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Supporting Student Research- International Travel Award

In an earlier issue of the *Bulletin* (Vol. 37, No. 1), I highlighted the R.E. Taylor Poster Award offered by SAS which acknowledges student contributions to archaeological research. For this issue, I wanted to remind our membership about an additional award available that supports international travel for student research, the *Student Research International Travel Award*.

This grant is used to support international travel for undergraduates (in their final year of study) and graduate students (at the MA or PhD level) to conduct research. The research can be either laboratory or field based. Up to $1000 is available. Students are well aware of the difficulty in finding funds to support their research and travel, so this grant provides a great opportunity to facilitate their archaeological research.

This issue of the *Bulletin* highlights some of the research that has been made possible through the SAS travel award. Michelle Eusebio, a graduate student at the University of Florida, used her award to travel to Vietnam this spring to work on an excavation at Lò Gạch. While on the project, she was able to obtain samples for organic residue analysis as part of her research into foodways in Neolithic and Metal Age Southeast Asia.

Our Associate Editor for Bioarchaeology, Katy Meyers, also reports on the research she conducted using funds from the International Travel award. Katy traveled to England to conduct research for her dissertation which examines the forms of body treatment at death during the Early Anglo-Saxon Period. Her travel involved examining collections and archives housed at two museums and had the opportunity to collect data from unpublished material.

Other examples of the wide range of research supported through this grant can be found in past issues of the *Bulletin* (such as last issue, Vol. 37, No. 2) as well as on the SAS website. The deadline for the next travel award is February 1 and we encourage student members to apply. More information on the award and guidelines for applying can be found here: http://www.socarchsci.org/Student%20Research%20Award.pdf

Vanessa Muros, Editor

In This Issue

A Sojourn into the Foodways of Prehistoric Southern Vietnam

Michelle S. Eusebio
Graduate Student, Dept. of Anthropology, University of Florida and winner of a recent SAS grant

Figure 1. The Lò Gạch site with ongoing activities: excavation, recording, mapping, flotation, sorting, and drying of washed excavated materials. Photo by the author.

Through the assistance of the Society for Archaeological Sciences Student Research International Travel Award, I was able to travel to Southern Vietnam during Spring 2014 to participate in the excavation of the Lò Gạch site (fig. 1), Long An Province, Vietnam for three weeks, and the post-excavation activities at the Long An Provincial Museum in Tân An City for two weeks. This

archaeological research was undertaken in collaboration with the Australian National University (ANU), the Center for Archaeological Studies of the Southern Institute for Sustainable Development (Hồ Chí Minh City), and the Long An Provincial Museum, as well as directed by Dr. Philip J. Piper of ANU.

My research investigates foodways in Neolithic and Metal Age Southeast Asia through the chemical analysis of food residues (after Evershed 2008) obtained from earthenware pottery. My objectives are to identify food items prepared and/or served in a variety of ceramics, as well as to establish key biomolecular markers based on a modern comparative reference collection, which is helpful for the identification of different foodstuffs. My goals in participating in the excavation of the Lò Gạch site (900-600 BC; Bui 2008; Piper 2013), which is one of the five sites sampled for pottery, were to select samples with the highest potential to produce organic residues, to perform experimental cooking in locally made modern earthenware pottery, and to collect biological samples of food items from Southeast Asia. The last two goals are crucial for building a comparative database for compound specific carbon isotopes of palmitic (C16) and stearic (C18) fatty acids from important food sources in Southeast Asian prehistory. Stable carbon isotope ratios of C16 and C18 fatty acids of food sources vary geographically (Gregg et al. 2009). Thus, the published databases from other geographic regions may not be applicable for Southeast Asia, and a comparative database for the region is greatly needed to be able to securely identify the former contents of ancient pottery.

I arrived at the Lò Gạch site on the afternoon of April 24, 2014. The excavations had already been ongoing for five days. I joined the fieldwork for three weeks. On my first two days, I was introduced to the already-established system of processing and curating the recovered materials. This includes recording bulk soil samples for flotation and wet sieving, cleaning artifacts and faunal remains, sorting of dried wet sieved materials, packing and cataloguing all cleaned ceramic sherds and faunal remains, writing soil and floor descriptions, context recording, and assigning numbers to unique artifacts for a separate catalog. I was also able to catch up with the progress of the ongoing excavations.

While helping out with the processing and curating of the recovered materials, I occasionally visited the three trenches for updates and looked out for trays filled with freshly excavated pottery sherds. Before these trays were given to our washer, I screened the pottery and then collected those that I selected for residue analysis (fig. 2, left). During the last two days of excavation, there was so much pottery being recovered from the first occupational layer of the two trenches that it became difficult to keep up with the screening of the pottery from the trays. I also assisted with the excavation of the biggest trench to be able to expose the natural layer and finish recording on-time for the scheduled departure from the site. I was able to select and recover *in situ* one pottery sample while excavating the first occupational layer. I collected more from this layer by surveying the washed pottery being dried under the sun.

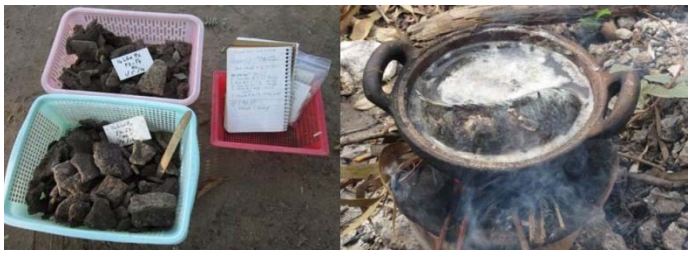

Figure 2. Left: Screening and selection of archaeological pottery samples for organic residue analysis. Right: Fish cooking in an earthenware pot. Photos by the author.

Experimental cooking of fish in local modern earthenware pottery was done while the excavations were ongoing (fig. 2, right). The cooking of different freshwater fishes had already started before I arrived, since the ichthyoarchaeologist of the team is building a fish reference collection for future identification of fish bones recovered from this and other sites around Southern Vietnam. By boiling these fishes in the pot, the oils were extracted and incorporated into the pot's matrix and the meat was easily separated from the bones. The bones were then further cleaned and curated for the reference collection. We also bought another pot and cooked marine fishes.

Collection of plants and processed animal samples was also done. Pig and chicken bones were acquired from the nearby village. One specific variety of dried freshwater fish, as well as brown rice, were acquired from the nearby market. It was originally intended to collect millet, a C_4 plant, due to the identification of its remains from Rạch Núi (Castillo 2014), another site in Southern Vietnam sampled for pottery; however, millet is not presently available in the area. Fortunately, the remains of another C_4 plant, known as Job's tears, were recovered from the excavation of Lò Gạch and its plants are available within the vicinity of the site. Sedges (*Scirpus* sp. *sensu lato*), another C_4 plant, were also recovered in Rạch Núi (Castillo 2014) and are available in the immediate vicinity of the site. Leaves and stems of sedges and Job's tears were collected in lieu of millet. For two weeks during the post-excavation activities at the Long An Provincial Museum, six more varieties of dried

freshwater and marine fishes were purchased from the Tân An City market.

I gained several advantages by participating in this fieldwork. First, I had an opportunity to undertake "on site" selection and collection of unwashed pottery samples, which have a higher probability of yielding organic residues compared to washed samples. Second, I gained direct knowledge on the provenience of my samples by helping out with the processing and curating of the materials, frequently visiting the trenches, and familiarizing myself with the systematic and efficient recording system. Third, my interactions with archaeobotanists and zooarchaeologists provided me with access to direct knowledge of the faunal and floral specimens being recovered from the excavations that I can compare to my residue analysis results. Fourth, this knowledge helped me to modify my sampling strategy of important plant and animal food species from southern Vietnam and Southeast Asia for building a reference collection. Finally, I was able to observe and experience the present-day foodway practices of the people living in southern Vietnam (fig. 3). These include rice planting, a preference for preparing and serving fish dishes in earthenware pottery, and household scale production of fish sauce in large stoneware jars. The research team got to enjoy numerous simple and sumptuous meals.

Figure 3. A glimpse into the present-day Southern Vietnamese foodways. Upper left: Women farmers planting rice. Upper right: Cá kho tộ (braised fish in caramel) is cooked and served in an earthenware pot. Lower left: Hotpot meal to be served to the excavation team. Lower right: Members of the excavation team enjoying the last lunch served by the hosting family living near the site. Photos by the author.

Through the results of the analysis of samples I collected during this successful and rewarding trip, I am looking forward to contributing to discussions of diverse pottery uses and foodway practices, the assessment of the feasibility of applying organic residue analysis to artifacts from tropical areas, and adding to existing databases for compound specific and bulk isotopic analyses in Southeast Asia and worldwide.

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For an extended version of this report with additional images, please visit the SAS blog (http://socarchsci.blogspot.com/2014/09/a-sojourn-into-foodways-of-prehistoric.html)

SCIENCE, ARCHAEOLOGY AND FORENSICS: ISA 2014

Yuan Lin , PhD student, Dept. of Materials Science and Engineering, UCLA

The 40th International Symposium on Archaeometry (ISA) was held this year in Los Angeles, CA from May 19th to May 23rd. During the first two days, the symposium took place at the Getty Villa, and was then held at the California NanoSystems Institute (CNSI), UCLA. There were over 300 scholars and students from all over the world who took part in the conference, with diverse research backgrounds such as archaeology, art history, materials science and engineering, chemistry, geoscience, physics, and so on. As a first year graduate student from the Materials Science and Engineering Department at UCLA, I participated in the conference as a student volunteer.

The symposium covered the following major sessions: "Stone, Plaster and Pigments", "Ceramics, Glazes, Glass and Vitreous Materials", "Metals and Metallurgical Ceramics", "Archaeochronometry and New Trends in Luminescence Dating", "Human Environment and Bioarchaeology", and "Remote Sensing, Geophysical Prospection and Field Archaeology". Many important and

new research results were presented during the talks followed by a fruitful exchange of ideas and discussions. Based on these major sessions, over 200 posters were presented at the Getty Villa and UCLA during four poster sessions.

Two keynote presentations were given during the symposium by Dr. Ian Freestone (Institute of Archaeology, UCL) and Dr. Terry Brown (Faculty of Life Sciences, University of Manchester). Dr. Freestone gave a talk on using different archaeometric methods and techniques to identify and determine production events and provenance the organization of production of archaeological materials. During his talk, he presented several interesting case studies on ceramics, glass and metals, which were very informative and instructive. Dr. Brown reviewed the history of ancient DNA (aDNA) research in biomolecular archaeology. Besides successful case studies where aDNA sequencing was applied to ancient human remains, he also discussed the associated current limitations and challenges as well as future trends.

A themed session on "Forensic Science Investigations in Art and Archaeology", chaired by Dr. Ioanna Kakoulli (UCLA/Getty Conservation Program and Materials Science and Engineering Department at UCLA) was introduced for the first time (fig. 1). This special session focused on the challenges and technological difficulties pertaining to forensic science investigations in art and archaeology such as the recovery of artifacts, the criminal investigation associated with looted artifacts requiring material characterization, identification and provenance of looted objects, and their repatriation. Agnieszka Helman-Wazny (University of Arizona) talked about the possibilities and limitations of fiber analysis in tracing the manuscripts with unknown origins from the Silk Road. Patrick Boehnke (UCLA) presented preliminary, yet interesting results, on how to use strontium isotopic and elemental analysis by secondary ion mass spectrometry (SIMS) with high lateral resolution to help the Dept. of Homeland Security provenance looted glass artifacts with unknown origins and heterogeneous compositions. Dr. Ernst Pernicka (Curt-Engelhorn Zentrum Archäometrie and University of Heidelberg) gave a talk on the investigations and testing on the authenticity of the Sky Disc of Nebra by various scientific methods and approaches. Dr. C. Brian Rose (University of Pennsylvania) reviewed the case of the Troy gold in the Penn Museum for which a repatriation claim was filed by Turkey. Lastly Dr. Timothy Potts (J. Paul Getty Museum) gave a thorough review on the evolution over recent decades of U.S. museum practices and policies relating to the acquisition of antiquities, as well as the issues of authenticity and conservation analysis involved.

Figure 1. Dr. Ioanna Kakoulli introduces the session on "Forensic Science Investigations in Art and Archaeology"

Unlike other sessions at ISA, the forensic science session did not have a Q&A at the end of each talk but instead held a panel discussion and open forum to answer questions after all five speakers had presented. The discussion was very fruitful and many scholars participated actively, giving their opinions on repatriation, the importance of having archaeometric studies be tied to specific archaeological research questions and the analysis of unprovenanced materials. Although this area is a relatively new branch of research, forensic science investigations in art and archaeology does not just involve extensive scientific determination and examinations, but is also complicated by other factors such as ethnical and political issues pertaining to the material being investigated.

Social events during the symposium were very impressive. The opening reception was held at the Getty Villa museum where attendees enjoyed drinks and food in the Roman peristyle garden surrounded by replicas of beautiful ancient artifacts. Conference participants could visit real antiquities within the museum galleries during the reception. On the last day of the symposium, two field trips were offered to historic sites in Los Angeles: the Eames House and Watts Towers. I went to the Eames House and found that it was not just a uniquely designed house but also an interesting case of conserving a family's history and art.

Overall, the ISA 2014 was successfully organized. The most recent key breakthroughs in archaeological science were presented. Fruitful discussions on their relevant, current limitations and challenges were conducted, and innovative ideas on future research trends were exchanged. The symposium provided an open and friendly panel for scholars and students from different research backgrounds and countries to participate and intercommunicate in this interdisciplinary field of study. As a student relatively new to this field, ISA 2014 offered a great opportunity for me to acquire more ideas about how science and engineering are interrelated and

complementary to archaeology and art history, as well as an excellent opportunity to meet other scholars and students and make new friends from all over the world.

ANNOUNCEMENTS

Awards

Congratulations to María Teresa Plaza (Institute of Archaeology, University College London), winner of the second ***R. Ervin Taylor Student Poster Award*** awarded in 2014. Her poster, "Metallurgical traditions under Inka rule: A technological study of metals and technical ceramics from the Aconcagua Valley in Central Chile", which was co-authored with Marcos Martinón-Torres, Prof. of Archaeological Science at UCL, was chosen from many submissions demonstrating innovative contributions to archaeological research through the application of scientific methods. The poster was presented at this year's International Symposium on Archaeometry held in Los Angeles, CA from May 19-23.

