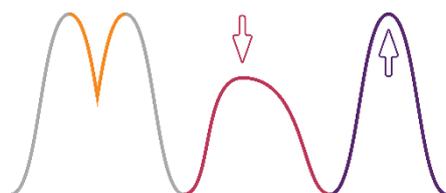
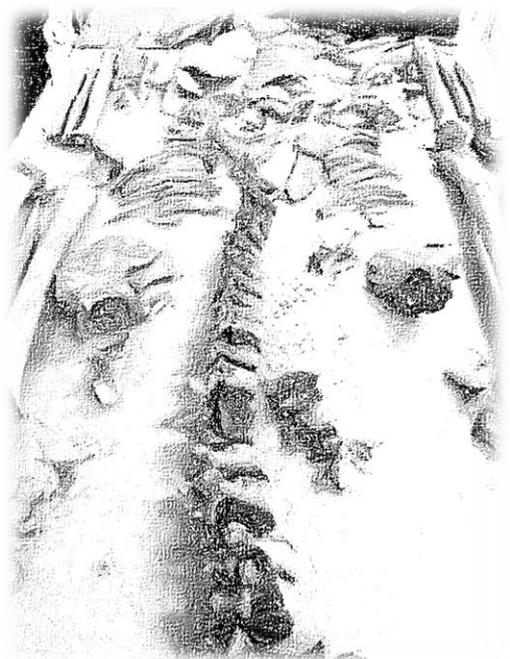


Young Researchers in Archaeometry



YRA 5th Workshop (online)
5 – 6 of September 2022

Book of Abstracts





This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

Participants

Anevlavis	Emmanouil	emanolios@hotmail.com
Barouda	Archontoula	archontoula.barouda.20@ucl.ac.uk
Borgers	Barbara	Barbara.Borgers@univie.ac.at
Crocco	Rosa	ros.crocco1@gmail.com
Delli	Georgia	delligeorgia991@gmail.com
Franczyk	Bogusław	b.franczyk@uw.edu.pl
Fundurulic	Ana	anafundurulic@gmail.com
Hafdal	Muh	hdlastro@gmail.com
Jaworska	Maria	mm.jaworska7@uw.edu.pl
Kriti	Alexandra Eleftheria Theodora	akriti@icac.cat
Kucukarslan	Nurcan	pb0c6mjp@s.okayama-u.ac.jp
Kumar	Udaya	archaeology1987@gmail.com
Mittermair	Nicole	Nicole.Mittermair@oeaw.ac.at
Moffa	Candida	candida.moffa@outlook.it
Mukherjee	Diya	diyamukherjee.nias@gmail.com
Neves	Maria João	maria.neves@uc.pt
Parasoglou	Martha	marthaparasoglou@gmail.com
Pinto	Ariane	ariane.pinto@hotmail.fr
Qureshi	Mo Rizwan Ahmad	rizwanq@iitgn.ac.in
Slavíček	Karel	slav.karel@sci.muni.cz
Solard	Baptiste	baptiste.solard@gmail.com
Šprem	Katarina	katarina.sprem7@gmail.com
Teixeira-Bastos	Marcio	marcioteixeirabastos@gmail.com
Tenczar	Wioletta	wioletta.tenczar@univie.ac.at
Tsirtsi	Kyriaki	k.tsirtsi@cyi.ac.cy
Tsoupra	Anna	atsoupra@gmail.com
Vallianatou	Eleni	evalianatou@gmail.com
Vlahos	George	giorgosvlachos1994.z@gmail.com
Xanthopoulou	Vayia	vxanthopoulou@upatras.gr

Organisers

Anevlavi	Vasiliki	vasiliki.anevlavi@oeaw.ac.at
Jakobitsch	Thorsten	thorsten.jakobitsch@oeaw.ac.at
Rose	Thomas	thomas.rose@bergbaumuseum.de
Srienc-Ściesiek	Magdalena	magdalena.srienc-sciesiek@oeaw.ac.at

White marble provenance studies in restoration, the case study of the Domitian temple in Ephesos

Vasiliki Anevlavi^{1,2}, Sabine Ladstätter², Walter Prochaska²

¹*University of Salzburg, Austria*

²*Austrian Archaeological Institute, Austrian Academy of Sciences, Vienna, Austria*

For 60 years, scholars have been applying natural science methods in the study of marble (petrographic and geochemical techniques) to investigate marble in terms of provenance, authenticity, weathering, conservation, and so on. Knowledge of the origin of marble could also be useful in the study of restoration, for example, in terms of substances of the same origin and confirmation of prior restoration attempts.

This work presents the results of research on the origin and types of marble used in the architectural façade of the so-called Temple of Domitian in Ephesos, Asia Minor. Located at the western end of the Upper Agora, the façade is composed of three zones and is decorated with reliefs representing barbarians and allegories. Shortly after the excavation in the 1960s, a partial reconstruction (anastylosis) was carried out using elements attributed to the building without prior scientific evidence. Recent archaeological investigations cast doubt on the proposed assembly. A major question related to this building program is whether the building material was obtained from the main marble source or whether other marble sources and quarries were used for this building or if the restoration project used mixed architectural elements without classification.

In order to characterize the different types of marbles and to determine their origin, petrographic, chemical, and isotopic analyses were performed. The results showed that different types of marbles can be detected in the present anastylosis and consequently reinforce the justified doubts about the correctness of the reconstruction.

Keywords: *Marble provenance, Ephesos, Temple of Domitian, restoration*

Databases of archaeological materials: A case study of ancient marble at the Austrian Archaeological Institute

Emmanouil Anevlavis¹

¹University of Piraeus, Greece

In recent decades, information and data have increased vividly through the development of technologies for the public. To better organize the data, the use of databases is being employed. A database is an object or mechanism used to store and manage information, forming a set of data characterized by a logical organization, and grouping, and helps in easy and proper management.

In recent years, the science of archaeology and archaeometry has been using various types of databases to organize data from excavations, museums, etc. More archaeological and archaeometric databases are being built to share data with the scientific community and the public. The case study presented here belongs to the Austrian Archaeological Institute, with the subject of ancient marble and archaeometric analyses. Information related to the Austrian Archaeological Institute is presented, including its role, vision, reason, and purpose for the creation of the database. An extensive description of the database will be given. The tools used for its creation and its entities are presented. Subsequently, the two different groups of samples (archaeological samples from Ancient Corinth and geological marbles from Mani Peninsula quarries), used to carry out the thesis, are reported.

Keywords: *Databases, Entity-Relationship Model, Relational Model, Archaeometry, Marble provenance*

Ceramic and plaster technologies and traditions at Neolithic Makri, Thrace, Greece

Archontoula Barouda¹

¹*Institute of Archaeology, University College London (UCL), UK*

As part of the Marie Skłodowska-Curie Innovative Training Network project PlaCe, this doctoral research project will investigate the ceramic and plaster technologies and traditions at the Neolithic site of Makri, Northern Greece, the only systematically excavated Late Neolithic site in the region of Thrace, an important contact zone between Anatolia in the west and the Balkans to the east. Many details of this coastal tell settlement have been preserved, including post-framed houses, plastered floors and various clay structures. Previous initial analyses of its rich pottery assemblage suggest that a single stable local tradition may have existed for an extended period and the Neolithic potters had a high level of know-how and technological skill. The origins of this tradition and its external influences may be key to understanding the cultural development of the site and its inhabitants. Of particular interest is the nature of pottery technology in the earlier occupation, dated to the last half of the 7th millennium BC and its continuity with that of the later phase (6th mill. BC). The abundance and good preservation of clay and plaster-based building materials at Makri, particularly during its main occupation, provides an opportunity to examine the wider uses and technologies of ceramics at the site, beyond pottery, a topic that is rarely approached by studies on Neolithic and or later prehistoric Greece. The proposed project will approach these and other questions via detailed scientific study and analysis of pottery, plaster and other ceramics.

