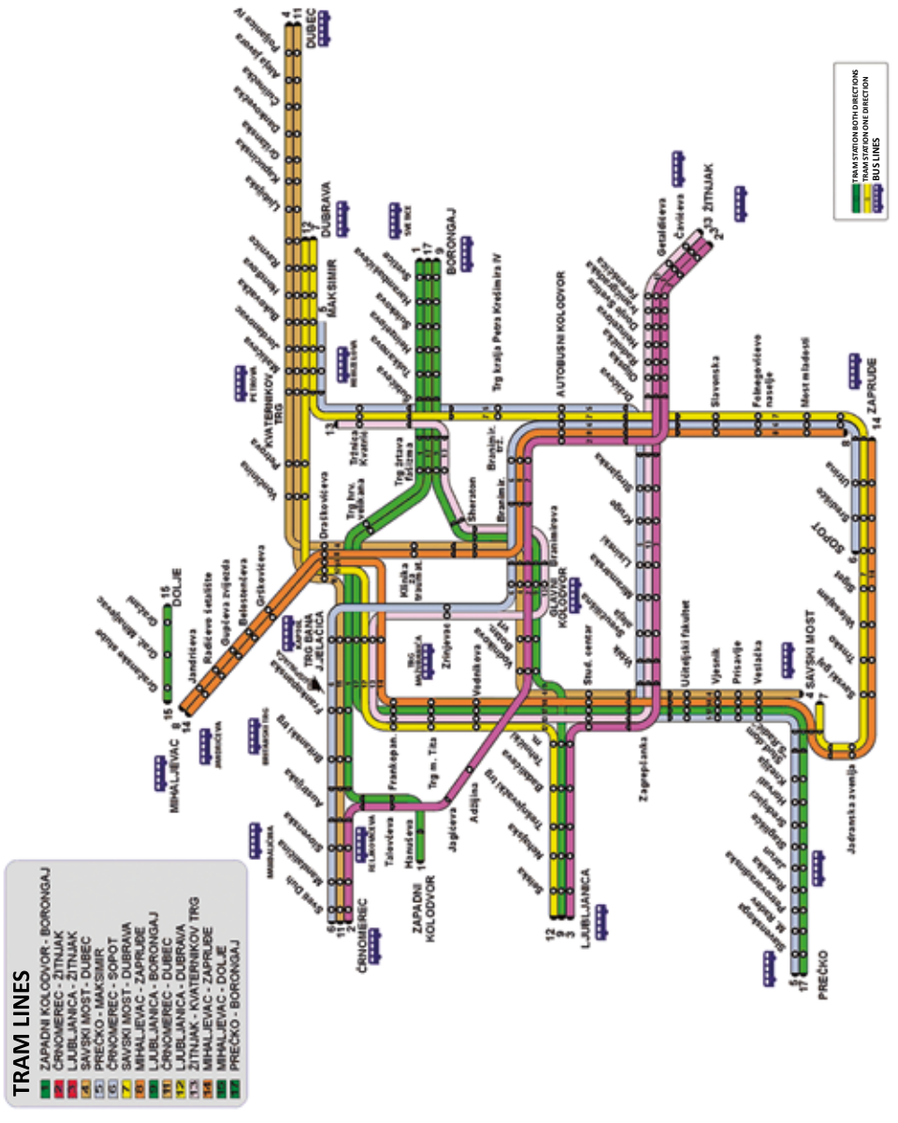
ZAGREB MUNICIPAL TRANSIT SYSTEM (ZET)

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

04TH SCIENTIFIC CONFERENCE

METHODOLOGY & ARCHAEOMETRY

Zagreb, 1ST - 2ND December 2016