Abstract: The Aconcagua Valley (Central Chile) is located in the southernmost limit of the Tawantinsuyu or Inka territory. In this area, some indicators of the Inka influence such as architecture, the Inka road, rock art and pottery have been largely studied, suggesting that the Inka developed a symbolic strategy to incorporate this area into the state. However, these studies have not considered the metallic and metallurgical evidence, which is both key in the Inka ideology, politics and expansion, and very distinctive of the Inka or Late Period in Central Chile. Considering that technology is culturally determined, this research uses an approach based on the analysis of the technical aspects of the metals and metallurgical ceramics to reveal important insights about the cultural choices and social dynamics of the groups using and/or producing metals in the area, and the influence of the Inka in those technologies. For this purpose, metallic artefacts and technical ceramics from two sites in the valley, Cerro La Cruz and Los Nogales, were subjected to analyses using SEM-EDS, optical microscopy, petrography, XDR and FTIR. These analytical techniques allowed to identify manufacturing techniques, raw materials, recipes and the extent of use of the metallic artefacts and technical ceramics. The results suggest that both sites represent different technological traditions. At Cerro La Cruz, the predominance of typologies and techniques rooted in the indigenous Diaguita Culture and the scarcity of bronze, indicate a conservatism that may reflect a cultural resistance to the Inka domain. Conversely, at Los Nogales, the presence of typical Inka perforated crucibles lined with bone ash, together with the use of bronze, point to a tradition closely related to the Inka expansion, also documented in north-western Argentina, which would reflect a cultural receptivity from some local groups towards new technologies and their associated values. These differences support the proposition that the Inka domination in the valley was heterogeneous and culturally contingent, and suggest a closer relationship between the state and some local groups, not previously identified.

A PDF version of the poster can be found at: http://socarchsci.org/poster/Plaza_ISA2014.pdf

New open access journal: *Science and Technology of Archaeological Research (STAR)*

STAR (http://www.maneyonline.com/loi/sta) seeks to provide a dynamic, rigorously reviewed, international and high quality open access forum for rapid publication of archaeological research interpreted from, and informed by, scientific and technological data. The journal is for authors who are concerned with maximizing the impact of their research and who need their work published rapidly.

The editors are looking for papers covering the full breadth of archaeological enquiry; no periods, regions or site types are excluded. *STAR* stipulates only that the article demonstrates the significance of the scientific or computational methods used to the archaeological knowledge base.

The editors are currently accepting submissions via the online submission system (https://www.edmgr.com/star/). Please contact the editors with your questions: Dr. Mark Lake (mark.lake@ucl.ac.uk), Dr. Ludovic Orlando (lorlando@snm.ku.dk), Prof. Alan K. Outram (A.K.Outram@exeter.ac.uk), or Prof. Robert H. Tykot (rtykot@usf.edu).

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ARCHAEOLOGICAL CERAMICS

Charles C. Kolb, Associate Editor

This issue contains four topics: 1) Book Reviews on Ceramics; 2) Informational Item; 3) Previous Professional Meetings; and 4) Forthcoming Professional Meetings.

Book Reviews on Ceramics

Excavations at Zeugma Conducted by Oxford University, 3 volumes, edited by William Aylward, Los Altos, CA: The Packard Humanities Institute, 2013. ISBN: 978-1-938325-29-8. http://zeugma.packhum.org/ This monograph is the report of rescue/salvage operations undertaken in 2000 at the site of Zeugma, Turkey founded initially as a Greek settlement by Seleucus I Nicator, one of the generals of Alexander the Great, in ca. 300 BCE. King Seleucus named the city Seleucia after himself; whether this city is, or can be, the city known as Seleucia on the Euphrates or Seleucia at the Zeugma is disputed. The population of the city at its peak was approximately 80,000. In 64 BCE Zeugma was conquered and ruled by the Roman Empire and the name of the city was changed into Zeugma, meaning "bridge-passage" or "bridge of boats." Under Roman rule, Zeugma was home base for the Legion IV Scythica, a 5,000-man unit entrusted with deterring Parthian incursions and protecting the town and bridge because of its strategic location on the river Euphrates situated on the border with the Persian Empire until the late 2nd century. In 256, the Sassanid king Shapur I invaded and destroyed the city but Zeugma and environs remained part of the Roman Empire. During the 5th and 6th centuries the city was ruled by the Early Byzantium or Eastern Roman Empire. As a result of the ongoing Arab raids the city was abandoned but in the 10th and 12th centuries, the Abbasids settled in Zeugma. In 1986, the general directorate of the Turkish State Water Department decided to build a series of dams on the Euphrates and Tigris rivers to foster development of the impoverished southeastern region of Anatolia and to solve the country's energy crisis. Construction of one of these, a half mile from Zeugma, was placed on the agenda, and four years later a feasibility study was submitted to the Turkish government and international construction companies. The lake to be created by the dam would inundate 21.6 square miles, including about 8% of Zeugma. See http://archive.archaeology.org/0009/etc/turkey.html

This searchable online publication documents the rescue excavations by Oxford Archaeology supported by a grant of $5.0 million US from The Packard Humanities Institute, which also supported the publication of three volumes: Volume I (xii + 279 pp., 13 chapters, 169 plates) focusing on the rescue excavations, domestic and monumental architecture, geophysics, and topographical survey; Volume II (258 pp., 8 chapters, 109 plates) devoted to ceramics – kitchen and table wares, transport amphorae, petrographic analyses, small ceramic artifacts, and glass; and Volume III (449 pp., 14 chapters) artifact and ecofact analyses; studies of metals, bone, stone; environmental studies; and summaries of the site's military history. The narratives and illustrations are downloadable and printable but cannot be copied and pasted. Each chapter has its own bibliography. A large number of the illustrations are in color. The focus of this review will be on the second volume but the contents of the other two are also reported as the studies would be of interest to readers of the *SAS Bulletin*.

Volume I (xii + 279 pp., 169 plates). "Foreword" by David W. Packard of the Packard Humanities Institute (pp vii-viii). Packard states that "The text printed in these three volumes is also available on our web site in a searchable format. We have therefore not thought it necessary to provide a printed index." "Preface" by William Aylward (pp. ix-xii); Chapter One "The Rescue Excavations at Zeugma in 2000" by William Aylward (pp. 1-54); Chapter Two "Site Conservation during the Rescue Excavations" by Roberto Nardi and Kristian Schneider (pp. 55-70); Chapter Three "The Houses: Domestic Architecture, Dated Deposits, and Finds in Context" by Jennifer Tobin (pp. 71-118); Chapter Four "A Monumental Building in Trench 1" by William Aylward (pp. 119-123); Chapter Five "Architectural Elements" by Sarah Rous and William Aylward (pp. 124-148); Chapter Six "Mosaics" by Katherine M. D. Dunbabin (pp. 149-167); Chapter Seven "Wall Painting" by Bettina Bergmann (pp. 168-177); Chapter Eight "Graffiti" by Rebecca Benefiel and Kathleen Coleman (pp. 178-191); Chapter Nine "Inscriptions on Stone" by Charles Crowther (pp. 192-219); Chapter Ten "A New Relief of Antiochus I of Commagene and Other Stone Sculpture from Zeugma" by Charles Brian Rose (pp. 220-231); Chapter Eleven "Geophysics" by Jamon Van Den Hoek and William Aylward (pp. 232-246); Chapter Twelve "Topographical Survey along the Shoreline of the Birecik Reservoir in 2001" by William Aylward (pp. 247-250); Chapter Thirteen "Context Descriptions" by William Aylward (pp. 251-279); and "Plates"

Volume II (258 pp., 109 plates). Chapter One "Pottery Other Than Transport Amphorae" by Philip M. Kenrick (pp. 1-81, plates 1-42). The author points out that the Zeugma rescue excavations of 2000 took place alongside parallel investigations by French and Turkish teams and it was deemed premature to embark upon a comprehensive description of the pottery. The discussion is arranged primarily by fabric, in order to distinguish where possible the sources from which Zeugma was supplied. Since there is also a high degree of correlation between fabrics and the functions for which the vessels were intended, five categories of ceramics were defined. 1) Table Wares made in fine fabrics with smooth surfaces, mostly with a distinctive surface finish such as a slip or glaze. Forms include plates, dishes, small bowls, drinking cups, and

lids intended for use with these forms; also some small flagons and jugs intended for use at the table. 2) Buff Wares made in calcareous clays, which fire to shades of white or gray. These comprise vessels for food preparation: large bowls, basins, and mortars, as well as storage vessels of all sizes, such as jars, spouted jugs. The category can overlap with slipped table wares (small bowls and cups); a specialized form that occurs only in Buff ware is the pot stand. There is also some overlap with transport amphorae and the border line between amphorae and smaller flagons. 3) Transport Amphorae (reported by Reynolds in Chapter 3). 4) Cooking Wares made in non-calcareous clays, which fire red to dark gray or black, these are essentially vessels for use over fire: flat pans or deeper casseroles and jars with sagging or rounded bases. There are occasional round-bottomed jugs that belong to this series (traces of lime-scale within show that they were used for boiling water), and lids. 5) Storage Wares in non-calcareous clays, which fire to shades of red, brown, or gray not already included under the Buff Wares. The clay often includes added temper of considerable size (particularly in the largest vessels, described here as pithoi). In his conclusion, the author discusses the ceramics of the Middle Euphrates region, and discusses the ceramic culture of Zeugma. He points out that "The value of petrographic studies in clarifying our understanding of pottery distribution is today unquestioned. The terms in which fabrics are reported are not always uniform in style, and it is sometimes difficult to make comparisons between different studies; however, in the present instance I have profited from the published work of Bartl, Schneider, and Bohme ["Notes on 'Brittle Wares' in North Eastern Syria" *Levant* 27:165-177, 1995] in as well as from the extensive geological knowledge displayed by Chris Doherty in the petrographic report following this chapter." (p. 75). There is also an "Index to Occurrence of Fabrics" (pp. 76-77) and an "Index of Contexts Included in the Dated Groups" (p. 77). Lastly, there is a Postscript dated August 2012: "The foregoing report was submitted for publication in 2004. In the intervening years, much has been published on the pottery of the region, not least by the French team that has worked at Zeugma. Regrettably, it has not been possible to revise the text to take account of those studies. The reader is directed in particular to Abadie-Reynal et al. (2007), Abadie-Reynal and Martz (2010), Martz (2007), Schneider et al. (2007), Vokaer (2010) and Vokaer (2011) which entries have at least been added to the bibliography" (p. 81).

Chapter Two "Petrographic Analysis of Table and Kitchen Wares" by Chris Doherty (pp. 82-92). This report presents a petrographic study of table and kitchen ware pottery samples from the rescue excavations at Zeugma. Petrographic analysis of pottery employs the concept of the pottery fabric, which is defined by the sum of the constituent minerals and tempers, etc., and the overall microstructure. The fabric is the common descriptive unit, and a series of fabrics may be interpreted to provide the following information: Fabric groups, technological aspects (addition of temper, surface decoration, and firing conditions), and provenance of raw materials. Twenty-eight fabric specimens were submitted by Kenrick. The samples were initially observed using low-magnification stereo binocular microscopy in the as-received state, to record those macro-characteristics often less evident in thin section (e.g., overall color and color distribution, presence of mica at surfaces, etc.). Next, the sherds were prepared as standard petrographic thin sections following impregnation with epoxy resin. The thin sections were examined using a standard polarizing microscope (Nikon Optiphot-2 model) to record the nature of the inclusions and clay matrix, i.e., the fabric of the sherd. Doherty reports that compositionally these fabrics are complex, containing a relatively large suite of mineral and other inclusions which is consistent with the highly varied geology of southeast Turkey, the catchment of the Euphrates headwaters. Other complications for analysis include the natural weathering of many minerals, mineral transformations due to firing, and very fine grain size. His work is supplemented by scanning electron microscopy (SEM) using a Cameca SU30 Semprobe fitted with a PGT energy dispersive analyzer (EDA). The local clays are characterized and related to the geology of the Euphrates headwaters in terms of predicted vs. observed clay mineralogy at Zeugma. Forty-five distinct inclusions were observed. Two samples of "Local" Hellenistic Fine Ware are distinct and contain typical Euphrates mineralogy but likely derived from different floodplain terraces. Five different fabrics of Glazed Fine Wares varied; some were likely Parthian rather than Islamic. Eleven Plain Buff Wares of different fabrics were submitted and Doherty responds to specific questions posed by Kenrick: same or different clays, etc. Six Cooking Ware and three Storage Ware specimens were also submitted with specific queries. The author especially laments the lack of comparative clay samples from the local region. No photomicrographs are included in this chapter or elsewhere in this volume.

Chapter Three "Transport Amphorae of the First to Seventh Centuries: Early Roman to Byzantine Periods" by Paul Reynolds (pp. 93-161, plates 43-74). The chapter focuses on three topics: 1) an evaluation and discussion of the material; 2) a typology with a summary of forms (Plates 43-48: drawings at 1:4; parallels illustrated on Plates 49-51, also at 1:4); and 3) a catalogue arranged, in numerical order of deposits, according to the ceramic

periods defined by Kenrick (Plates 52–74, drawings at 1:3). There were no amphorae from Group E, dating to the early sixth century. Late Augustan/Tiberian Phase (Group B): Form 1 (reused in inhumation burials) and Form 3 are common. It is possible that the Balih Valley, or at least the most western sector of the Syrian Euphrates, was the source of Forms 1–2 and the produce they contained. In the Balih Valley they have been termed "Roman/Parthian" amphorae. The Flavian (/Trajanic) Phase (Group C): A new style of collar-neck appears while long-distance imports from overseas are relative rare, the most common being Rhodian amphorae. A.D. 253 (Group D): The destruction levels associated with the Sasanian sack of CE 252/253 yielded a rich assemblage of amphora finds, including a number of complete or nearly complete amphorae. Reynolds's comprehensive amphora typology (pp. 106-117) characterizes forms, fabrics and decorative schemes: Collar Neck, Long Body, Hollow Toe Amphorae; Small Collar Rim, Strap-handle, Ring-foot, Rounded Sagging Base Table Amphorae; Third-century Table Amphorae; Local Amphorae; and Pale-Fabric Painted Amphora Series: Syrian Euphrates Region Imports. His catalog of transport amphorae records catalog numbers, fabrics, number of sherds, weights rim and base diameters, and decoration (pp. 117-157) and includes 557 entries.