Keywords: *neolithic, ceramics, plasters, archaeometry*

Production and Trade of 4th-3rd c. BC Cooking Ware.

A Case Study from the Palatine Hill, Rome

Barbara Borgers¹, Antonio Ferrandes², Matilde Fortunato², A. Vivona³

¹*University of Vienna, Institute of Classical Archaeology, Austria*

²*The Sapienza Università di Roma, Italy*

³*Independent Researcher*

The Sapienza Università di Roma and the Parco Archeologico del Colosseo have been conducting excavations in the valley of the Colosseum and on the north-eastern slope of the Palatine Hill since the 1980s. In this urban context, the excavations have permitted to identify a long and complex settlement sequence, dated to between the Iron Age and present day. Evidence pertaining to the mid-Republican period (4th-3rd c. BC) stands out for its quality and quantity.

The stratigraphically investigated contexts and analysis of ceramics have permitted to reconstruct the change of the urban landscape and analyse its building and sacred activities. Evidence dated to the 4th-3rd c. BC includes: a) an important road network from the 7th/6th c. BC; b-c) two places of worship, the first (whose titular deity is still debated) on the south-western slope of the Velia, and the second (identified with the sanctuary of the Curiae Veteres) on one summit of the Palatium; d) a domus, which was located behind the Curiae and rebuilt several times until the 64 AD fire devastated the area.

As part of a project focusing on trade of cooking ware in 4th-3rd c. BC Central Italy, 60 fragments were selected and examined, using thin section petrography and WD-XRF, with the aim to reconstruct their production technology and origin. The results indicated that there are few compositional groups among the sherds analysed, suggesting that pottery production was organised at a large scale. The classifications were also compared with known reference groups, permitting to map 4th-3rd c. BC regional networks wherein this pottery circulated.

Keywords: Mid-Republican Coarse Ware, Thin Section Petrography, WD-XRF, Production Technology, Provenance, Rome

Unveiling the Pottery Manufacturing from the Middle Euphrates Site of Zeytinli Bahçe Höyük, during the Late Chalcolithic

Rosa Crocco¹

Sapienza Università di Roma, Italy

During the 4th millennium BC, Zeytinli Bahçe Höyük was a small peripheral site, possibly a hamlet or a village, located on the left bank of the Turkish Euphrates in the Birecik district of the Şanlıurfa province. At this site, the Late Chalcolithic levels (LC3, dated to c. 3900 - 3500 BC) took place after the collapse of the Ubaid culture and forewent the arrival of Uruk influences and groups from southern Mesopotamia. During this time, the site shows the development of a material culture of local tradition. To gain information about this local culture, a small number of ceramic sherds from the LC3 levels of Zeytinli Bahçe was investigated through an integrated approach that combines observations of the macroscopic evidence with petrographic and chemical analysis. Preliminary results shed light on the operational chains adopted in the manufacturing of pottery vessels. It appears that at least three different recipes were used in the vessels' production, made with clays and raw materials of local origin. Eventually, a mixed technique (i.e. wheel-coiling) was employed in some of the vessels' forming and shaping, encompassing a rotatory device used at different steps in the operational chain that may indicate an experimental phase in the slow wheel's adoption. Finally, the results suggest that several technological and aesthetic choices made by the artisans (e.g. the surface treatments) may be typical of this local culture. These preliminary results seem to exhibit an ongoing specialization in craftsmanship at the small site of Zeytinli Bahçe, at a time preceding the contacts with the Uruk world.

Keywords: Zeytinli Bahçe Höyük; Local Late Chalcolithic; Middle Euphrates; Pottery Analysis; Wheel-coiling Technique

The coastal fortification of Samos. A mortar case study

Georgia Delli¹

¹National and Kapodistrian University of Athens, Greece

During the last decade, byzantine Samos has been the subject of systematic archaeological research. The examination of some monuments presented difficulties in terms of use and chronology, while in one case it was impossible to say whether the monument is byzantine, Frankish, or Ottoman. That is the case of the coastal fortification of Samos.

This unpublished monument of Samos constitutes an exceptional source of information regarding cases of uncertain attribution. Based on the construction technique of the fortification, it was impossible to say whether it was byzantine, frankish or ottoman made. Consequently, it was selected as one of the most eligible cases for mortar sampling.

The samples that were taken from the monument are under examination with OM, XRF, and SEM/EDS. The first results are encouraging in identifying the mortars as Byzantines, excluding any other assumption. These first results will contribute significantly to archaeological research, since we can now begin to discuss a part of the byzantine history of the island which eluded us. The results will also, finally, contribute significantly in studying other similar constructions in the empire.

Keywords: *Samos, fortification, Byzantium*

Thick-section in reconstruction of pottery forming techniques

Bogusław Franczyk¹

¹Faculty of Archaeology University of Warsaw, Poland

Constation that learning and sharing of knowledge takes place within a community changes the way in which we perceive cultural transmission. During acquisition of knowledge, apprentices learn how to make things "in the proper way". Those technological fingerprints are deeply rooted in the memory and in fact they are quite resistant to external influences. Thus, technological changes, which are observed in ceramic materials, can be linked with changes in the way of transmission of knowledge. In this regard technological choices and constraints could be perceived as emanations of social structures. Briefly, changes in technology correspond with changes in societies.

From this theoretical framework, a practical question arises: how to recognise those technological traces (at least in the profile of a clay vessel) and how to document them properly in the field? I would like to present a handy field method of thick-sectioning and the various ways of analysing acquired data.

At the beginning I would like to explain how this method works. Starting from selection of samples, cutting, grinding and scanning, up to the mapping of components under the stereo microscope. In the second part I will try to show how to analyse data from thick-sections and to what extent we can infer about technological actions. As a case study I chose examples of 17-19c.CE ceramic materials acquired during archaeological excavations at Old Dongola citadel (Sudan) within the ERC Starting Grant project "UMMA – Urban Metamorphosis of the community of a Medieval African capital city.

Keyword: pottery; technology; learning; Sudan

Show me the value of dirt! Some thoughts on the analyses of visible organic amorphous remains

Ana Funduruli^{1,2}

¹*Department of Environmental Biology, Sapienza University of Rome, Italy*

²*HERCULES Laboratory, University of Évora, Portugal*

Different types of organic substances from the past, detectable by the naked eye, have been studied intensively and interpreted as foodstuff or food preparations, adhesives or waterproofing agents, cosmetics and medicines, even ancient ink and illuminants. These visible organic residues could derive from heating, cooking, and burning, or from materials used for decoration, impregnation and sealing. Charred visible residues could also be detected in archeological sediments, from storage vessels or units, and transport vessels, that have been carbonized post-deposition. They are also sometimes referred to by their presumed origin, like food crust, soot, adhesives or sealants. However, when structural characteristics do not allow specific substance identification, a more general term of visible organic residue might be more suited. Integrating archaeological and chemical information allows more inclusive interpretation of the organic matter. Here multi-analytical workflow is presented, where visible residues and sediments were screened for the presence of organic matter by ATR-FT-IR, then analyzed with chromatographic techniques (GC/MS and Py-GC/MS). SEM-EDS and XRD were used to acquire elemental and/or mineralogical composition for the inorganic fraction of the archeological material, providing clearer determination of the complex residues.