Chapter Four "Petrographic Analysis of Transport Amphorae" by Chris Doherty (pp. 162-175). This report documents 56 coarse wares from the rescue excavations at Zeugma. The main aim of the author's petrographic study is to characterize the sherds and determine the consistency of fabric groups based on field observations made by Reynolds, and to respond to specific questions he asks of the samples. In addition, this analysis clarifies whether single or multiple clay sources were used, as well as the degree to which raw materials were modified by the potters. Anomalous fabrics (those that appear at odds with the nature of locally available clay) are further considered to attempt to determine their possible provenance. Table 1 lists the sample details lab and sample references, amphora catalog designation, fabric group, and form; more than 20 fabrics are included. Questions asked and responded to include fabric consistencies, the identification of new fabrics, coarseness and fineness variation, distinguishing Syrian painted wares, and defining long-distance imports. All 56 fabrics are summarized as to mineral composition (pp. 170-174).

Chapter Five "Ceramic Oil Lamps" Mahmoud Hawari (pp. 176-201, plates 75-109). The range of lamps in the assemblage indicates numerous fabrics and types, corresponding with the known history of the site, dating from the Hellenistic period to the Islamic period. While the majority of these lamps are common finds on contemporary sites in Anatolia and in the Levant, a minority of lamps in the assemblage are only known at Zeugma. The lamps are classified into nine types, which are described with a discussion on their dating based on the contexts in which they were found and on parallels from other sites and collections. The catalogue (pp.185-199) is arranged by date and type. Table 2 presents the data by archaeological context in order to shed light on distribution of the finds and period of use at Zeugma. The author notes the methods employed and comparative material consulted. Eight types are detailed. Chapter Six "Terracotta Figurines" by Jeffrey Gingras and William Aylward (pp. 202-209). Over half of the 24 terracottas are fragments of anthropomorphic figurines (TC1–TC14, TC17, and TC19). Five are whole or partial female heads (TC10–TC14), and two are fragments of miniature theatrical masks (TC15, TC16). A bird, probably a dove, is the only example of an animal (TC18). Architectural ornament may have been the function of TC20. The two fragments of theatrical masks (TC15, TC16) and a Papposilenos figurine (TC4) provide evidence in support of a theater, a building that is suspected but not yet proven by archaeological excavations at Zeugma. This chapter is, in the main, a catalogue of the specimens; contexts, dimensions, descriptions, color illustrations, and references to other sites with similar objects are provided for all 24 specimens. Chapter Seven "Bullae" by Sharon Herbert (pp. 210-217). Twenty-one clay sealings, of the type commonly known as bullae, were found during the rescue project at Zeugma in 2000. These are tiny clay pellets (average 15 mm dia.) that carried impressions of individuals' seal rings and were commonly used to close and notarize papyrus and parchment documents in the Hellenistic and Roman eras. Those under study here represent only a very small sample of the 140,000+ sealings unearthed at Zeugma from 1998 to 2000. A catalogue includes dimensions, color illustrations and monochrome line drawings, descriptions, and parallels from other sites.

Chapter Eight "Glass" by R. A. Grossmann (pp. 218-258). The glass finds from the Zeugma 2000 excavations total nearly 10,500 fragments. Vessel glass accounts for a little less than half of that number (45.5%), window glass for a little more than half (54 %); glass objects make up a minuscule fraction of the total (0.5%). Hellenistic glass is poorly represented (one specimen) as is Seleucid (one specimen of cast glass). "The Commagenian period at Zeugma encompasses a fertile era in the history of glass, during which technical advances allowed for increased production of cast glassware, while Roman expansion into Asia Minor fostered a major escalation of trade" (p. 219). Cast bowls with linear-cut decoration in the Syro-

Palestinian tradition continued to be produced, declining in the Augustinian era. A catalogue accompanies the chapter: contexts, forms, descriptions, monochrome line drawings and some color illustrations, and remarks about similar specimens from other sites are included for 120 artifacts (99 vessels, window glass [12 fragments]). Monochrome and polychrome beads, bracelets, beads, rings, and miscellaneous objects comprise the rest of the specimens. "Plates" (109 sets of illustrations) complete Volume II.

Volume III (449 pp.). Chapter One "Coins and Hoards" by Kevin Butcher (pp. 1-92); Chapter Two "Copper Alloy Objects" by Elias Khamis (pp. 93-166); Chapter Three "Ironwork" by Ian Scott (pp. 167-278); Chapter Four "Gold Objects" by Ian Scott (pp. 279-280); Chapter Five "Worked Bone and Ivory" by Bethan Charles (pp. 281-294); Chapter Six "Milling and Weaving Equipment, including Hand-held Stone Tools, Mortars, Querns, and Stone Vessels, Loom Weights, and Spindle Whorls" by Holly Parton (pp. 295-344); Chapter Seven "Textiles" by Franca Cole (pp. 345-352); Chapter Eight "Arms, Armor, and Other Military Objects" by Ian Scott (pp. 353-374); Chapter Nine "Zeugma's Military History in Light of the Rescue Excavations" by Hugh Elton (pp. 375-380); Chapter Ten "Military Installations at Zeugma: An Overview of the Swiss Archaeological Investigations, 2001–2003" by M. Hartmann and M. A. Speidel (pp. 381-392); Chapter Eleven "Environmental Studies: Overview and Context" by David Meiggs (pp. 393-398); Chapter Twelve "Faunal Remains" by Bethan Charles (pp. 399-410); Chapter Thirteen "Charred Plant Remains" by Dana Challinor and Dominique de Moulins (pp. 411-432); and Chapter Fourteen "Charcoal" by Rowena Gale (pp. 433-349).

The first scientific excavations within Zeugma were launched in 1987 and today the excavation works are being carried out by the University of Ankara. Much of the ancient town and its modern counterpart of Belkıs now lie under the reservoir created by the construction of one of Turkey's largest dams in 2000. The preserved parts of the ancient city include the Hellenistic Agora, the Roman Agora, two sanctuaries, the stadium, the theatre, two bathhouses, the Roman legionary base, administrative structures of the Roman legion, the majority of the residential quarters, Hellenistic and Roman city walls, and the East, South and West necropoli. Zeugma has been designated a UNESCO World Heritage site, in part because of its mosaics and life-size limestone statues. The Zeugma Mosaic Museum, which opened in 2011, is in the modern city of Gaziantep, south-eastern Turkey, not far from the excavation site. Overall, the three volumes provide an excellent description and evaluation of the architecture, artifacts, and some botanical materials from the Zeugma salvage operation undertaken in 2000. The French and Turkish excavation reports have, apparently, never been published. The chapters by Kenrick and Reynolds are clear and consider issues and problems in analysis but very few wares are adequately illustrated in these reports. The two chapters on ceramic petrography and SEM by Doherty are valuable contributions but appear to date to about 2002 and lack photomicrographs. Obviously, there are new analytical techniques that could be applied to the pottery and clay artifacts.

Previous Professional Meetings

Materials Issues in Art and Archaeology X (Symposium PP) was held at the 2013 Materials Research Society (MRS) Fall Meeting & Exhibit 1-6 December 2013. Pamela Vandiver was the organizer and chairperson. Nine papers on ceramics were presented and will be edited by Pamela Vandiver, Weidong Li, Philippe Sciau, and Christopher Maines and published in *Materials Issues in Art and Archaeology X* (Cambridge and New York: Cambridge University Press) later this year or in early 2015. The nine papers and abstracts are as follows.

"Analysis and replication of Jianyang teabowls from Song Dynasty China" by James Dustin Morehead. Black-glazed tea bowls from Jianyang, Fujian province, China, were studied to further understand the visual appearance of the Jian teabowls. The black-glazed Jian bowls are segregated into two distinct visual appearances called "Hares Fur" and "Oil Spot". These black glazes are alumino-silicates rich in calcium and iron oxides that through heat treatment form anorthite and various iron-oxide precipitates. Twenty-six teabowl sherds were analyzed from the collection of James Plumer who in 1935 first identified three of the Jianyang kilns. Data include electron microprobe analysis, scanning electron microscopy with energy dispersive X-ray analysis, X-ray diffraction, dilatometry and optical microscopy. Atomic and chemical compounds were determined, the melt temperature range was established, and glaze formulation and reproduction tests will be shown. These results provide further clues to unlocking the stunning but mysterious appearance of the Jianyang teabowls. "Ancient Chinese Glaze--Composition, Microstructure, Color and Feel" by Weidong Li and Xiaohan Liu. Ancient Chinese glaze is implicative and mysterious. Traditional ancient Chinese high-fired glaze falls into the category of calcium glaze or calcium-alkali glaze, originating from the plant ash glaze of the Shang Dynasty. The physico-chemical basis of Chinese high-fired glazes can be supposed within the confines of the phase equilibrium relationships of CaO-Al_2O_3-SiO_2

ternary system and the metastable liquid-liquid immiscibility region in the system. The color and feel of glaze is determined by its chemical composition and microstructure. Glaze feel can be described by its transparency and gloss, which is firmly related to the amount, size and distribution of the scatterers (bubble, crystal, liquid-liquid immiscible structure) exiting in the glaze as well as at the glaze surface. Factors affecting glaze color include chemical factor (coloring agent such as iron ion) and physical factor (structural coloring), which factor is predominating depends on specific cases. As for transparent celadon glaze, it is no doubt that Fe^{2+}/Fe^{3+} ions determine the glaze color, and the body color beneath the transparent glaze also modify the visual effect of glaze color. While the coloring mechanism of opaque and translucent glaze is more complicated. Our latest research shows that, the mild blue colors of Jun glaze and Ru glaze mainly result from the amorphous photonic structures in the glazes, which is an important breakthrough in understanding the coloring mechanism of ancient Chinese glazes. Computer simulation of glaze structure and simulative calculation of optical properties has been carried out to establish the corresponding relationship between structure and reflective spectrum. Coloring mechanism for the glazes from the same kiln site, however, is not invariable. Because glazes with the same compositions may have different microstructures when fired at different temperatures (different thermal histories) or kiln atmosphere. Temperature or kiln atmosphere varies in different firing processes or at different positions in the same kiln. For example, Ru glazes with same compositions may appear to be different colors such as azure blue, sky blue, bean green, grayish green, moon white etc., I believe both ion coloring and phase-separation structure take effects in the coloration of glaze, while the micron-sized anorthite crystals in glaze just result in the opacification of glaze. The interaction and coordinated effect between ion coloring and structural coloring needs to be further investigated. In ancient Chinese glaze, Fe is the most magical element which has multiple functions. Fe acts as both flux and coloring element, favors the strong immiscibility tendency between SiO_2 and CaO, and precipitates from the glaze under supersaturation. Takes the famous Jian kiln ware as an example, Fe plays an important role for the wonderful exterior appearance of Jian glaze. This study will help us scientifically understand the essence of ancient Chinese porcelain.

“Ceramics at the emergence of the Silk Road: A case from Southeastern Kazakhstan” by MaryFran Heinsch. Between the fourth century B.C. and second century A.D., changes in climate, culture and commerce converged to extend networks of influence and intensify social stratification in communities situated along the Silk Road. The horse-riding nomads and agro-pastoralists of what is now Southeastern Kazakhstan were important actors in the unfolding of these events. The settlements and kurgan burials of the Saka and Wusun could be found dotting the alluvial fans north of the Tien Shan Mountains just a short time before Alexander the Great founded outposts in the Ferghana Valley and Chinese emissaries formalized relations with their periphery. In other words, the appearance of Iron Age Saka-Wusun sites anticipated the formation of the Silk Road’s northern branch and subsequently helped mediate long-distance relationships connecting East and West. Historical accounts appear to confirm the presence of the Saka and Wusun in this role, but there is much that remains unknown regarding relationships both within and across their communities. Typological variability in their material culture has fed speculation concerning their position within trade networks, but there has been very little in the way of materials analysis to test the validity of these assumptions. The ceramics recovered at Tuzusai near Almaty provide an excellent opportunity for examination of the impacts and implications of extended regional contacts. Although a few imports have been identified, mineralogical and compositional analyses indicate that an extensive vocabulary of pot forms was locally produced. Some elements of this local production point to the influence of finishing techniques and aesthetics from outside the region. The importation not just of ceramics, but of production methods, suggests greater social permeability of Saka-Wusun communities than was previously proposed and allows us to understand the formative dynamics of trade on the Silk Road and the rise of nomadic steppe empires.

“Technological behavior in the Southwest: Pueblo I lead glaze paints from the Upper San Juan tegion” by Brunella Santarelli, David Killick, and Sheila Goff. Although widely employed in prehistoric Eurasia, lead glazes were produced in only two small regions of the Americas prior to European contact, both in the Southwest. Southwestern glaze paints are unique in that they developed as decorative elements instead of as protective surface coatings. The first independent invention of glaze paints was in the Upper San Juan region of southwestern Colorado during the early Pueblo I period (ca. 700-850 CE). Despite recent interest in the later Pueblo IV glaze paints of New Mexico (ca. 1275-1400 CE), there have been no technological analyses of the Pueblo I glaze paints. This research project presents the first analysis and technological reconstruction of the Pueblo I glaze paints. It is in the production of the glaze paints that the potters are innovating and experimenting with materials; the

selection, processing and use of the lead-glazed materials developed as a culturally patterned behavior that connects the material to its symbolic and iconographic function. These early glaze paints have the potential to provide important information regarding both technology of production as well as the relationships and interactions of potters during this period in the Upper San Juan region. This project aims at reverse engineering the technology of production of Pueblo I lead glaze paints. Over 300 samples of Pueblo I glaze-painted ceramics, selected from the Arizona State Museum and from the Animas-La Plata archaeological excavations, were analyzed using x-ray fluorescence (XRF) spectroscopy, backscattered electron (BSE) imaging and wavelength dispersive spectroscopy (WDS). A pattern of traits that involves raw materials, processing, properties and performance of the final product suggests the existence of a patterned technological behavior. Results provide a comprehensive survey of the technology and the social context of production of the earliest glazes in the Americas.

"The technological development of decorated Corinthian pottery, 8th to 4th Centuries B.C.E." by Jay Stephens and Pamela B. Vandiver. Decorated pottery from Corinth, Greece, developed over centuries from monochrome, dark brown slips and washes on a calcareous yellow clay body to a wide range of decorative techniques that involved experimentation with innovative compositions, textures, colors, and decorative techniques. Some slip colors involve multiple-step processing, especially the control of glass content and sintering of the slip; the control of particle size to produce variable roughness and a matte or semi-matte appearance, others involve reprocessing of materials from another craft specialty. A post-fire paint was also documented. Once significant experimentation with color variability began, seven colors, each with various levels of gloss were produced. Although considerable evidence supports nearly continuous ceramic engineering of the decorative slips, no data support the improvement composition or processing of the ceramic bodies. For instance, significant macro-porosity is present consistently. We present results from the study of 200 examples of Corinthian decorated pottery sherds and clays collected by Dr. Marie Farnsworth from Greek archaeological site in the 1950s. Analytical techniques included scanning electron microscopy, wavelength and energy-dispersive spectroscopy, x-ray diffraction and differential thermal analysis.

"The 4000 to 6000 year-old Mesopotamian tradition of composite ceramic tool manufacture at Nippur, Iraq" by Pamela B. Vandiver, Brendan Tobin, Leah Hearlihy, Rita Weinsettle, and McGuire Gibson. At 4000 BCE in lowland Iraq, ceramic sickles, hammars [sic.], axes and adzes were formed and fired using natural well-fluxed, calcareous seabed clay mixed with a coarse narrow particle-size quartz-sand that was high-fired between 1150 and 1200°C. By 2250 BCE only the ceramic sickles are present in the archaeological record. In 1989 in fields off the tell at Nippur in 20 minutes four of us were able to collect 120 fractured, worn sickles often with evidence of re-sharpening by flaking of the edges. Some sickles were overfired and bloated, adhered to one another during firing, often with evidence of subsequent use as hammarstones [sic.]. Furthermore, overfired, vitreous ceramics were reused as temper, ground and added to bodies of large jars and some bowls whose use and transport required fracture toughness. We have investigated this widespread Mesopotamian lowland technological tradition. Sickles and raw materials were characterized using traditional materials research techniques of petrography, SEM-EDS, WDS, XRD, and DTA. Processing, especially thermal history was examined using Xeroradiography and SEM-EDS of sickles and replicates. Replicates were made from Iraqi raw materials from Nippur and nearly sites. Mechanical properties of replicate test tiles were investigated using 3-point bend to determine MOR. We have examined performance characteristics using sickle replicates to harvest orchard grass (hay) and wheat.

"'Hare's Fur' and 'Oil Spot'? Study of ancient black-glazed Jian (Temmoku) Wares" by Catherine Dejoie, Weidong Li, Philippe Sciau, Apurva Mehta, Benjamin Kocar, Samuel Webb, Kai Chen, Martin Kunz, Nobumichi Namura, and Zhi Liu. The Black glazed "Jian ware", also known in Japan as "Temmoku ware", was produced in Jian Kiln located in Jianyang of Fujian Province. The black glazed pottery was produced in China as early as Eastern Han dynasty. Its production increased significantly in the Song dynasty (960-1279 A.D.) especially with the making of high quality black-glazed tea bowls. Jian tea bowls were highly desirable not only due to the thick and lustrous black glaze but also the spectacular glaze effects as "hare's fur" and "oil spot". Some finest examples of Jian ware were also brought to Japan by Buddhist monks. Several of them, Yohen tenmoku (Inaba tenmoku), belong to the national treasures of Japan. The origin of the different colored patterns at the surface of Jian tea bowls, in relation with the glaze composition and the firing procedure are still not well understood. The objective of our project is to investigate the correlation among composition, microstructure, firing technique, and glaze appearance. The external appearance and the characteristic patterns of the Jian wares are believed to be related to the decomposition of hematite during the high temperature

firing process. O^2 released from rich hematite region will form bubbles. As the bubble grows in size and moves up, it will carry iron to the surface. Condition of crystallisation of iron oxides at the near surface is then a key point to decipher the scientific mystery behind the aesthetically pleasing appearance of Jian glazes. We have carried out investigations using X-ray microdiffraction (ALS-BL12.3.2, Berkeley), X-ray micro-fluorescence and micro-XANES (SSRL-BL2-3, Stanford), micro-Raman and electron microscopy (CEMES, Toulouse) on several Jian ware samples. The glaze can be described as a Si-Al semi-opaque glass, in which micrometric dendritic crystals and nanoparticles of iron oxide are dispersed. Several thin cross-section samples show a 1-2µm crystallized rich-Fe layer beneath the surface, which is consistent with the reported formation mechanism. Furthermore, XANES spectra at the Fe K-edge did show that Fe in the silver "oil spot" is significantly more reduced than that of the brown "hare's fur", in relation with the firing condition of the ceramics. The origin of the changes in the visual effects results from the combination of the chemical state of iron along with the distribution and particle size of iron oxides at the surface of the glaze.

"Distinguishing handmade and wheel thrown pottery using X-Ray Diffraction" by Lesley Frame, Sarah Doherty, and Ian C. Freestone. The potter's wheel is one of the most significant innovations in the history of ceramics. Its adoption has been related to increased craft specialisation and changes in social organisation. However, our understanding of the introduction of the wheel in many cultures is unclear. Characteristic superficial evidence of the wheel has frequently been obscured by finishing techniques, and devices such as the tournette blur the distinction between hand-made and wheel-thrown fabrication methods. Methods proposed to distinguish fabrication techniques include thin-section examination, macroscopic examination and in particular X-radiography. However, all have limitations, which may include a perceived element of subjectivity in the method, the requirement for whole pots or large sherds for examination, and the need for large elongate inclusions or voids in the ceramic fabric which track the applied fabrication pressures. New approaches are required, which are widely applicable; require relatively small and easily transportable sherds, and which offer the possibility of an objective assessment of the likelihood of wheel use. We have piloted the use of X-ray diffraction in the assessment of pottery fabrication methods, based upon the preferred orientation of platy minerals (e.g. sheet silicates) in the pottery fabric. The relative intensities of the reflections from the 001 crystallographic plane, parallel to the main (perfect) cleavage plane of the mineral, and crystallographic directions perpendicular to this (including 110, and 020 for most sheet silicate minerals selected for this study), may be compared with the relative intensities in randomly oriented grains from powder diffraction data. When analysed along the plane of preferred orientation (e.g. the surface of a wheel-thrown pot), the relative intensity of the 001 reflection increases with increasing alignment of the mineral particles. We have cut sections of archaeological and replica sherds, made using coil, pinch, slow and fast wheel methods, and analysed along six orientations at and below the surfaces of the vessels. Selected reflections were measured using a PANalytical X'Pert Pro X-ray diffractometer (XRD), operating with CuKα radiation at 40 kV voltage and 30 mA current, 5mm divergence and 3mm receiving slits, in the 7-26° 2θ range, scanning at 120s/step, and using a RTMS X'Celerator detector. Results indicate strong orientation at the surfaces of both wheel-thrown and several of the hand-made pots. However, in the centres of the walls, there are clear differences between forming methods. These results call for a systematic evaluation of the enhanced capabilities of non-destructive synchrotron X-ray diffraction in the measurement of preferred orientation in ceramics.

"Quantitative porosity studies of archaeological ceramics by petrographic image analysis" by Chandra L. Reedy and Jenifer Anderson. Pores in archaeological ceramics can form in a number of different ways. Porosity is a reflection of the raw materials selected by the potter, of clay processing and fabrication methods, and of drying and firing regimes. Some ceramics are deliberately designed to be porous for certain functions such as cooking or water storage, while others are designed to be impermeable to liquids, with low porosity. Porosity can impact the performance characteristics of a vessel, and also has implications for understanding the extent of deterioration and for developing and evaluating effective conservation treatments. There are a variety of traditional methods for characterizing porosity of archaeological ceramics both directly and indirectly. However, using digital image analysis of thin sections holds a number of advantages: the thin sections can also be used for qualitative mineral identification, quantitative analysis of non-plastics, and the study of structural aspects that relate to fabrication and decorative choices. With archaeological ceramics we rarely want to sacrifice the amount of sample material that may be required for performing tests found in ISO or ASTM standards for assessing porosity, so the relatively small sample size needed for thin sections, and the usefulness of those thin sections for addressing other research questions, are important considerations. Image analysis of petrographic thin sections has been demonstrated to provide comparable results to optical

point counting and micrometer measurements, but is much faster, allowing for inclusion of a larger number of areas and specimens in quantitative work. While thin sections have been considered sufficient for analysis of macroporosity, the resolution has usually been considered insufficient for measurement of microporosity. We will present the results of experiments aimed at improving resolution of the smaller pores, using varying lighting conditions and ultrathin sections. This is especially important because questions have been raised about the reliability of image analysis of SEM-generated images for porosity studies due to variations in parameters (magnification, voltage, working distance, and detector type). We will examine the reproducibility of petrographic image analysis of ceramic thin sections using laboratory-prepared specimens of known recipes, and will outline the preferred protocols for measuring Total Optical Porosity, pore size (as a useful predictor of median pore throat aperture), and pore shape (aspect ratio and roundness) using the Image-Pro Premier software package. These procedures will be demonstrated with a variety of archaeological ceramics ranging from low-fired to high-fired wares, with discussion of possible interpretations of results.

The 9th International Congress on the Archaeology of the Ancient Near East **(ICAANE)** was held in Basel, Switzerland 9-13 June 2014. This Congress was organized by the University of Basel with the cooperation of the university's Faculty of Humanities, the Faculty of Science, and the Faculty of Theology: http://9icaane.unibas.ch/ . The Congress is the most prestigious event of this kind for Near Eastern archaeologists and is held biannually in different cities. The Program and Abstracts for the oral papers, posters, and workshops (altogether more than 550) are posted online: http://9icaane.unibas.ch/themes.html and http://9icaane.unibas.ch/ICAANE2014AbstractsMay.pdf There were 407 Oral Presentations (12 on ceramics): Fatemeh Alizadeh, Reza Mehr Adarin, and Rouhollah Shirizi "Study of the pottery samples of the Parthian period in Baluchestan (Classification, typology and typology comparison)"; Marta D'Andrea "Pottery production at Khirbat Iskandar, Jordan: Preliminary results of the technological study of EB IV pottery from the site"; Anja R. Dreiser "Islamic ceramics from central and eastern Oman"; Meysam Fallah and Abed Taghavi "New Islamic potteries discovered from Masjed-e Jome Amol (Friday Mosque)"; Giulio Maresca "Echoes of regional traditions plus western typological influences: Some notes about the Post-Achaemenian pottery qssemblage from the Italian excavations at Qalāa-ye Sam (Iran, Sistan)"; A. K. Marghussian and R. A. E. Coningham "Investigation of Neolithic pottery from Sialk in the Central Plateau of Iran, utilising chemical and XRD Analysis; Angela Massafra "The Egyptian presence in Southern Palestine at the dawn of the Late Bronze Age as reflected by pottery imports"; Maria Gabriella Micale "Women of clay: Localization and circulation of the female image in the Persian Achaemenid Near East as seen from Tell Mardikh"; Seyeed Rassol Moosavi Haji, Ruhullah Shirazi, Maryam Zour, and Saman Farzin "Survey of the pottery samples collected from the Islamic ages in Nikshahr and Chabahar (south-east of Iran)"; Çilem Uygun "Roman pottery from Üçtepe excavation in south-east Anatolia"; Turgay Yaāar Yedidā "Hellenistic moldmade bowls from Phrygia Epiktetos: New evidence from Dorylaion"; and Zohreh Zehnari, Reza Mehrafarin, and Seyeed Rassol Moosavi Haji "The new studies of potteries in Dahan-E Gholaman, Sistan, Iran." In addition, there were 126 Workshop presentations (4 on ceramics): S. Khasswnehi, A. Murray, and D. Bonatx "Investigating OSL dating technique for young archaeological heated materials using potshards from the Tell Tabqat Fahl (Pella) in the Jordan Valley"; Eli Cohen-Sasson "Qurayya ware (Midianite Pottery) in the Southern Levant"; Mario Martin "Iron IIA pottery from the Negev Highlands and its link to the Weadi Arabah Copper districts"; and Nigel Goring-Morris and Anna Belfer-Cohen "The relationship between the aceramic and ceramic Neolithic in the Southern Levant." In addition, there were 59 Posters (6 on ceramics): I. Calini and J. J. Herr "Qasr Shemamok/Kilizu: Ceramic material from the first four campaigns"; Eloisa Casadei "The Ur III pottery in northern contexts: Reconsidering a chronological periodization"; Marta D'Andrea "New data from old excavations: Preliminary study of the EB IVB pottery from Area H at Tell Mardikh/Ebla, Syria" Carolin Jauss, Marisol Corra Ascencio, and Richard P. Evershed "Taking the lid off Uruk period pots. Results of an analysis of organic residues preserved in pottery from Southwest Iran and Northern Syria"; Maryam Mollaie "Analysis of Sassanian pottery on base new findings of this period"; and M. Rajaee and Z .Rezaei "Systematic survey of Bishapur surface pottery."

The 22nd Conference of the European Association for South Asian Archaeology and Art took place in Stockholm, Sweden, 30 June-4 July 2014: https://www.varldskulturmuseerna.se/forskning-samlingar/forskning/easaa-conference/ There were 98 papers; two presentations focused on ceramics: Laxshmi Greaves, "A series of figurative terracotta plaques from the Gupta Period Śiva Temple at Ahichhatra, Uttar Pradesh"; and Danika Parikh, "Ceramics, hybridity and the negotiation of identity in the Indus Civilisation."

La Segunda Conferencia Intercontinental en Lima, Peru from 8-10 of August, 2014 had 41 presentations. Only one paper dealt with ceramics: Henry Tantaleán y Charles Stanish "La ceràmica Paracas de Cerro de Gentil, Valle de Chincha, costa sur del Peru." Abstract: En este ponencia presentamos y discutimos el corpus cerámico relacionado con la cerámica de estilo Paracas recolectada durante nuestras excavaciones del 2012 y 2013 en el sitio de Cerro del Gentil, ubicado en el valle medio de Chincha en la costa sur del actual Perú. Estos materiales ofrecen la oportunidad de entender la ocupación Paracas del sitio y de este sector del valle en cuestión. Las nuevas evidencias nos han revelado que el sitio tiene una importante ocupación humana prehispánica que va desde el periodo Formativo Tardío (500 a.C.-200 a.C.) hasta el periodo de los Desarrollos Regionales Tempranos (200 a.C.-600 d.C.). Estos materiales nos permiten incrementar el conocimiento de la cultura material de la sociedad Paracas y adentrarnos en la discusión de dicho fenómeno social relacionado con la construcción de grande complejos piramidales y de la complejidad social temprana de la costa sur.