Rethinking the ways in how to approach the research of archeological organic materials, that are easily susceptible to decay, allows to uncover more value in the dirt and secrets that it can hold. When used deliberately, residue analysis can expand our comprehension of the presence, use, and meaning of organic products in past societies and provide a more nuanced interpretation of human interactions within the natural environment.

Keywords: *Bioarchaeology; soil analysis; organic material; excavation; makro remains*

Human Diet Pattern on Macro Observations on the Occlusal of Paleometalic Human Isolation Tooth in Leang Codong, Soppeng Regency, South Sulawesi, Indonesia

Muh Hafdal¹

¹Universitas Hasanuddin, Indonesia

This research discusses the human diet 2000 years ago at the Leang Codong Site, Soppeng Regency. The findings of human isolated teeth found during excavations in 2017 became the main material in this research. The number of isolated teeth found was 27 teeth. For this research only 25 teeth were analyzed. The method used in the form of macro observations on the occlusal surface of Leang Codong human isolated teeth in the form of suspensions on tooth wear, measurement with imageJ software of attrition and caries areas. The results showed that traces of attrition on all teeth and also traces of caries were found. The wear score shows the wear rate of the 25 teeth have a score from 2 to 8 scores. Based on the correlation relationship, there was no difference between gender pattern diet on attrition and caries data. The level of caries that is not directly proportional to attrition in humans illustrates that carbohydrates and glucose are very influential. Meanwhile, the male correlation analysis did not show any significance between the caries data and the attrition of the teeth. The use of human teeth at the Leang Codong site does not show a tendency from the side of the tooth used. Caries and attrition areal data on two sides of the teeth showed no effect. Based on differences in diet pattern on scores and degrees of slope remaining on the loose teeth found at the Leang Codong Site which was in the paleometalic period, a indication agricultural.

Keywords: *Tooth, Leang Codong, Occlusal, Paleometalic, Diet*

What can bryophytes reveal?

A case study of the Neolithic pile dwelling site Mooswinkel (Austria)

*Thorsten Jakobitsch*¹

¹*Austrian Archaeological Institute, Austrian Academy of Sciences, Vienna, Austria*

Pile dwellings at lake shores, which were common in the Alpine area from the Neolithic to the Bronze Age, offer a vast amount of well-preserved botanical remains for archaeobotanical studies. Mosses (bryophytes) are a common find in these waterlogged sediments. This material is very helpful in the reconstruction of the vegetation, yet they are rarely analyzed. The case study of the recently excavated Mooswinkel pile dwelling at the Austrian lake Mondsee gives an insight into the archaeobotanical study of moss remains. Moss remains are recovered with the wash-over method, then handpicked from the different sieving fractions and identified with light-microscopy. The ecological classification is performed with Ellenberg indicator values and forest attachment values. The analysis shows that many of the moss species were deliberately gathered by the pile dwellers and could have served several possible uses. The vegetation from where the different species were gathered was ranging from closed forests to open land – showing that humans had already opened patches of land in the forests. In addition, for understanding the human impact on vegetation and vegetational change, the modern moss flora at the site was studied and compared to the Neolithic species.

Keywords: *Bryology, mosses, Archaeobotany, vegetation reconstruction, late Neolithic*

Late Roman lamp production in Ptolemais (Cyrenaica)

Maria Jaworska¹, Małgorzata Daszkiewicz²

¹University of Warsaw, Poland

²Freie Universität Berlin, Germany

Ptolemais (modern Tolmeita, Libya) was a prosperous port city of the Libyan pentapolis, which in the Late Roman period was promoted and established as the capital of Libya Superior province. From 412 C.E. it also held an important role for the Christian community as the seat of the Libia Pentapolitana bishopric.

During almost ten years of Polish excavations in Ptolemais, a significant set of clay oil lamps and lamp moulds was discovered. In 2005 a Late Roman workshop with the kiln to fire lamps was excavated together with a deposit of many production wastes. Research on the moulds and the lamps that matched them indicate their local production. Samples of local clays, lamps and lamp moulds were selected for further archaeometric analyses.

The combination of traditional archaeological methods (typological, iconographic, comparative) with archaeometry (WD-SRF, MGR, thin-section) allows us to characterize the features of the local Late Roman production in Ptolemais. It constitutes an important element in the discussion on both inter- and supra-regional influences that shaped the patterns used in the local workshops.

Conclusions on Late Roman lamp production in Ptolemais will be further discussed in the context of socio-economic changes in Late Antiquity and early Christian art.

Keywords: Ptolemais in Cyrenaica; Late Roman lamps; local production; provenance studies

New methods to explore past agriculture: Modern Experimental Cultivations and 3D Geometric Morphometrics

*Alexandra Eleftheria Theodora Kriti¹, Alexandra Livarda¹, Ioannis Mylonas², Elissavet Ninou³,
Hector Orengo¹*

¹Institut Catala d' Arqueologia Classica, Spain

*²Hellenic Agricultural Organisation-DIMITRA, Institute of Plant Breeding and Genetic Resources,
Greece*

³International Hellenic University, Department of Agriculture, Greece

In this paper we aim to present a new experimental cultivation project in the north of Greece, and how this can be used towards the development of new tools that will allow investigation of agriculture in the past.

The project focuses on barley (*Hordeum vulgare* L.) and its experimental cultivation at the Institute of Plant Breeding and Genetic Resources, based at Thessaloniki, north Greece. The barley genotypes are originating from various regions of contemporary Greece and constitute the traditional landraces, until the Green Revolution. Also, a modern cultivar from Thessaloniki is used as a control reference. Different cultivation regimes are simulated by traditional agricultural practices. We are conducting regular observations and measurements on all the plants, thus assessing the landraces' response to the climatic and environmental conditions, and their potential impact on the phenotype of the grain and its dietary value. Furthermore, few hundreds of grains from selected landraces are recorded with a high-precision 3D scanner. This is the first time that such a method is applied on cereal grains in archaeology. The high-resolution grain models are used for the extraction of 3D Geometric Morphometric (GMM) measurements. All this information is used to train a machine-learning (ML) algorithm with the aim to identify distinct landraces.

It is the first step towards the creation of a cost-effective tool that can be applied on archaeobotanical material from all periods. The preliminary results will be presented, as well as the next steps of the project.