Forthcoming Professional Meetings

The 21st Neolithic Seminar: Pottery and Food: Dietary Practices in Prehistory is scheduled 7-8 November 2014 and organized by the Department of Archaeology, University of Ljubljana. This conference presents a forum for various interdisciplinary discussions: on operational sequences of pottery production and use of vessel; on biochemical markers on ceramic vessels associated with food processing, storage and consumption; on stable carbon and nitrogen isotope ratios in human bone collagen; and on the composition of animal bone assemblages and plant macrofossil remains deposited in settlement contexts. The conference aims to evaluate a broad range of innovative approaches and interpretative postulates across different subjects in archaeology, bioarchaeology and biochemistry, archaeozoology and archaeobotany. The Neolithic Seminars are a focus for many links and interests that connect people and institutions involved in the conference. The Neolithic Seminar proceedings are published in the international journal *Documenta Praehistorica* (numbers XXI-XL are available at http://revije.ff.uni-lj.si/DocumentaPraehistorica)

Participation is in the form of a presentation followed by a discussion and a general discussion of all participants at the end of each session:
http://www.ff.uni-lj.si/arheologija/1/Dejavnosti/Konference-in-posveti/Neolitski-seminar.aspx .

Participants are invited to submit an abstract of 150-200 words, including name, institution and title of the paper. The deadline for abstracts is 1 September 2014. Abstracts should be emailed to: miha.budja@ff.uni-lj.si

The American Anthropological Association's 113th Annual Meeting will be held in Washington, DC, USA, 4-7 December 2014. The meeting includes Ceramic Ecology XXVII on December 4th. Organizers: Sandra L Lopez Varela (Universidad Autónoma del Estado de Morelos) and Kostalena Michelaki (Arizona State University); Chairs: Kostalena Michelaki (Arizona State University) and Sandra L Lopez Varela (Universidad Nacional Autónoma de México); and Discussant: Anabel Ford (University of California Santa Barbara). The session and paper abstracts follow. Session Abstract: Ceramic Ecology is a symposium series, initiated at the 1986 AAA meeting at the suggestion of Frederick R. Matson. Ceramic Ecology is an international and interdisciplinary symposium, reflecting the range of scholarly work currently undertaken on the examination and analysis of ceramics. The 28th in the annual series brings together scholars from all over the world to discuss multiple theoretical and methodological approaches related to environmental parameters, raw materials, technological choices and abilities, and sociocultural variables to the manufacture, distribution, and use of pottery, supported by physicochemical and ecological approaches. Interpretation of these data and explanations of the ceramic materials utilize methods and paradigms derived from the social sciences, humanities, and the arts to approach fundamental anthropological questions, such as the socio-economic context of production, social systems of learning, communities of practice, the formation of identity, or the effects of economic development.

"Neo-Assyrian Palace Ware: The role of material culture in an imperial system" by Alice Hunt (University of Georgia). The spread of 'Palace Ware', an 8th–7th century BCE drabware, across the Neo-Assyrian imperial landscape coincides with the annexation of territory and establishment of vassal states and buffer zones throughout the ancient Near East. Consequently, Palace Ware has been considered 'imperial' material culture and equated with imperial identity. This unilateral, top-down interpretation reduces material expression of complex interregional, intercultural interaction into either imposition or emulation. In this paper, we take a more nuanced approach to the transmission of Palace Ware. Imperial interactions are context specific, recursive relationships negotiated through material culture and symbols of identity and power. If Palace Ware served as a medium through which Neo-Assyrian imperial

relationships were established, justified and maintained, it is important to understand (a) how it was transported across the empire; and (b) who consumed Palace Ware both inside and outside the Neo-Assyrian heartland. In the process of answering these questions, using morphometric, petrographic and geochemical data, we are able to evaluate subtle changes in the social function and semiotic meaning of Palace Ware across the Neo-Assyrian imperial landscape and better understand the nature of these relationships. "Specialization, standardization and the state: The case of Syrian Caliciform Ware" by Sarah R Graff (Arizona State University). This paper examines the relationship between ceramic specialization, standardization, and the development of early city-states in western Syria during the Early Bronze Age (2500-2000 B.C.). Archaeologists in Syria use Caliciform Ware to identify the political power and extent of the city-state of Ebla. Many describe this ware as standardized and mass produced. Based on thin section analysis of Caliciform Ware from the Ghab, which is considered within Ebla's political and economic purview, I argue that the production of Caliciform Ware was not standardized or mass produced. Instead these wares were made with different material styles at each site. The evidence for consumption of these ceramics indicates a socially valued good, explaining the homogenous forms and decorative patterns. This study emphasizes the need to examine ceramic structures across the political landscape in detail to fully understand processes of production and their relationship to the state. "The ceramic production and interaction network of La Reconnaissance, Trinidad during the early-late Ceramic Transition (ca. AD 500-800) by Marcie L Venter (University of Kentucky), Neal H. Lopinot (Missouri State University, Center for Archaeological Research), Jeffrey R. Ferguson (Missouri University Research Reactor) and Michael Glascock (Missouri University Research Reactor). Regional syntheses have characterized Trinidad's Northern Mountain Range as a boundary between two distinct interaction spheres during the Early Ceramic Age. Changes occurring on Trinidad, the southern Caribbean archipelago, and the South American mainland resulted in the disintegration of these earlier style zones at the end of the Early Ceramic. This so-called Late Ceramic cultural realignment included climate change, the renegotiation of political and social networks, and demographic transformations. In this paper, we consider ceramic evidence in the evaluation of the Northern Range's role as an Early Ceramic boundary and the changing nature of settlement during the Early-Late Ceramic transition. "Volcanic tempers: The case of coastal Ecuadorian Fineware Ceramic technology" by Maria Masucci (Drew University). Ethnographic studies offer examples of the relationship between ceramic technology and the social and symbolic realms but this is more difficult to discern in the archaeological record. The use of volcanic ash temper intersects discussions of technology and function but also potential examples of the relation of technology to belief and symbolic value. This particular material is heavily associated with Maya Classic pottery and its significance, source and function have been a central discussion since its identification by Anna O. Shepard. Now the Prehispanic ceramics of the coast of Ecuador are added to the list of similar examples. The circumstances of this case mirror remarkably those of the Mesoamerican situation. Questions of source, long term technological stasis even with total transformation in style and form of the ceramics involved, possible ties with long term long-distance movement of obsidian from highlands to the coast and the lack of recorded ash falls in the region create parallels and distinctive elements between Ecuador and the Maya region. Petrographic analysis of fineware ceramics from Engoroy through Manteño-Guancavilca spanning from 500 BC to European contact indicates the use of pumice as a tempering material in fineware ceramics. This material has not been identified locally and ashfall from potential source volcanoes is problematic as an explanation. Evidence from petrographic, geochemical and experimental analysis is discussed in order to begin the discussion of the significance of volcanic temper in the ceramic technology and societies of coastal Ecuador. "The olleros of Chijipata Alta, Bolivia: Digging, growing and spreading an archaeological landscape" by Andrew P. Roddick (McMaster University). In 1987 Karen Mohr Chavez reported on a modern potting settlement between Lake Titicaca and Cuzco. Andeanists have since developed a rich scholarship on specialized potting villages. Yet despite a long tradition of pottery production in the region no scholars have worked with modern potting communities in the Southern Lake Titicaca Basin. In this talk I report on recent work of the Proyecto Olleros Titicaca Sur (P.O.T.S.), a project I recently initiated to explore the relationship of learning, identity and social boundaries using both ethnographic approaches (participant observation, oral history, and videography`) and archaeological methods (excavation, petrography, radiography, among others). I focus here on Chijipata Alta, a specialized community of olleros located 1-hour outside the capital city of La Paz. These potters of produce standardized cooking, toasting and storage vessels that are particularly "reputable" (*sensu* Sillar 1997) across the Bolivian and Peruvian altiplano. Three particular material traces associated with the life of these vessels resonate with ongoing archaeological research in the region: (1) The paste recipes, which are excavated from a long utilized and important clay quarry to manufacture the utilitarian pots. (2) The ash mounds that

grow over many generations of pottery firings within and across the boundaries of this specialized community. (3) The fragments of Chijipata Alta produced cooking pots that are distributed across the larger South-Central Andes. I argue that the social dynamics behind these three variables provide valuable insights to ongoing archaeological research into issues of identity and social boundaries in the deeper past. "Terracotta pottery traditions in Tepakan, Campeche" by Lorraine A Williams-Beck (Universidad Autónoma de Campeche). Calling the ancestors home with terracotta whistles, and accompanying splendid religious altars with their preferred foods, miniature animals, and fantastic fauna figurines are annual Day of the Dead traditions in the Camino Real region in Campeche, Mexico. This paper will discuss figurine and whistle production and clay procurement strategies in Tepakan, including the spatial disposition of clay and temper sources, favored tempering materials, decorative preferences, and firing environments. Also I will discuss the social context in which this terracotta figurine production tradition persists, despite only a hand-full of specialists that currently dedicate part of their quotidian activities to creating these specialized crafts during a few weeks each autumn, in addition producing other low-fired large vessel forms throughout the rest of the year. Recent global market and local social demographic trends are combining to slowly extinguish this time-honored tradition.

ARCHAEOMETALLURGY

Thomas R. Fenn, Associate Editor

The column in this issue includes the following categories of information on archaeometallurgy: 1) New Books; 2) New Book Chapters/Articles; 3) Doctoral and Master Theses; 4) Forthcoming Meetings; and, 5) Research Opportunities.

New Books

Under the Volcano: Proceedings of the International Symposium on the Metallurgy of the European Iron Age (SMEIA) held in Mannheim, Germany, 20-22 April 2010, edited by Ernst Pernicka and Roland Schwab, expected Autumn 2014, *Forschungen zur Archäometrie und Altertumswissenschaft* (*FAA*) Band 5, Verlag Marie Leidorf (VML), Rahden/Westf., ISBN: 3896468758 (hbk.); 9783896468758 (hbk.). This volume contains a selection of papers presented at the International Symposium on the Metallurgy of the European Iron Age (SMEIA), held in Mannheim, Germany, April 20-22, 2010. Contributions to the volume comprise "Preface and introduction" (Ernst Pernicka, Roland Schwab; p. 7), "Late Bronze Age iron inlays on bronze artefacts from central Europe" (Daniel Berger; p. 9), "The Early Iron Age hoard from Fliess in Tyrol and ore resources in the eastern Alps" (Joachim Lutz, Roland Schwab; p. 25), "Early Iron Age metallurgy: A question of specialization?" (Diana Modarressi-Tehrani; p. 35), "Iberian falcata in the British Museum" (Janet Lang; p. 49), "Organisation of bloomsmithing activities in agglomeration at the end of the Iron Age (France – 2nd–1st century BC)" (Marion Berranger, Philippe Fluzin; p. 59), "Iron in the landscape of Iron Age East Yorkshire, UK" (Peter Halkon; p. 73), "Smelting and forging during the La Tène period: Preliminary results of surveys and excavations in Siegerland region, Germany" (Thomas Stöllner, Manuel Zeiler; p. 91), "An urban fine smithing quarter in the oppidum of Rheinau (canton Zürich, Switzerland)" (Marianne Senn, Stefan Schreyer, Vincent Serneels; p. 103), "Witnesses of complex bronze technology of the Celts: A boar-headed carnyx and a swan-shaped helmet from Tintignac" (Barbara Armbruster; p. 121), "Precious metal torcs from the Iron Age Snettisham treasure: Metallurgy and analysis" (Nigel Meeks, Aude Mongiatti, Jody Joy; p. 135), "XRF characterisation of Celtic silver from the Židovar treasure (Serbia)" (Jelena Živković, Thilo Rehren, Miljana Radivojević, Miloš Jevtić, Dragan Jovanović; p. 157), "Resources and recycling: Copper alloys and non-ferrous metalworking in the oppidum of Manching (Germany)" (Roland Schwab; p. 175), "Silver jewellery from the Late Iron Age to Roman times in central Europe: A comparative analysis on selected manufacturing techniques" (Birgit Schorer; p. 189), and "Celts and Romans: A contribution to research into cultural interactions" (Janka Istenič, Žiga Šmit; p. 205). More information can be found at the publisher's website: http://www.vml.de/e/detail.php?ISBN=978-3-89646-875-8.

New Book Chapters/Articles

From the book ***Anatolian Metal VI***, edited by Ünsal Yalçın, 2013, *Der Anschnitt*, Beiheft 25. *Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum*, Nr. 195, Deutsches Bergbau-Museum, Bochum, Germany, comes "Prähistorische Kupfergewinnung in Derekutuğun, Anatolien" (Ünsal Yalçın, Alexander Mass; pp. 153-194). From the book ***Ancient Iran and Its Neighbours: Local Developments and Long-Range Interactions in the Fourth Millennium BC***, edited by Cameron A. Petrie, 2013, *Archaeological Monograph Series III*, Oxbow Books, Oxford, comes "Iranian Metallurgy of the Fourth Millennium BC in its Wider Technological and Cultural Contexts" (Lloyd Weeks,; pp. 277-291). From the book ***The Nile Delta as a centre of cultural interactions between Upper Egypt and the***

Southern Levant in the 4th millennium BC, edited by Agnieszka Maczynska, 2014, Studies in African Archaeology 13, Poznan Archaeological Museum, Polish Academy of Sciences, Poznan Branch, Poznan, comes "First data on the nature and origin of the metalwork from Tell el-Farkha" (Thilo Rehren, Ernst Pernicka; pp. 237-252). From the book ***Mobility and Heritage in Northern Thailand and Laos: Past and Present. Proceeding of the Chiang Mai Conference, 1-2 December 2011***, edited by Chayan Vaddhanaphuti, Olivier Evrard, and Dominique Guillaud, 2013, Center for Ethnic Studies and Development, Faculty of Social Sciences, Chiang Mai University, comes "Sedentarity and metallurgy in upland Southeast Asia" (Oliver Pryce; pp. 27-45). From the book ***Archaeological Chemistry VIII***, edited by Ruth Ann Armitage and James H. Burton, 2013, *ACS Symposium series 1147*, American Chemical Society, Washington DC, comes "Metal plate connectors and iron nails on the Tripitaka Koreana printing woodblocks" (Choon Ho Do, Chong-Hong Pyun, Byung-Yong Yu, Jung Hyun Bae; pp. 277-291). From the book *The Encyclopedia of Ancient History*, edited by Roger S. Bagnall, Kai Brodersen, Craige B. Champion, Andrew Erskine, and Sabine R. Huebner, 2013, John Wiley and Sons, Inc., Malden, MA, comes "Metallurgy, Greece and Rome" (Thilo Rehren; pp. 4466–4469).

The most recent edition of ***The Crucible*** (Issue 85, Spring 2014) is available from ***The Historical Metallurgy Society (HMS)***. The issue includes 20 pages of news, correspondence, interviews, meeting notes, book reviews, and more. A PDF version of the issue is at: http://hist-met.org/images/pdf/hmsnews_85.pdf.