Keywords: *Archaeobotany, method development, experimental archaeology, agriculture, 3D Geometric Morphometrics*

Early efforts for ironmaking in Central Anatolia: analysis of iron artefacts from the Bronze Age in Kaman-Kalehöyük

Nurcan Kucukarslan¹, Tsutomu Ota¹, Katsura Kobayashi¹, Eizo Nakamura¹, Sachihiko Omura²

¹The Pheasant Memorial Laboratory, Institute for Planetary Materials, Okayama University, Japan

²The Japanese Institute of Anatolian Archaeology of the Middle Eastern Culture Centre in Japan, Turkey

Iron becomes a commonly processed metal during the Middle and Late Iron Ages (ca. 900-430 BC) in central Anatolia. When tracing back earlier, iron appears as a scarce source of valuable metal in the ancient texts from the Old Assyrian Colony and Hittite Periods (ca. 2000-1200 BC). Thus, it is quite rare to uncover an iron artefact from the Bronze Age. However, a group of iron artefacts were excavated from the settlement layers at Kaman-Kalehöyük, which were dated to the Middle Bronze Age (ca. 2000-1400 BC) and Early Bronze Age (ca. 2300-2000 BC). Some of the artefacts were re-examined in this study, with the particular aim of understanding how they were produced in such early periods. For instance, were the artefacts made by smelting from the terrestrial ores and made of an iron alloy with carbon consciously? Six iron artefacts were analyzed using scanning electron microscopy and energy dispersive spectroscopy (SEM-EDS) via a minimally invasive approach to determine their chemical composition and microstructure. The results of EDS analysis indicate that the Ni and Co concentrations within the iron artefacts are very low, being below the detection limit of the instrument. Two artefacts were mainly composed of Fe-metal while other artefacts are completely corroded. Besides trapped slag inclusions with wüstite and glassy silicate phases, unevenly distributed cementite/pearlite remnants are observed within each artefact. The artefacts are thus composed of ferrite and/or steel. Such a finding could highlight the range in early efforts for ironmaking during the Bronze Age in central Anatolia.

Keywords: ironmaking; Bronze Age; central Anatolia; microstructure analysis

Understanding past technology through an experimental approach: Case study of pottery techniques, bone tool making and iron smelting process

Udaya Kumar¹

¹*National Institute of Advanced Studies, India*

The term experimental archaeology is a convenient way of describing and disentangling the collection of facts, theories and fiction that have been assembled through a century of interest in the reconstruction and function of past remains. The aim of this paper is to understand and observe the micro aspects of past technology through an experimental approach. In this research, the author has taken three different techniques for the experimental study that is pottery techniques (hand-made and wheel-made), bone tool-making and the iron smelting process. As concerned to pottery techniques, the author discusses all stages involved in pottery techniques such as preparation of clay, hand-made pottery, wheel-made methods, burnishing, pre-heating and firing of the pottery. The focus of the bone tool (point & knife) study is to document the choices made between pig and buffalo bones as well as the stages of processing the bone by pyro-technology. With respect to iron smelting, furnaces are broken, and the tuyere is removed to recover the bloom leaving often little or no traces of these stages of the process in the archaeological context. New furnaces may then be constructed either on the same spot or in its vicinity, and the time between these events is often confusing for archaeologists, especially because most commonly used relative dating based on pottery types is not possible in these instances. Here, the author examines this question by looking at the process of furnace construction and its destruction in ethnographic and experimental studies. Experimental archaeology helps us understand processes from the past rather than specific events giving us a much better understanding of the socio-cultural and economic aspects of the past.

Keywords: *Experimental archaeology, pottery techniques, bone tool, iron smelting process, furnaces*

Regional and Local Alloying Habits in the Bronze Age Western and Central Balkans

*Nicole Mittermair*¹

¹*Austrian Archaeological Institute, Austrian Academy of Sciences, Vienna, Austria*

During the last decades geochemical analysis of copper-based artefacts from the Balkans have been intensively conducted in order to reconstruct raw material networks during the Bronze Age. However, information on elemental composition of metal finds is irregularly distributed throughout the area. Chemical compositions provide not only information on possible copper ore sources but help us understand the organization and supply of metal-producing workshops more precisely. This also includes alloying practices and the formation of craft traditions within particular regions.

In this paper, the already published results of metal finds from Slovenian hoards will be compared to newly obtained results from the western and central Balkan. With the help of minor and trace element analyses, parallels and particularities concerning alloying habits can be observed over the course of the 2nd millennium BC in different regions. The investigated find spectrum comprises intermediate artefacts like ingots and casting waste as well as final objects of different functions.

By consulting typology and find context, insights into technological processes of metal crafting workshops are observed on a regional and larger scale. Alloying practices not only correlate with general material property requirements. Certain object categories seem to favor supra-regional standardized alloying associated with function, use and distribution of objects. Moreover, a nuanced local perspective on elemental data of specific sites enables to reconstruct fragments of object biographies within the deposition context.

Keywords: *archaeometallurgy; Bronze Age metal craft; trace element analyses; alloying; bronze production*

THz-FDS identification of potentially damaging VOCs in the cultural heritage field

Candida Moffa¹

¹*Scienze di Base e Applicate per l'Ingegneria (SBAI)-Sapienza Università di Roma, Italy*

This work was motivated by the increasing demand to monitor the air-quality to prevent deterioration and preserve the cultural heritage (CH) which can be located indoor or outdoor. Volatile organic compounds (VOCs) have a high vapor pressure at room temperature and are often emitted from building materials such as wood, coatings, plastics and adhesives and are produced also by common industrial processes. They are considered dangerous for living being and can have a deleterious effect on CH materials due to reactions that can induce and cause degradation, cracking, opacification, softening or efflorescence of the different layers.

In this work, terahertz spectroscopy in frequency domain (THz-CW) was applied to obtain the optical information on compounds related to the conservation of CH materials.

In order to preserve the CH, a new portable experimental approach based on THz-CW high resolution spectroscopy was used. Firstly, the pure optical response of five VOCs (methanol, ethanol, isopropanol, 1-butanol and 2-butanol) was investigated and the molar absorption coefficient in the spectral region 0.06-1.2 THz was determined. Then, the optical response of their mixtures (achieved with ambient air or ethanol) was investigated. Moreover, the ability to discriminate binary mixtures of these compounds proved that it is possible a differentiation of single components by describing their spectral absorption in terms of the linear combination of pure compounds.

The results showed that THz-CW can be a useful technique for the characterization of VOCs of interest in the cultural heritage field providing a methodology for the preventive conservation of artefacts.

Keywords: *THz-CW; VOCs; spectroscopy; air-quality; microclimate*

An archaeo-technological experimental approach to ancient copper smelting

Diya Mukherjee¹

¹National Institute of Advanced Studies, India

The paper unfurls the archaeological evidence of ancient copper smelting technology provided by archaeological excavations. Pyro-technology has always been an integral part of Harappan culture and the metallurgical activities of that particular culture have been identified to be a consequential factor in branding it as the first urbanization. The remains of metallurgical activities are found in form of fragments of ores, kilns or fragments of kilns attributed to metal processing, metallurgical slag from the reduction of ore to metal, tools used for metal processing such as crucible fragments with metal prills, moulds, anvils, stakes, hammers and chisels and so on and metal objects including smelting and melting ingots, semi-finished and finished objects. Based on these shreds of evidence attempts have been made to understand ancient technology. Experimentation can make it possible to recover the means of appropriation of thermic transition phenomena in antiquity. A comparison of the attitudes of the current, scientific and protohistoric craftsman in the field of metallurgy shows all the misunderstandings that can emerge from these two approaches which are such different ways to practice the same technique. These terminologies often restrict our perspective of understanding the past technologies but in this paper, the focus is rather on attempting to understand the process of past technology through the trial and error method. The methodology adopted for this paper is to review literature (review of previous experiments by eminent scholars) and also ethnographic surveys conducted for my doctoral degree. The process will be discussed in detail during the presentation.

The author strongly believes the use of modern equipment like machine bellows, modern furnaces, and other modern instruments like a thermometer, etc. is futile to understand ancient technology. Henceforth, the author has strictly restricted the use of any kind of modern instruments and instead relied on ancient equipment like leather bellow, clay furnace, use of stone hammers, etc. The researcher has also collected copper ores (sulphide ores which are considered complex ores used by the Harappan people) from the Khetri copper mine in Rajasthan, one of the sources exploited by the Harappan people for copper.

Keywords: *Harappan culture, Experiment, Copper Smelting*

Old problems, new approaches and bigger challenges: a transdisciplinarity approach in the human skeletal analysis on Late Prehistory sites in Southwestern Iberia

Maria João Neves¹

¹University of Coimbra - CIAS - Research Centre for Anthropology and Health/ Institute of Interdisciplinary Research, Portugal

Late Prehistoric funerary sites have dynamic and complex biographies. These sites include a vast amount of architectural solutions (passage graves, tholoi, hypogea, pits...). The majority of these sites were used as collective tombs which housed fresh cadavers, skeletons, commingled bones, and various material culture items.

In Portugal, the scientific exploration of a particular kind of megalithic tombs, hypogea, started in the 1860s, with several discoveries taking place until the 1960s. Original archaeological documentation and early publications suggest a static understanding of these sites, where synchronic and diachronic approaches were mainly absent, primarily due to a lack of suitable excavation methodologies.

After a research hiatus of more than fifty years, the boom of preventive archaeology yielded a new series of discoveries, promoting a real empirical revolution.

The hypogea complex at Monte do Carrascal 2 (Beja) and the hypogea cluster at Monte Canelas (Faro) illustrates this game-changing time. Here, Archaeoethanatology, Geoarchaeology and GIS analysis, coupled with the radiocarbon dates from well-defined stratigraphic contexts, provided a new understanding of the rhythm of funerary depositions, interruptions of use, reformulations, abandonment of the monuments, and how all of these aspects were affected by taphonomic factors over the last 5000 years. This work highlights how a reflexive methodological practice can liberate us from static perspectives toward dynamic observations, shedding light on past funerary practices with new inter and transdisciplinary approaches.

Keywords: Archaeoethanatology, Hypogea, 4rd/3rd millenia BCE, Portugal

Fire and Sand:

An archaeometric analysis of the Roman architectonic glass found during the excavation of Lamia's Gardens

Martha Parasoglou¹, Laura Medeghini², Pedro Barrulas³, Michela Botticelli⁴

¹*University of Evora, Portugal*

²*Sapienza University of Rome, Italy*

³*HERCULES Lab, Portugal*

⁴*University of Glasgow, UK*

A multi-analytical approach has been applied to characterize early Roman architectonic glass from the archaeological site of Lamia's Gardens (Rome, Italy) dated between the second half of the 1st century and the first half of the 2nd century AD. The aim of this work is to investigate the production technology of Roman architectonic glass and to explore the nature and the provenance of the raw materials. Optical microscopy (OM), Scanning Electron Microscopy coupled with Energy Dispersive Spectroscopy (SEM-EDS), Electron Microprobe Analysis (EMPA) and Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) demonstrated that the glass fragments analyzed belong to the natron-lime-silica glass type. Furthermore, the comparison between the samples analyzed and known compositions of Roman glass indicated that the raw glass was produced in two different locations, possibly in Egypt and on the Syro-Palestinian coast. glass studies; architectonic glass;

Keywords: *Lamia's Gardens; production technology; provenance*

Identification and characterization of gilding in 16th and 17th c. paintings

Ariane Pinto¹

¹*National Center for Research and Restoration in French Museum, France*

This post-doctoral research belongs to the AORUM interdisciplinary project (Analyse de l'OR et de ses Usages comme Matériau pictural) dedicated to the study of gold as a material for easel painting in Western Europe in the 16th and 17th c. During this Modern Period, some art-theoricians as Alberti and Vasari consider that gold is not supposed to be used anymore in artistic practices of painting, due to the development of perspectivism and illusionism. However, a more thorough study highlights the persistence of gold use in paintings of famous artists such as Raphael, Dürer, Rubens, Rembrandt, or Vermeer.

We aim to conduct a multi-analytical approach on historical paintings to access gilding materials and manufacturing processes: surface panel preparation, gilding nature (water gilding, oil gilding, garlic gilding), gold type (shell-gold, gold leaf), gold composition and thickness and gilding post-treatment (burnishing, stamping, varnishing). We also aim to compare material and technical data with historical technical treatises. Modern replicas were also made in order to characterize materials according to different manufacturing processes, to compare them to historical samples and to perform optical measurements.

First results were obtained on a corpus of 15 cross-sections coming from 14 paintings. SEM-EDX allowed the characterization of gold chemical composition, and the identification of metal allows used in gold leaf (silver, copper) and their content, as well as the gold leaf thickness. FTIR gave valuable information regarding gilding bole and oil paste. Finally, the study of conservator's reports highlighted some of the 'chaîne-opératoire' steps such as panel preparations, gilding post-treatments and alterations.

Keywords: *Gilding ; Painting ; Modern Period*

Iron Technology in Medieval Kerala: Scientific Analysis of Iron Artifacts from Triprangode

Mo Rizwan Ahmad Qureshi¹, Alok Kumar Kanungo¹, Amit Arora¹, Krishnaraj K.²

¹Indian Institute of Technology Gandhinagar, India

²Department of Archaeology, Government of Kerala, India

Iron has been one of the markers of second urbanization in Indian archaeology. A number of studies are available on antiquity and archaeometallurgical study on Indian Iron and its regional variations. A few works on high carbon Ancient South Indian steel are published. Iron was a new entrant and a must in weaponry in the 2nd and 1st millennium BCE. There is every possibility of it being used for generations and depositing or hiding the same for use in time of need or even as part of religious activities. Dating Iron has been mostly based on the associated finds, whereas irons are repeatedly melted, shaped, and reused. Differentiating the iron in use and iron from earlier times has been a challenge, and requires the dating of the artefacts. The artefacts recovered from a cave near Triprangode, Kerala, include samples of two swords and one tripod, which were claimed to be of the 1st millennium BCE based on associated finds and typological comparison. The optical microscopy (OM) and scanning electron microscopy (SEM) technique are employed for microstructure analysis. The X-ray fluorescence (XRF), X-ray diffraction (XRD) and energy dispersive spectroscopy (EDS) analyses are performed to identify the element and phases present in the sample. For the first time in the Indian context, AMS radiocarbon dating is carried out to determine the age of the artefacts. A combination of these indicates Bloomery technique is involved in iron making.

Keywords: Archaeometallurgy; ancient iron-making technology; bloomery iron; AMS radiocarbon dating; Triprangode, Kerala

From OXALID to GlobaLID: Towards a community-standard for lead isotope data in archaeology

Thomas Rose^{1,2}, Sabine Klein^{2,3,4}, Katrin J. Westner⁵, Yiu-Kang Hsu²

¹*Institut für Geowissenschaften, Goethe-Universität Frankfurt, Germany*

²*Forschungsbereich Archäometallurgie, Leibniz-Forschungsmuseum für Georessourcen/Deutsches Bergbau-Museum Bochum, Bochum, Germany*

³*Ruhr-Universität Bochum, Institut für Archäologische Wissenschaften, Bochum, Germany*

⁴*FIERCE, Frankfurt Isotope & Element Research Centre, Goethe Universität, Frankfurt am Main, Germany*

⁵*Ecole Normale Supérieure de Lyon, CNRS, Université de Lyon, Lyon, France*

Lead (Pb) isotope geochemistry is an approved key method in archaeological sciences to reconstruct the resource provenance of metals and trade networks of the past civilisations. Successful application and interpretation of Pb isotope signatures of metal artefacts rely crucially on the published ore data, which are partly only available from pre- or re-digitalised publications. Most Pb isotope reference data collections were compiled by individual working groups, usually focussing on their projects and regions of interest. A great step towards a large-scale collection of Pb isotope data came with the release of the OXALID database in the early 2000s, which has benefited the scholars in the natural science discipline as well as the more untrained users from the archaeological community. GlobaLID aims to continue this process by providing a modern infrastructure consisting of a database for lead isotope data in accordance with the FAIR principles and a web application to access this database and to carry out most of the standard tasks in raw material provenancing with lead isotopes. Prototypes of both, database and app were launched in early 2022.