From ***Historical Metallurgy*** (2014, Vol. 46, No. 1) comes "Prehistoric iron smelting in London: evidence from Shooters Hill" (David Dungworth, Lorraine Mepham; pp. 1-8), "The Laurion shafts, Greece: ventilation systems and mining technology in antiquity" (Denis Morin, Richard Herbach, Patrick Rosenthal; pp. 9-18), "Understanding the Walloon method of iron refining: archaeological and archaeometric experiments, phase 1" (Philippe Dillmann, Andrea Perez, Enrique Vega, Danielle Arribet-Deroin, Régis Aranda, Maxine L'Héritier, Delphine Neff, Ludovic Bellot-Gurlet; pp. 19-31), "Hot blast iron smelting in the early 19th century: a re-appraisal" (Paul Belford; pp. 32-44), "[Review of] *Conquest, tribute, and trade. The quest for precious metals and the birth of globalization*, by H. J. Erlichman, Prometheus Books, New York, 2010, 227x150mm, 541pp, 9 figs, 24 pls, indes, ISBN 978-1-61614-211-7, $29.00, h/b" (Marcos Martinón-Torres; pp. 45-46), and "[Review of] *The Great Trial: A Swaledale lead mining dispute in the Court of Exchequer 1705-1708*, by Tim Gates, *Yorkshire Archaeological Society Record Series* CLXII for 2011-12, and Boydell Press, Woodridge, 2012, 236x157mm, 429pp, 6 figs, ISBN 9781903564561, £50, h/b" (David Crossley; pp. 46-47).

From the ***Journal of Archaeological Science*** (2014, Vol. 50) comes "Characterization and comparison of the copper-base metallurgy of the Harappan sites at Farmana in Haryana and Kuntasi in Gujarat, India" (Jang-Sik Park, Vasant Shinde; pp. 126-138), "Reconstructing the impact of human activities in a NW Iberian Roman mining landscape for the last 2500 years" (Lourdes López-Merino, Antonio Martínez Cortizas, Guillermo S. Reher, José A. López-Sáez, Tim M. Mighall, Richard Bindler; pp. 208-218), "Goldwork in Ancient Egypt: workshop practices at Qurneh in the 2nd Intermediate Period" (Lore G. Troalen, Jim Tate, Maria Filomena Guerra; pp. 219-226), and from (2014, Vol. 49) comes "Refining gold with glass – an early Islamic technology at Tadmekka, Mali" (Th. Rehren, S. Nixon; pp. 33-41), "Cinnabar in Mesoamerica: poisoning or mortuary ritual?" (Alfonso Ávila, Josefina Mansilla, Pedro Bosch, Carmen Pijoan; pp. 48-56), "Tracking archaeological and historical mines using mineral prospectivity mapping" (F. Monna, E. Camizuli, R. Nedjai, F. Cattin, C. Petit, J.-P. Guillaumet, I. Jouffroy-Bapicot, B. Bohard, C. Chateau, P. Alibert; pp. 57-69), "Late Bronze and Early Iron Age copper smelting technologies in the South Caucasus: the view from ancient Colchis c. 1500–600 BC" (Nathaniel L. Erb-Satullo, Brian J.J. Gilmour, Nana Khakhutaishvili; pp. 147-159), "Geochemical survey and metalworking: analysis of chemical residues derived from experimental non-ferrous metallurgical processes in a reconstructed roundhouse" (Chris J. Carey, Helen J. Wickstead, Gill Juleff, Jens C. Anderson, Martyn J. Barber; pp. 383-397), and "The exploitation of manganese-rich 'ore' to smelt iron in Mwenge, western Uganda, from the mid second millennium AD" (Louise Iles; pp. 423-441), and from (2014, Vol. 47) comes "A view of iron and steel making technology in the Yan region during the Warring States period and the Han dynasty: scientific study of iron objects excavated from Dongheishan site, Hebei province, China" (Haifeng Liu, Jianli Chen, Jianjun Mei, Jinbiao Jia, Lei Shi; pp. 53-63), "Casting cores used to craft large bronze masterpieces of the Florentine Renaissance and Mannerism" (Sonia Mugnaini, Marco Giamello, Anastasia Pisani, Salvatore Siano; pp. 85-98), and "The Iron Kuay of Cambodia: tracing the role of peripheral populations in Angkorian to colonial Cambodia via a 1200 year old industrial landscape" (Thomas Oliver Pryce, Mitch Hendrickson, Kaseka Phon, Sovichetra Chan, Michael F. Charlton, Stéphanie Leroy, Philippe Dillmann, Quan Hua; pp. 142-163), and from (2014, Vol. 46) comes "A compositional study of Cypriot

bronzes dating to the Early Iron Age using portable X-ray fluorescence spectrometry (pXRF)" (Andreas Charalambous, Vasiliki Kassianidou, George Papasavvas; pp. 205-216), and "The geoarchaeology of "waste heaps" from the ancient mining and beneficiation of copper-rich ores in the Wadi Khalid in southern Jordan" (John P. Grattan, David D. Gilbertson, Jonathon H. Waller, Russell B. Adams; pp. 428-433), and from (2014, Vol. 45) comes "New insights into Levantine copper trade: analysis of ingots from the Bronze and Iron Ages in Israel" (Naama Yahalom-Mack, Ehud Galili, Irina Segal, Adi Eliyahu-Behar, Elisabetta Boaretto, Sana Shilstein, Israel Finkelstein; pp. 159-177), and from (2014, Vol. 44) comes "A 3300-year atmospheric metal contamination record from Raeburn Flow raised bog, south west Scotland" (A. Küttner, T.M. Mighall, F. De Vleeschouwer, D. Mauquoy, A. Martínez Cortizas, I.D.L. Foster, E. Krupp; pp. 1-11), "Lead provenance study in medieval metallic materials from Madinat al-Zahra (Medina Azahara, Córdoba)" (Marc Gener, Ignacio Montero-Ruiz, Mercedes Murillo-Barroso, Eduardo Manzano, Antonio Vallejo; pp. 154-163), and from (2014, Vol. 43) comes "Smelting of magnetite and magnetite–ilmenite iron ores in the northern Lowveld, South Africa, ca. 1000 CE to ca. 1880 CE" (David Killick, Duncan Miller; pp. 239-255), "Not so efficient, but still distilled: the technology of Qing Dynasty zinc production at Dafengmen, Chongqing, southwest China" (Wenli Zhou, Marcos Martinón-Torres, Jianli Chen, Yanxiang Li ; pp. 278-288), and from (2014, Vol. 42) comes "Arsenical copper and bronze in Middle Bronze Age burial sites of southern Portugal: the first bronzes in Southwestern Iberia" (Pedro Valério, António M. Monge Soares, Maria Fátima Araújo, Rui J.C. Silva, Eduardo Porfírio, Miguel Serra; pp. 68-80), "More questions than answers: the Southeast Asian Lead Isotope Project 2009-2012" (Thomas Oliver Pryce, Sandrine Baron, Bérénice H.M. Bellina, Peter S. Bellwood, Nigel Chang, Pranab Chattopadhyay, Eusebio Dizon, Ian C. Glover, Elizabeth Hamilton, Charles F.W. Higham, Aung Aung Kyaw, Vin Laychour, Surapol Natapintu, Viet Nguyen, Jean-Pierre Pautreau, Ernst Pernicka, Vincent C. Pigott, Mark Pollard, Christophe Pottier, Andreas Reinecke, Thongsa Sayavongkhamdy, *et al.*; pp. 273-294), "Iron reinforcements in Beauvais and Metz Cathedrals: from bloomery or finery? The use of logistic regression for differentiating smelting processes"(A. Disser, P. Dillmann, C. Bourgain, M. L'Héritier, E. Vega, S. Bauvais, M. Leroy; pp. 315-333), and from (2014, Vol. 41) comes "Moving metals II: provenancing Scandinavian Bronze Age artefacts by lead isotope and elemental analyses" (Johan Ling, Zofia Stos-Gale, Lena Grandin, Kjell Billström, Eva Hjärthner-Holdar, Per-Olof Persson; pp. 106-132), "Reconsidering the role of Thorikos within the Laurion silver mining area (Attica, Greece) through hydrological analyses" (Kim Van Liefferinge, Martinus van den Berg, Cornelis Stal, Roald Docter, Alain De Wulf, Niko E.C. Verhoest; pp. 272-284), "Gold in the Southwest of the Iberian Peninsula during the 3rd Millennium BC" (F. Nocete, R. Sáez, M.R. Bayona, J.M. Nieto, A. Peramo, P. López, J.I. Gil-Ibarguchi, N. Inácio, S. García, J. Rodríguez; pp. 691-704)

From ***Archaeometry*** (2014, Vol. 56, No. 4) comes "The Evolution of Pre-Islamic South Arabian Coinage: A Metallurgical Analysis of Coins Excavated in *Sumhuram* (Khor-Rori, Sultanate of Oman)" (L. Chiarantini, M. Benvenuti; pp. 625-650), "Isotopic composition of lead in copper ores and a copper artefact from the La Profunda Mine (León, Spain)" (G. Huelga-Suarez, M. Moldovan, M. Suárez Fernández, M. Ángel de Blas Cortina, J. I. García Alonso; pp. 651-664), "How mineralogy and geochemistry can improve the significance of Pb isotopes in metal provenance studies" (S. Baron, C. G. Tămaş and C. Le Carlier; pp. 665-680), and from (2014-, Vol. 56, No3.) comes "First finding of early Medieval iron slags in Sardinia (Italy): A geochemical–mineralogical approach to insights into ore provenance and work activity" (P. Mameli, G. Mongelli, G. Oggiano, D. Rovina; pp. 406-430), "A speleothem record of early British and Roman mining at Charterhouse, Mendip, England" (D. A. McFarlane, J. Lundberg, H. Neff; pp. 431-443), and from (2013, Vol. 56, No. 2) comes "Middle Bronze Age II battleaxes from Rishon LeZion, Israel: Archaeology and metallurgy" (S. Shalev, E. N. Caspi, S. Shilstein, A. M. Paradowska, W. Kockelmann, T. Kan-Cipor Meron, Y. Levy; pp. 279-295), and "Indigenous African furnace types and slag composition—Is there a correlation?" (S. Chirikure, F. Bandama; pp. 296-312), and from (2013, Vol. 56, No. 1) comes "Defining the lead isotopic fingerprint of copper ores from north-west Spain: The El Milagro mine (Asturias)" (G. Huelga-Suarez, M. Moldovan, M. Suárez Fernández, M. Ángel De Blas Cortina, J. Ignacio García Alonso; pp. 88-101), and "An interdisciplinary study on the environmental reflection of Prehistoric Mining activities at the Mitterberg Main Lode (Salzburg, Austria)" (E. Breitenlechner, Th. Stöllner, P. Thomas, J. Lutz, K. Oeggl; pp. 102-128), and from (2013, Vol. 55, No. 6) comes "Ancient mining and smelting activities in the Wadi Abu Gerida Area, Central Eastern Desert, Egypt: Preliminary results" (Y. Abd El-Rahman, A. A. Surour, A. H. W. El Manawi, M. Rifai, A. Abdel Motelib, W. K. Ali, A. M. El Dougdoug; pp. 1067-1087), and from (2013, Vol. 55, No. 5) comes "Mineralogical and petrological investigations of Early Bronze Age Copper-Smelting remains from the Kiechlberg (Tyrol,

Austria)" (M. Krismer, U. Töchterle, G. Goldenberg, P. Tropper, F. Vavtar; pp. 923-945).

From ***Archaeological and Anthropological Sciences*** (2014, Vol. 6, No. 3) comes "A study of the composition and microstructure of silver hoards from Tel Beth-Shean, Tel Dor, and Tel Miqne, Israel" (S. Shalev, D. Shechtman, S. Sh. Shilstein; pp. 221-225), and from (2013, Vol. 5, No. 4) comes "'Biblical' bronze coins: New insights into their timing and attribution using copper and lead isotopes" (Nathan W. Bower; David B. Hendin; Craig C. Lundstrom; Michael S. Epstein; Austin T. Keller; Andrew R. Wagner; Zachary R. White; pp. 287-298), "Manufacture of Eastern European decorative tin–bronze discs from twelfth century BC" (Marianne Mödlinger, Paolo Piccardo; pp. 299-309), and "Prehistoric iron production technologies in the Upper Thai-Malay Peninsula: Metallography and slag inclusion analyses of iron artefacts from Khao Sam Kaeo and Phu Khao Thong" (Lynn Biggs, Bérénice Bellina, Marcos Martinón-Torres, Thomas Oliver Pryce; pp. 311-329), and from (2013, Vol. 5, No. 3) comes "Reassessment and new data on the diachronic relationship of Thassos Island with its indigenous metal resources: A review" (N. Nerantzis, S. Papadopoulo; pp. 183-196), and "Evolution of an old mining district between 725 and 1630 AD at the boundary between Thüringen and Bayern, SE Germany, using mineralogical and chemical markers, radio-carbon dating, and coal petrography of slags" (H. G. Dill, A. Techmer, J. Kus; pp. 215-233).

From ***Journal of Archaeological Method and Theory*** (2014, Vol. 21) comes "Forty thousand arms for a single emperor: From chemical data to the labor organization behind the Bronze arrows of the terracotta army" (Marcos Martinón-Torres, Xiuzhen Janice Li, Andrew Bevan, Yin Xia, Kun Zhao, Thilo Rehren; 534-562). From ***Journal of African Archaeology*** (2013, Vol. 11, No. 2) comes "Ores sources, smelters and archaeometallurgy: Exploring Iron Age metal production in the Southern Waterberg, South Africa" (Foreman Bandama, Shadreck Chirikure, Simon Hall; pp. 243-267), and [Review of] *Métallurgie du Fer et Sociétés Africaines: Bilans et nouveaux paradigmes dans la recherche anthropologique et archéologique*. By Caroline Robion-Brunner & Bruno Martinelli. B.A.R. International Series 2395. Cambridge Monographs in African Archaeology 81. Archaeopress, Oxford, 2012" (David Killick; pp. 273-276), and from (2013, Vol. 11, No. 1) comes "Iron artefacts from the DGB-1 Site, Northern Cameroon: Conservation, metallurgical analysis and ethnoarchaeological analogies" (Scott MacEachern, David A. Scott, Molly O'Guinness Carlson, Jean-Marie Datouang Djoussou; pp. 39-54). From ***Journal of Field Archaeology*** (2014, Vol. 39, No. 3) comes "Early ironworking in Iron Age South India: New evidence for the social organization of production from northern Karnataka" (Peter G. Johansen; pp. 256-275), and from (2014, Vol. 39, No. 1) comes "Metallurgical remains from regional surveys of "non-industrial" landscapes: The case of the Kythera Island Project" (Myrto Georgakopoulou; pp. 67-83). From ***Das Altertum*** (2013, Vol. 58, No. 4) comes "Anthropomorphe Metallfigurinen aus Alacahöyük, Anatolien" (Ünsal Yalçın, H. Gönül Yalçın; pp. 241-262). From ***Levant*** (2014, Vol. 46, No. 1) comes "Middle Bronze Age metal artefacts and metallurgical practices at the sites of Tell Arqa, Mougharet el-Hourryieh, Yanouh and Khariji in Lebanon" (Ziad El Morr, Marianne Mödlinger; pp. 27-42). From ***Bulletin of the American Schools of Oriental Research*** (2013, No. 370) comes "The exploitation of the landscape: Metal resources and the copper trade during the age of the Cypriot City-Kingdoms" (Vasiliki Kassianidou; pp. 49-82). From ***Pasiphae: rivista di filologia e antichità egee*** (2013, Vol. 7) comes "The production and trade of Cypriot copper in the Late Bronze Age. An analysis of the Evidence" (Vasiliki Kassianidou; pp. 133-146), "Metals and beyond: Cyprus and Sardinia in the Bronze Age Mediterranean network" (Fulvia Lo Schiavo, Franco Campus; pp. 147-158), and "Cypriot metalwork of the Late Bronze Age" (George Papasavvas; pp. 169-178). From ***Interdisciplinaria Archaeologica Natural Sciences in Archaeology*** (2013, Vol. 4, No. 2) comes "Arsenical copper production in the Late-Chalcolithic Period, Central Plateau, Iran. Case study: Copper-based artefacts in Meymanatabad" (Poorya Kashani, Bita Sodaei, Rouhollah Yousefi Zoshk, Mehdi Hamivand; pp. 207-210), and "A Study of Sasanian silver coins employing the XRF Technique" (Bita Sodaei, Parasto Masjedi Khak, Mostafa Khazaie; pp. 211-215), and from (2013, Vol. 4, No. 1) comes "A study of Urartian metallurgy techniques. Case study: Urartian Bronze weaponry in the Reza Abbasi Museum" (Poorya Kashani, Bita Sodaei, Shahram Heydarabadian, Behrooz Paranj; pp. 99-103), and "Application of PIXE spectrometry in determination of chemical composition in Ilkhanid silver coins" (Bita Sodaei, Poorya Kashani; pp. 105-109). From ***International Journal of Conservation Science*** (2013, Vol. 4, Special Issue), comes "Isotopic lead characterization of archaeological bronzes from Fraga dos Corvos (N Portugal)" (Susana Sousa Gomes, Elin Figueiredo, Maria Fátima Araújo, Filipa Lopes, João Carlos Senna-Martinez; pp. 661-672). From ***British Museum Technical Research Bulletin*** (2013, Vol. 7) comes "Simple sophistication: Mauryan silver production in north west India" (Paul Craddock, Caroline Cartwright, Kirsten Eckstein, Ian Freestone, Lalit Gurjar, Duncan Hook, Andrew Middleton, Lynn Willies; pp. 79-93). From ***Mediterranean Archaeology & Archaeometry***

(2013, Vol. 14, No. 1) comes "A bronze Osiris statuette from the Egyptian Museum in Cairo: Microstructural characterization and conservation" (Mohamed A. Ghoniem; pp. 37-49), and "Analytical investigation of five Roman Pb-based scale weights (Qasr Ar-Rabbah, Jordan): A case study" (Ahmad Abu-Baker, Wassef Al Sekhaneh, Atef Shiyab, Jan Dellith, Andy Scheffel, Alebrahim, M. Anwar, Jürgen Popp; pp. 181-190), and from (2013, Vol. 13, No. 2) comes "Elemental analyses on Ilkhanid period coins by PIXE: A case study on King Ghazan silver coins" (Parasto Masjedi Khak, Mostafa Khazaei Kouhpar, Mahdi Hajivaliei, Farhang Khademi; pp. 83-88), and "Elemental analysis of silver coins of Seljuk's' of Rome by PIXE: A case study" (Parasto Masjedi, Farhang Khademi, Mahdi Hajivaliei, Seyyed Mehdi Mosavi Kouhpar, Javad Neystani; pp. 181-187), and from (2013, Vol. 13, No. 1) comes "PIXEaAnalysis on Urartian bronze armors and harnesses in the Reza Abbasi Museum, Iran" (Poorya Kashani, Farhang Khademi Nadooshan, Reza Shabani Samghabadi, Parviz Abroomand Azar, Parvin Oliaiy; pp. 127-133), "Possible sources for extraction of silver by comparison of Parthian and Sasanian coins in Mede Satraps" (B. Sodaei, M. Hajivaliei, F. Khademi Nadooshan; pp. 161-170), and "Elemental comparison of silver coins of Iranian Seljuk with those of Roman Empire by PIXE" (Parasto Masjedi, Farhang Khademi, Javad Neystani, Seyyed Mehdi Mosavi Kouhpar; pp. 321-328). From ***Latin American Antiquity*** (2013, Vol. 24, No. 4) comes "Copper pigment-making in the Atacama Desert (Northern Chile)" (Marcela R. Sepulveda, Valentina L. Figueroa, Sandrine Pagés-Camagna; pp. 467-482).

Doctoral & Master Theses

The Compleat Metalsmith: Craft and Technology in the British Bronze Age, by Elpidia Giovanna Fregni, (Doctor of Philosophy thesis, Department of Archaeology, University of Sheffield, UK), June 2014, 233 pages, 55 figures, 7 tables, 5 appendices, index. This thesis explores the craft of metallurgy in the British Bronze Age through an examination and analysis of metalworking tools.

The goal of this research was to reassemble the Bronze Age metalsmithing toolkit based on an understanding of the craft and its practice. The first chapters examine the smith and metalsmithing tools through literary sources to establish a theoretical framework for understanding the significance of tools and smiths in the British Bronze Age.

This is followed by a study of metalsmithing tools in museum collections. These examinations focused on wear, design, and chemical composition. Tools were cross-referenced to contemporary tools, descriptions from ethnographic literature, and tools in modern workshops.

This research also supplied data to create replica tools for use in an experimental program to explore tool use and performance. The research culminated in establishing a system called Minimum Tools Required (MTR). It is based on the idea that the presence of an object implies the existence of the tools and materials necessary for its manufacture, and that the presence of tools implies a purpose, and the possibility of other tools and materials that are associated with that purpose. Using this system provides a means to assess assemblages and aids in understanding the kind and the number of tools and materials that were a necessary part of the Bronze Age metalsmith's toolkit.

The system also allows for more precise interpretations to be made of hoards. Tools can indicate the types of metal objects being made, or represent specific metalsmithing tasks. Thus by recognizing the tools and their function, statements can be made about how these tools were used and the processes by which metal objects were made in the Bronze Age, resulting in a more complete understanding the organization of the metalsmith's craft in antiquity. [Abstract by thesis author]

Forthcoming Meetings and Conferences

The NARNIA research network (http://narnia-itn.eu/) is pleased to announce the organization of the international conference, entitled: "***Interdisciplinary Studies of Ancient Materials from the Mediterranean***", to be held at the main campus of the University of Cyprus, in Nicosia, Cyprus, between the 17th and 19th of September 2014. The conference will provide an opportunity for new and established researchers to share research in an international forum and to exchange ideas on the latest interdisciplinary approaches, analytical techniques and methodologies for the integrated study of ancient materials, technologies and the environment. The NARNIA network is a collaboration of researchers who are engaged in the holistic study of ancient materials to facilitate a better understanding of the strategies associated with the production and the consumption of material culture and its impact on the historic and ancient environment.

Among the organized sessions is one entitled "*Copper Metallurgy across the Mediterranean*". Papers to be presented in the first part of this session comprise "Metal production on the south coast of Late Bronze Age Cyprus" (Lente Van Brempt), "Examining the Late Bronze Age and Iron Age metallurgical ceramics from the workshops of Kition" (Dimitris Ioannidis), "A

diachronic study of Cypriot copper alloy artefacts" (Andreas Charalambous), "An interdisciplinary study of a new slag heap from Skouriotissa dating to the first millennium BC" (Vasiliki Kassianidou, Erez Ben Yosef, Thomas Levy, Ron Schaar, Lisa Tauxe, Brita Lorensen), and "An archaeomagnetic study of major slag deposits in the central Timna valley" (Ilana Peters, Erez Ben-Yosef, Lisa Tauxe).

Papers presented in the second part of the session will include "Copper metallurgy of the Early Bronze Age in Thassos, North Aegean" (Nerantzis Nerantzis, Yannis Bassiakos, Stratis Papadopoulos), "A new approach for investigating the role of metals in Late Bronze Age societies on Crete" (Lena Hakulin), "Seeing the forest for the trees: assessing technological variability in ancient metallurgical crucible assemblages" (Frederik Rademakers, Thilo Rehren), "Some aspects of copper production in antiquity considering the furnace types and production techniques" (Damir Rumenjak), and "Egyptian bronzeworking practices in Late Bronze Age Canaan" (Naama Yahalom-Mack).

Papers presented in the second part of the session will consist of "The transition from bronze to iron; a view from a smith's hoard from Early Iron Age Megiddo" (Adi Eliyahu-Behar), "Votive bronzes in Late Period Egypt: where did the raw metals come from? (Aurelia Masson-Berghoff), "Copper in the pre-Islamic Sahara – a Mediterranean provenance?" (Aurélie Cuénod, David J. Mattingly), and "Copper-alloy consumption in a Tyrrhenian medieval town: the case of Leopoli-Cencelle (Italy)" (Mainardo Gaudenzi Asinelli, Marcos Martinón-Torres).

Other relevant oral presentations presented in different session include "XRF analysis of silver alloys from the EM I - MM IIA cemetery of Petras, Crete" (Alessandra Giumlia-Mair, Susan C. Ferrence, Philip P. Betancourt, James D. Muhly), "Iron Age silver hoards from Southern Phoenicia: surface analysis using pXRF" (Tzilla Eshel, Ayelet Gilboa, Sariel Shalev, Naama Yahalom-Mack).

Poster presentation on archaeometallurgy will include "Metal workshops at the settlement of Kastro-Palaia, Volos, Greece: Tin bronze versus arsenical copper" (Eleni Asderaki-Tzoumerkioti, Evangelia Skafida), "The Early-Middle Bronze age basalt anvils of Pyrgos/Mavroraki. Their use, context and related tools" (Maria Rosaria Belgiorno), "Greek coinage in context: the characterisation and provenance of silver from Greek colonies in the Western Mediterranean 5^{th}-3^{rd} centuries BCE" (Thomas Edward Birch, Fleur Kemmers, Sabine Klein, Michael Seitz, Heidi Höfer), "Study of metals found in Cova des Pas (Minorca, Spain)" (Bartomeu Llull Estarellas, Laura Perelló Mateo), "Precious metals in the eastern Mediterranean as a measure of changing economic and political realities" (Amir Golani), "Deteriorating effects of the metal threads on embroideries. Technical and analytical study on archaeological textiles" (Mohamed Marouf), "Metallographic characterization of two ancient Roman copper-based metal fragments" (Olga Papadopoulou, Panayiota Vassiliou), and "AR.CHI.MIN.: A multidisciplinary project for the study of the ancient mining heritage" (Luisa Dallai, Alessandro Donati).

The full conference program can be accessed at: http://www.eurocyinnovations.com/narnia-portal/wp-content/uploads/2014/02/NARNIA-conference-programme-and-abstracts.pdf

The NARNIA conference proceedings will be published in the form of an edited volume in the *Journal of Archaeological Science Reports* (Imprint: ELSEVIER, ISSN: 2352-409X, editors: A. Howard, C.O. Hunt). Publications guidelines have been sent to the conference participants. For further information or clarifications, please contact Dr Maria Dikomitou-Eliadou, the NARNIA project manager, Archaeological Research Unit, University of Cyprus, e-mail: m.dikom@ucy.ac.cy.

The ***SEDPGYM 15th International Conference on Geological and Mining Heritage***, will be held in September, 2014, in Spain. The 2014 annual conference of the Spanish Society for the Protection of the Geological and Mining Heritage (Sociedad Española para la Defensa del Patrimonio Geológico y Minero; SEDPGYM), held in memory of Vicente Sod Baynat and Craig Merideth, will take place in the village of Logrosán (province of Cáceres, central Spain) from the 25^{th} to 28^{th} of September, 2014. The village of Logrosán is located within the Villuercas-Ibores-Jara Geopark which has a long mining tradition. Two important mining sites are located by the village: the Costanaza Mine, an open to the public underground phosphorite mine and the Cerro de San Cristobal (a Geosite) casiterite mines. Both of them will be visited during the congress.

Coinciding with new archaeological campaigns carried out in summer 2013 in the Cerro de San Cristóbal, this congress is dedicated to honor the memory of two men who promoted research of the Cerro, the geologist Vicente Sos Baynat and the archaeologist Dr. Craig Merideth.

The scope of the conference is centered, with no geographical or chronological limitation, in aspects

related with geological and mining-metallurgy heritage, archaeology and history of mining, and protection, public use and didactic values of the geological and mining heritage.

The conference languages will be Spanish, Portuguese and English. The booking form (general fee 150 €) is available on the web site www.sedpgym.es (please indicate if you will join the free pre- and post-congress excursions). For more information or any inquiry you may have, please contact mhunt@us.es, or post to Dr. Mark A. Hunt-Ortiz, Jiménez Aranda, 6. Apartment 34. 41018-Seville, Spain.

The Historical Metallurgy Society Annual Conference, "***Metallurgy in Warfare – A Spur to Innovation and Development***", will be held from October 3-5, 2014, at City Hall, Malthouse Lane, Salisbury, Wiltshire, SP2 7TU, UK. The 2014 annual conference is timed to coincide with commemorations of the outbreak of the First World War – "The Great War" of its generation. Salisbury has been chosen as the venue because of its convenient location for many military museums, two of them associated with weapons inconceivable without metals, the Bovington Tank Museum, and the Museum of Army Flying at Middle Wallop. Sunday 5th Oct will be available for Museum Visits. Salisbury City Hall is itself a Memorial Hall for the Second World War.