The biggest challenge of GlobaLID was and still is the compilation of high-quality and rich metadata. Several examples will show why the compilation of such a database can only be achieved through a coordinated effort of the entire community and the development of a common standard for the reporting of lead isotope data – and why this is crucial for mastering the plethora of data from the past decades.

Keywords: Lead isotopes; Archaeometallurgy; FAIR; databases; Provenancing

Pottery as a witness of commercialization: The case of 9th-century ‘Great Moravia’

Karel Slaviček¹, Michal Hlavica²

¹Department of Geological Sciences, Masaryk University, Brno, Czech Republic

²Institute of Archaeology of the Czech Academy of Sciences, Brno, Czech Republic

The assemblage from the 9th century Moravian center at Staré Město near Uherské Hradiště was evaluated by archaeometric methods (XRF, petrography, XRD) and resulted in the detection of a complex exchange network connecting the center with multiple parts of its hinterland.

Keywords: Commercialization; Great Moravia; Pottery; XRF; XRD; Petrography

Back to Black: A Mineralogical and Chemical Characterisation of Atticising 4th Century BCE Black Gloss

Baptiste Solard¹, Silvia Amicone¹, Eleni Aloupi-Siotis², Beatrice Boese¹, Lars Heinze³, Claudia Lambrugo⁴, Christoph Berthold¹

¹Competence Center Archaeometry - Baden-Wuerttemberg, Universität Tübingen, Germany

²THETIS Authentics LTD, Athens, Greece

³ArchaeoConnect GmbH, Tübingen, Germany

⁴Dipartimento di Beni Culturali e Ambientali, Università degli Studi di Milano, Italy

Previous studies on Attic Black Gloss technology focused mostly on pottery productions from Greece, especially Athens. However, Black Gloss dispersed across the Mediterranean over several centuries, constituting one of the most wide-spread decoration techniques from the Archaic to the Hellenistic times. Focusing on both Attic and Atticising Black Gloss productions from Sicily and Asia Minor, our work aims to shed new light on the technology of this decoration and its transmission throughout the Mediterranean during the 4th century BCE. For this purpose, we applied an integrated analytical approach, aiming to characterise both the chemistry and the mineralogy of our Black Gloss samples. This approach includes ceramic petrography, portable X-ray fluorescence (pXRF), micro-X-ray diffraction (μ -XRD²), and energy-dispersive X-ray spectroscopy (SEM-EDS). Specimens from the 4th century BCE from Manfredonia (chora of Gela), Iasos (Caria), and Priene (Ionia) were analysed. These assemblages reflect various production groups that were identified by the chemical and petrographic analyses of the ceramic bodies. The μ -XRD² and SEM-EDS measurements show a certain degree of mineralogical and chemical variability that does not seem to correlate with the different production groups recognised. Despite this variability, the results indicate that the glosses were produced with a very similar technological process and allow us to have a better understanding of the mechanisms through which Black Gloss technique was diffused in the Mediterranean during the timespan considered in this study.

Keywords: *Atticising Black Gloss; Ceramic technology; Ceramic petrography; SEM-EDS; micro-XRD*

Micropetrographic analysis of limestone for provenance studies in the Istrian Antiquity, Croatia

Katarina Šprem¹

Juraj Dobrila University of Pula, Croatia

During Antiquity in Istria, Croatia, stone for the building of the cities and villae rusticae was quarried in several locations on the peninsula. The most famous quarry is the so-called Cave Romane quarry near Pola in the south of the peninsula, but there are also many more. For our doctoral research we sampled most of the Roman quarries and mapped their locations in QGIS superimposed on geological maps. This allowed us to start creating a petrographic database of limestone lithotypes exploited during the Antiquity in Istria. We also took samples from several Roman monuments and sites from the Parentium and Pola agri and compared them to a hypothesized quarry of provenance. Using polarizing petrographic microscope, we conducted a micropetrographic analysis on all the samples which enabled us to bring forth some conclusions about the usage of stone during the Antiquity in the Istrian peninsula.

Keywords: *Istria; Antiquity; limestone; micropetrographic analysis; quarries*

Early medieval health, diet, and mobility in the eastern Alpine region in Austria and interdisciplinary applications

Magdalena Srienc-Ściesiek¹

¹Austrian Archaeological Institute, Austrian Academy of Sciences, Vienna, Austria

The early medieval period (7th-11th century CE) in the Jauntal Valley, located in southern Austria near the Karavanke Mountain ridge, was deeply influenced by the fall of the Roman Noricum at the end of the 6th century CE. This transitional phase, which was also affected by the expansion of Christianity across Europe, created a melting-pot of various cultural groups such as the Romans, Slavs, Avars, Ostrogoths and Lombards that settled and migrated within the Valley. Many questions regarding the development, structure, and boundaries of the human population remain unanswered, despite the number of historical and archaeological sources. Likewise, no settlements have been discovered to date and the core information comes from cemetery contexts. This paper aims to present the systematic bioarchaeological analyses conducted as well as the planned analyses of the early medieval cemetery in the Jauntal Valley at Jaunstein/Podjuna (130 individuals). The demographic distribution and archaeological evidence at the site suggests a rural population, and the presence of metabolic disease observed macroscopically, such as scurvy, could suggest a lack of available nutrition; however, in periods of cultural transition, scorbutic morphologies can highlight the relationship communities had with their environment. Initial stable isotope (carbon and nitrogen) results also show a change in diet throughout the early medieval period and mitochondrial aDNA data is pending.

Keywords: *Bioarchaeology; paleopathology; diet reconstruction; mtDNA*

New Insights into the Provenance and Technology - Applying Ceramic Petrography Analysis to Ancient Pottery Studies

Marcio Teixeira-Bastos¹

¹University of São Paulo, Brazil

This contribution concentrates on the development of a petrographic approach to the study of two distinctive archaeological contexts. The first is related to the provenance of roman pottery from the Middle East, especially from Palestine; and the second case is connected with the technology of indigenous pottery from the Amazon. Despite distinctive regions and periods, in both cases, as I hope to demonstrate, the application of archaeometric research provided genuine new insights into the respective past societies. Thus, increasing our knowledge significantly. The cases under discussion serve to reinforce the efforts on developing a demonstrably interdisciplinary methodology for the study of ancient pottery and archaeological sites, combining geoarchaeology and social anthropology. Although incorporating data at the micro-level, a landscape-oriented anthropological perspective is interested in human adaptation to changing (social, economic, religious) and environmental conditions, especially as related to increasing settlement density, mobility, and social-religious-ecological relationships.

Keywords: Ceramic Petrography; Middle East; Amazon; Provenance and Technology

The preliminary study of the early bronze age pottery from a stronghold in Ratzersdorf, Lower Austria.

The first petrographic observations and pXRF measurements

Wioletta Tenczar^{1,2}

¹*University of Vienna, Austria*

²*Austrian Archaeological Institute, Austrian Academy of Sciences, Vienna, Austria*

At the southeastern foothills of the Dunkelstein Forest, in the district of Ratzersdorf, the remains of the early bronze age stronghold are hidden. The fortification has been discovered in 1928 by archeologist J. Bayer. Unfortunately, the systematic research of the stronghold was postponed due to the early death of its finder. The first campaign of the current excavation in Ratzersdorf (Mnr. 19156.18.03) took place from July 2 to August 29, 2018.

The Dunkelstein Forest grows on a quartz-rich geological formation, Bohemian Massif. This geomorphological province is best known for its excellent kaolins and ceramic clays - such as fire clays. The stronghold in Ratzersdorf was built according to the natural hill formation. The plateau is surrounded by an oval ditch, which completely encloses the former settlement area. Due to strong soil erosion and scarce documentation of early archeological measures the evaluation of the finds proves to be challenging.

The combination of the pXRF and petrographic analyses focuses on the question of the provenance and pottery production techniques. Pottery samples were taken from the area of the northern wall part and plateau – Section 1 (Schnitt 1) - during stratigraphic excavation campaigns in 2018 -2020. The preliminary study was conducted on a representative group of handles, loom weights, rims, and pottery-wall fragments.

This research is a part of a master graduation project at the University of Vienna in cooperation with Austrian Archeological Institute.

Keywords: *Ratzersdorf; pXRF; petrography; early bronze age; Lower Austria*

Agricultural practices and dietary patterns in the late Classical-early Hellenistic Period: the evidence from archaeobotanical remains

Kyriaki Tsirtsis¹, Evi Margaritis¹

¹The Cyprus Institute (STARC), Cyprus

Daily activities related to food production or procurement and storage, as well as cooking stages, reflect important scheduling decisions and ancient economic models which can be deciphered through the study of archaeobotanical remains. This presentation attempts to unfold snapshots of daily agrarian life at the site of Sikyon (Peloponnese) dated to the Classical-Early Hellenistic period. Both macrobotanical (charred grains) and microbotanical (starch granules) remains are used to decode the agricultural and cooking activities that took place in this site, in the framework of the collaborative 'Old Sikyon Project'. While macrobotanical remains have the potential to shed light on a wide range of human-plant interactions, from resource management and environmental impact to cultural modification of plant products and the plants themselves, starch granules are a source of information concerning plant use and human dietary behavior. As such, the interdisciplinary nature of the present study not only allows for the tracing of exploited plant resources, relationships between people and plants, and past day-to-day rural life during the Classical-Early Hellenistic periods in NE Peloponnese, but also facilitates suggestions concerning contextual interpretations at the site.

Keywords: *archaeobotany; 1st millennium BCE; carbonized seeds; geometric morphometrics; starch granule analysis*

Determination of loss-on-ignition (loi) in x-ray fluorescence spectroscopy to analyse archaeological ceramic materials

Anna Tsoupra¹, Joao Fontiela², Jose Mirao^{1,3}

¹HERCULES Laboratory, University of Evora, Portugal

²Department of Physics (ECT), Institute of Earth Science (IIFA), University of Évora, Portugal

³Department of Geosciences, School of Science and Technology, University of Évora, Portugal

Among the array of analytical techniques used in archaeometry, XRF spectroscopy has an elevated position. To obtain bulk elemental compositions of the studied material, fused beads preparation is required and the LOI determination is essential. Conventionally, LOI is determined after calcination of an amount of sample. As sample-size related to archaeological material is valuable, we intend to establish a methodology for LOI determination to avoid any further destruction of material. Regression analysis was applied on the results obtained from 6 standard reference materials (SRMs) to verify experimentally the efficiency of the suggested methodology.

Keywords: *archaeology; X-ray fluorescence; LOI; regression analysis.*

Land-use evolution and change in five settlements of Northeastern Messenia, Greece: an interdisciplinary approach from prehistory to modern times with the contribution of new technologies

*Eleni Vallianatou*¹

¹*University of the Peloponnese, Greece*

Beginning in antiquity and continuing into the present, Messenia Greece is well known for its agricultural goods produced as a result of the fertile soils of the region. This research focuses on an extensive regional study of five settlements of Northeastern Messenia and their surroundings that hosts a mythic and historic past which is linked to the usage and exploitation of land by the different populations. New technologies such as historical aerial photographs, satellite imagery along with geomorphological-hydrological maps created by GIS, proved to be very useful in determining the evolution of land-use for northeastern Messenia. The area of study consists of five contemporary villages (Stenyclaros, Kallirrhoe, Polichne, Konstantinoi, Diavolitsi) which are bordered by natural geographical formations. The existence of the five settlements in close ratio, the fertility of the soil, and the remains of antiquity and the modern agricultural and farming activities are pivotal indicators for the existence of continuous exploitation of the fertile land.

Data from the historical aerial photographs and the satellite models showed contemporary changes at the water supply of the villages' arable lands after 1990, to be the key element for the differentiation of the modern cultivation. For the palaeoenvironmental reconstruction, many suggestions were made regarding the morphology and ancient exploitation but a more detailed analysis is asserted as a future goal.

Keywords: *GIS; satellite imagery; geomorphology; Messenia Greece; land-use*

Playing with dirt: clayey raw materials and ancient pottery analysis from three case studies in Northern Peloponnese, South Epirus and West Crete, Greece

Vayia Xanthopoulou¹, Eleni Nodarou², Ioannis Iliopoulos¹, Marillia Antonopoulou¹

¹*University of Patras, Greece*

²*INSTAP Study center for East Crete, Greece*

Archaeometric analysis has employed clay sampling at many instances and in many ways in order to discuss the origin of ancient pottery. Among the issues tackled through the study of “dirt” is the plasticity and strength of the clayey materials of an area and hence their suitability in pottery manufacture. When compared to the analytical data from the pottery the analysis of the geological materials can provide useful insight into the origin of the pottery at a local and off-site level.

This presentation deals with systematic clay sampling in three different geographical areas associated with the analysis of ancient pottery of different date: sampling in northern Peloponnese and southern Epirus was associated with roman pottery whereas sampling in west Crete was carried out within the confines of pottery assemblages of minoan date. We present the entire process from the prospection and sampling in the field to the processing and analysis of the clayey materials in the laboratory. We discuss the analytical methodology employed for the determination of their mineralogical composition and their physico-chemical properties according to the protocol developed at Minerals and Rocks Research Laboratory of the Department of Geology at the University of Patras. Finally, we compare the analytical results from the raw materials and experimental briquettes with the archaeological pottery and discuss the potential of this multi-analytical approach not just for the specific assemblages but also for future studies in the respective areas.

Keywords: *Clayey raw materials, ancient ceramics, experimental briquettes, analytical techniques*

YRA 5th Workshop – Tutorials

In this year's edition, YRA 5th Workshop provides pre-recorded tutorials this year! Provided by renowned experts, they tackle different topics and methods in the field.

Bioarchaeology

<https://yrarchaeometry.weebly.com/bioarchaeology.html>

Kelly Blevins, Durham University

Kelly E. Blevins, PhD is currently a Postdoctoral Research Associate in the Department of Archaeology at Durham University, UK. She specializes in human paleopathology and bioarchaeological applications of ancient DNA (aDNA). Her research interests include genomic evolution and paleoepidemiology of mycobacterial pathogens that cause tuberculosis and leprosy, as inferred through the recovery and analysis of their ancient and modern genomes.

Email: kelly.blevins@durham.ac.uk

aDNA in bioarchaeology: applications and sampling strategies

Friðgeir Grímsson and his team, University of Vienna

Friðgeir Grímsson (Senior Scientist, University of Vienna) is a paleobotanist and palynologist with a geological background. His focus is on fossil and extant pollen/spores from all time periods, geographic regions, and interesting samples.

Email: fridgeir.grimsson@univie.ac.at

Is pollen useful for archaeological research? The what, why, and how!

Archaeological Materials

<https://yrarchaeometry.weebly.com/archaeological-materials.html>

Sabine Klein, Deutsches Bergbau-Museum Bochum

Sabine Klein studied mineralogy with a focus on economic geology, petrology and geochemistry. This was followed by a doctorate on early mediaeval bronze metal slags from the Höxter/Corvey area at the Goethe University in Frankfurt. A research grant from the Volkswagen Foundation enabled a one-year stay at the National Institute of Standards and Technology (NIST) in Gaithersburg, MD, and a second year at the Massachusetts Institute of Technology (MIT) in Cambridge, MD, USA. Back in Germany as a postdoctoral fellow in the Frankfurt Research School "Archaeological Analytics", her research preference for archaeometry solidified, and she finally habilitated in 2008 with a numismatic-oriented archaeometallurgical thesis on "The Copper of the Roman Imperial Period and its Raw Material Sources". With the award of the Venia Legendi for Mineralogy and Archaeometry, she was granted the authorization to teach at Goethe University. Since 2016, she has been head of the research area of archaeometallurgy at the German Mining Museum Bochum and professor at RUB. Her research interests are in the field of archaeometallurgy, inorganic archaeometry, applied geochemistry, and isotope applications.

Email: sabine.klein@bergbaumuseum.de

Archaeometallurgy – What metals tell us about the past

Artemios Oikonomou, Cyprus Institute

Artemios Oikonomou studied Physics and then specialized in Materials Science and Engineering as well as Fine Arts and Sciences, conducting the first systematic study of archaic glass from Greece. His professional experience includes a Marie Curie Post-Doctoral Fellowship at the University of Nottingham, a Geoarchaeology Fellowship at the American School of Classical Studies at Athens, and since 2018, a post-doctoral fellowship at Science and Technology in Archaeology and Culture Research Center (STARC) of The Cyprus Institute.

Artemios' research focuses on the application of state of the art scientific techniques on the study of ancient materials and especially glass as a mean for: a. the identification of ancient technological aspects, b. answering archaeological questions in relation to the reconstruction

of ancient technologies, c. changing technological practices through space and time, d. the provenance of ancient materials, and e. the fusion of scientific results with aspects of the humanities. As an archaeological scientist, he is involved in various interdisciplinary archaeological projects, both as primary researcher and research associate, in the broad field of Archaeological Science.

He has authored and co-authored research papers in edited volumes, peer reviewed scientific journals and conference proceedings, while he has participated in international conferences since 2006 with oral and poster presentations. Furthermore, he is a member of the Editorial Board of Heritage Journal and Guest Editor at the Journal of Archaeological Science: Reports, while he has acted as a reviewer in many International Scientific Journals. Finally, he is a member of national and international professional organisations such as the Hellenic Society of Archaeometry (elected member), the Society of Archaeological Sciences (SAS), the American Ceramic Society (ACerS) the International Council on Monuments and Sites (ICOMOS) and the Association Internationale pour l' Histoire du Verre (AIHV).

Email: a.oikonomou@cyi.ac.cy

Reflecting into ancient glass technology

Alexandra Rodler, ÖAI/ÖAW

Rodler Alexandra is a postdoctoral researcher and MSCA-IF fellow at the Austrian Archaeological Institute of the Austrian Academy of Sciences and senior research fellow at the University of Vienna. She is an isotope geochemist, who currently works with archaeometry, researching pigment provenance and technology in Roman peripheral provinces.

Email: alexandra.rodler@oeaw.ac.at

Colorful Indications of (Ex)Change – Pigment provenance and processing in Roman Noricum

Methods

<https://yrarchaeometry.weebly.com/methods.html>

Eleni Palamara, University of Peloponnese

Eleni Palamara studied Mechanical Engineering in the National Technical University of Athens (Greece) and holds an MSc degree in Archaeological Sciences from the University of Oxford (UK). She carried out her PhD and Post-doc research on the archaeometric analysis of archaeological glasses and glazes in the University of the Peloponnese (Kalamata, Greece).

Since 2015 she is a lab tutor for the MSc in Cultural Heritage Materials and Technologies – CultTech of the University of the Peloponnese and between 2018–2020 she taught in the department of History, Archaeology and Cultural Resources Management of the University of the Peloponnese. She is currently a research technician within the ARISTEAS project (Advancing Research Infrastructure & Scientific Techniques in Archaeological Science), which is co-funded by national and EU resources and is implemented within the context of the NSRF operational programme “Competitiveness, Entrepreneurship and Innovation 2014-2020 (EPAnEk)” of the ministry of Development and Investment of the Hellenic Republic. She is also a member of the Art e-Solutions company, which focuses on the application of advanced electron microscopy techniques in Cultural Heritage.

Her main research focus lies on the physicochemical properties of archaeological materials (glasses, glazes, pottery, pigments). She is experienced in the use of Electron Microscopy techniques (SEM/EDS, SEM/CL), spectroscopic techniques (Raman, IR) and X-Ray Fluorescence analysis. She is the author/co-author of 16 papers published in peer-reviewed journals and co-editor of 3 edited books. She has also reviewed manuscripts for archaeometric journals, such as the Journal of Archaeological Science: Reports and the Journal of Archaeological and Anthropological Sciences.

Email: el.palamara@gmail.com

Advanced Electron Microscopy Techniques in Cultural Heritage

Walter Prochaska, ÖAI/ÖAW

Walter Prochaska is an internationally leading expert in the field of marble research. He is authoritatively involved in the further development of methods of determining the provenance of especially white marbles. He has been able to set new standards for the combined interpretation of isotope analysis, trace element analysis, and the analysis of the chemistry of the inclusion fluids. He is currently involved in the FWF 33042 project 'Fingerprinting White Marbles; Quarries and Cities of Roman Thrace, 1st-3rd century AD', at the Austrian Archaeological Institute in Vienna.

Email: walter.prochaska@oeaw.ac.at

Application of the ion chromatography in archaeology

Katrin Westner, ENS Lyon

Katrin Westner studied mineralogy at the University of Erlangen-Nuremberg and, starting with her PhD, participated in several archaeometallurgical research projects. She currently is a postdoc at the ENS de Lyon where she mainly investigates ores and coins from Macedonia, Thrace and Illyria in the framework of the ERC project SILVER (PI Francis Albarede). For her research, Katrin regularly uses various analytical techniques, including ICP-MS for compositional and isotopic measurements.

Email: katrin.westner@ens-lyon.fr

ICP-MS techniques and their applications in archaeometry