The scope of the conference is not limited to any particular historical or pre-historical period. Although any relevant contribution will be considered, the organizers are particularly hoping for papers on the following themes:

- Developments in metallurgy arising from particular military needs
- Developments in weapons or military organization arising from metallurgical innovation
- Developments in the organization and management of metal/metal artifact production required as a result of urgent military demands

The provisional program can be found at: http://hist-met.org/images/Warfare_Programme.docx. For more information please contact mejbirch@aol.com. The booking form and further information can be found at: http://hist-met.org/images/MetallurgyInWarfareConf2014BookForm.pdf, and online payment can be made at: http://hist-met.org/component/mijoshop/product/42-metallurgy-in-warfare.html.

The international conference ***Archaeometallurgy in Europe IV*** will be held in Madrid, Spain from 3-6 June, 2015. *Archaeometallurgy in Europe (AIE)* has been organized every four years since 2003: in Milan, Italy (2003); Grado-Aquileia, Italy (2007); and, Bochum, Germany (2011). The Madrid Edition represents the consolidation of the most important forum for scientific discussion on early metalworking in Europe and far abroad. All this has been possible thanks to the support and generosity of many researchers and institutions, but most of all the organizers want to thank every participant who attended the last three conferences. The scientific meeting in Madrid is organized by the Institute of History of the Spanish National Research Council (CSIC) in collaboration with the National Center for Metallurgical Research (CENIM-CSIC), the Autonomous University of Madrid (UAM) and the German Archaeological Institute (DAI-Madrid).

The organizers cordially invite the submission of abstracts for oral or poster presentations to the International Conference "Archaeometallurgy in Europe IV". Madred Edition, 3-6 June, 2015. Please follow the instructions of the registration form at the end of this announcement. There will be 6 sessions covering the following main themes under which fall a wide range of possible topics:

- Early metallurgy: technological innovation and social negotiation
- Developments: new materials, alloys and processes
- Technological transmission, change and persistence
- Mines, mining and the miner
- Archaeometallurgy *versus* Archaeometry: you first
- Comparative studies

Due to space and administrative restrictions organizers are limited to a maximum of 90 oral papers and 60 posters. Abstracts should be sent as text documents (preferably in Word format) by **November 15th, 2014** to: aie4@cchs.csic.es. Please follow the attached template that includes title, authors' complete name and affiliation, full postal address and email address. Abstract should not exceed a maximum of 300 words and must contain a clear description of the main paper's topic. Proposals will be selected by the Scientific Committee.

A PDF version of the first Call for Papers circular can be found at the following link: http://www.congresos.cchs.csic.es/aie4/sites/default/files/4aie_-_first_circular_0.pdf. A template for the abstract

submission form can be found at the following link: http://www.congresos.cchs.csic.es/aie4/sites/default/files/abstract_template.doc. Further information about the conference, the organizers, call for papers, venue, registration, program and other links can be found at: http://www.congresos.cchs.csic.es/aie4/conference.

BIOARCHAEOLOGY

Katy Meyers, Associate Editor

Society for Archaeological Sciences International Travel Grant

I am very grateful for the support that was given to me by the Society for Archaeological Sciences. It allowed me the opportunity to conduct a research trip in England to collect primary data for my PhD dissertation. My research examines the presence of multiple forms of body treatment at death during the Early Anglo-Saxon Period in England. This era that dates from the mid-5th c to the late 7th c CE is characterized by its high levels of variation due to diverse cultural interactions between the Post-Roman Britons and incoming Northern European immigrants. Responses to the changes in power and social structure ranged from hybridization to warfare, and it is generally seen as an era of instability. Burials and cemeteries are a good indicator of the change, with the introduction of cremation in the mid-5th century and shifts to furnished burial across England. Mortuary behavior and burials can be indicative of social organization, religious beliefs, status, cultural influence, and ancestral ties. There were two primary forms of burial treatment employed: cremation, deliberate burning of human remains prior to burial, and inhumation, burial of a body without treatment. The archaeological remains of these practices are found in varying frequencies throughout England and often co-occur within the same cemetery. Despite a renewed interest in Anglo-Saxon funerary archaeology, the meaning behind co-occurrence of cremation and inhumation burials at a single site is unknown, and often the different treatments are examined separately.

The lack of attention to co-occurrence of cremation and inhumation is a problem within archaeology, and data-driven study of co-occurrence of burial treatments is limited for a number of reasons. A cohesive approach to co-occurrence is possible and vital to our interpretation of Anglo-Saxon England. I propose that burial methods in this period were a way of maintaining and negotiating identity in a period of instability, and part of this negotiation was expressed in differing burial types. This dissertation will develop an approach to co-occurrence of cremation and inhumation within Anglo-Saxon cemeteries that will allow for more comprehensive and systematic investigation of this mortuary behavior. If both burial practices are addressed concurrently we can improve interpretation of this important era of history.

From June 1 to June 15, I conducted a research trip to England. Primary excavation data was needed from two specific archaeological sites for which no published information is currently available. The published material for the site of Alwalton/Minerva lacks detailed information about each burial since it was only partially published in a journal, and the primary sources are only available for at the Museum of Peterborough. From the museum, I was able to access excavation records, laboratory records, site maps, grave maps, photographs, and microfilm. This data will allow me to complete a full analysis of the cemetery and use it in my dissertation research. The second collection I visited was for the site of Worthy Park. While Worthy Park has been published as a monograph, due to the untimely death of its primary author and archaeologist, it is missing a number of chapters. However, the notes for these chapters and the original data are available at the Museum of Peterborough. From this museum, I was able to collect detailed excavation records, maps, and proofs of the unpublished chapters. Data collection from both museums consisted of cataloging and digitizing unpublished primary materials, and spatial data was collected using a hand scanner to digitize maps for use in a Geographic Information System.

The data collected from this research trip, will allow me to conduct my data analysis and successful complete my dissertation. I fully appreciate the support of the Society for Archaeological Sciences, and I look forward to sharing the results of my research over the next year.

BOOK REVIEWS

David Hill, Associate Editor

Handheld XRF for Art and Archaeology, edited by Aaron N. Shugar and Jennifer L. Mass. 2013. Studies in Archaeological Sciences 3. Leuven University Press. Hardcover, 473 pp. ISBN: 978-9058679079. € 69.50

Reviewed by Robert H. Tykot, University of South Florida

This edited volume includes 14 chapters all focused on the use of hand-held, portable X-ray fluorescence spectrometers for art conservation and archaeological

research projects. Such small pXRF instruments were first introduced commercially more than a decade ago, but only have become extremely popular and widely used in archaeology in the last five or so years. A number of individual articles have now been published, including in the *Journal of Archaeological Science*, and here in the *SAS Bulletin* (Drake et al. 2009; Hayes 2009; Matsunaga 2009; Shackley 2010). The major issues continuously raised concern the limitations of these small hand-held versions relative to laboratory-based instruments, their use by under-trained individuals, and producing numeric values with precision and accuracy that may be compared with analyses done by INAA, ICP-S, LA-ICP-MS, ED-XRF, and WD-XRF (e.g. Frahm & Doonan 2013; Goodale et al. 2012; Speakman et al. 2011).

Editors Shugar and Mass begin with a detailed introduction of the history and principles of XRF, with the goal of "ensuring that this new research and its interpretation is achieved using rigorous analytical methodologies and a sound background in the theory and practical application of X-ray fluorescence." For all non-destructive XRF analyses, one major issue is the minimal, variable penetration of the primary X-rays on archaeological artifacts with surfaces that have become degraded, contaminated, corroded, or otherwise altered from their original composition. In addition, most materials are not homogeneous to begin with, for example ceramics varying horizontally because of temper inclusions, and metals and paintings varying by depth due to layering. Due to matrix effects on X-rays, calibration to produce quantitative data may be rather difficult. The papers in this volume were selected to represent a broad range of materials encountered in conservation and archaeological research, with the intent of providing the best practice - while making the limitations clear - for each material. It is really essential for pXRF users to understand the physics of this technique, use proper analytical settings, and interpret the data accordingly.

In Chapter 1 Shugar and Mass give a great overview of the application of XRF to art and archaeology, namely asking questions about natural and intentional bulk composition, paint and pigment types, provenancing obsidian and ceramics, and identifying soil contaminants and activities. They emphasize the differences between ancient and modern materials, especially concerning altered surfaces. They also give an overview of the physics of X-ray analysis, of the features and settings of XRF instruments, evaluating the spectra produced, and coming up with "real" numbers. One point that always needs to be considered is identifying elements vs. compounds, and portable XRFs cannot measure carbon or oxygen, so for example cannot discriminate among different carbonates, acetates, and oxides in minerals, pigments and other materials.

I start with Chapter 12 (Ferguson), because obsidian is one of the most homogeneous materials, its geological sources are relatively limited, and hundreds of research studies have been done on obsidian using many analytical methods, including pXRF. As Jeff explains very well, having a database of geological samples analyzed with the same instrument makes it unnecessary to worry about comparing calibrated values between XRF and INAA and other methods, when the pXRF itself has sufficient precision to discriminate between sources. But improper assignments may occur especially on very small or thin samples where X-rays of some but not all elements of interest pass through.

Chapter 14 (Kaiser and Shugar) covers man-made glass, with research questions about the bulk composition, colorants, and their sources. By their very nature there is a great range in their composition, which affects calibration accuracy; analysis issues concerning the depth (thickness) and density (e.g. SiO_2 vs. PbO based glasses) of the sample; surface weathering effects (especially alkali depletion); and the importance of light elements Mg, Na, K, Ca while oxygen cannot be measured with a pXRF. Effects caused by using the internal vacuum - creating a small depression in the nose piece window and therefore having some air between the sample and the detector, and by the window itself attenuating Na, may be avoided by removing the nose piece and running a He flush system instead. I find this novel idea very promising if one wants to get results for all of the major and minor elements in lithic and ceramic materials too. The differences obtained between sanded and unsanded samples, for Cl, K, Mn, Fe, and Ca, are extremely important to be aware of not just for glass artifacts.

Chapter 13 (Aimers, Farthing and Shugar) deals with ceramics, which in nearly all cases are not homogeneous and may include temper of different types and sizes, slip or paint or glaze added to the surface, and contaminants on the surface and in porous areas. With most clay sources unknown or at least untested, most research is done to identify different compositional groups in order to interpret production practices and distribution patterns. pXRF cannot be used nondestructively to test clay composition when the surface is covered with paint or glaze. The authors have gone to the trouble of creating a number of ceramic standards, analyzing them as well as representative archaeological ceramics on a WD-XRF spectrometer, so as to incorporate these values into the calibration of pXRF analyses on Postclassic pottery from Belize. Not having completed all of this at the time of

publication illustrates that high quality research using a pXRF still requires a significant time commitment.

Chapter 8 (Bezur and Casadio) provides a lengthy and detailed study on the analysis of porcelain, which also may have glazed surfaces which are different than the interior, and also may be very thin so that some X-rays may pass through. They mention the issue of beam size (from 1.5 to 9 mm diameter) and how that affects results on heterogeneous materials, and discuss the potential limitations of analyzing external samples for low-Z elements where the X-rays are absorbed in the air, especially common components like Na and Mg, which would be used to distinguish lime-alkali vs. alkali-lime type glazes. They argue, however, that results for low Z elements in the glaze layer can be at least semi-quantitative since they will not penetrate beyond 100 microns.

Chapter 10 (Donais and George) illustrates multi-purpose usage of a portable XRF, for in situ archaeological site analysis of different materials. There is excellent coverage of the protocols used for these scientific analyses, followed by three case studies. The first was on analyzing drainage system walls to potentially detect lead from pipework no longer present; the second on ceramic tiles to test their production history and compositional consistency; and identification of pigments used on frescoes, including cinnabar and hematite. Of particular importance for readers are the details provided about detection limits, standardization and comparison of raw and calibrated data, and the limitations and cautions that users must be aware of when using a handheld XRF.

Chapter 2 (Smith) is titled as on Renaissance bronzes, but is really focused on the advantages and methods of using a handheld XRF to conduct such analyses in museums, and how to quantify the analytical results obtained. The author discusses well the issues of patination, inhomogeneity at the micro-scale (especially due to phase segregation), surface enrichment, and applied coatings. The relatively large beam size avoids much of the micro-variation, while the analytical settings and the methods and standards used for calibration of the results on Cu, Fe, Ni, Zn, As, Ag, Sn, Sb, and Pb are covered in great detail. Included are discussions of spectral line selection, normalization of the total, limits of detection and quantification, and comparison to other instruments. There is also detailed coverage of the practicalities involved in analysis, including analysis time, spot selection, reviewing data, and team work and safety.

Chapter 7 (Mass and Matsen) focuses on the analysis of silver alloys to assess provenance, authenticity, technology of manufacture, and state of preservation, while dealing with the advantages and disadvantages of two different handheld XRFs and two regular XRF instruments. In all cases where the analysis is conducted non-destructively, only results for the surface are being obtained and thus there are limitations due to the segregation of copper-silver alloys, irregular surface structures, post-manufacturing surface treatments such as pickling, reworking/repairing, and corrosion/tarnish layers. It is important that users be aware of this and whether it affects the precision needed for their research questions, e.g. assessing whether objects met the silver standards for different countries and time periods, or may be the result of recycling.

Chapter 11 (Neff, Voorhies and Paredes Umana) is focused on analysis of archaeological sediments in Mesoamerica, to identify activity areas on what was thought to be a clay floor, and interpret stratigraphic layers which include volcanic ash. The ability to test soils in the field is one of the primary reasons for commercial development of pXRF instruments, and provides rapid results without sample preparation on many samples at low cost. Analysis of the floor was focused on measuring variability of P, Zn, Cu, Fe, and Mn to represent the presence of organic materials, and differentiate between plants, bone, and aquatic resources. Analysis of tephra layers (for elements P, Ca, Ti, V, Fe, Zn, Sr, and Ba) at another site were done to identify the specific volcanic eruption and its impact on pre-existing sediments whether thru erosion or human disturbance. This is important at many sites when addressing the accuracy of stratigraphic layers and contexts.

Overall, handheld/portable XRFs are usable for many archaeological research projects, and have significant advantages over other instruments in terms of time, cost, and non-destructive nature. At the same time, users must be aware of the limitations, especially heterogeneity due to surface analysis, and the need to use material specific standards and calibration procedures on the resulting data There are five more chapters for which I will not go into depth here, since they are not about archaeological materials, but rather about photographs (Chapter 3 - Stulik and Kaplan), paintings (Chapter 4 - McGlinchey), manuscript illuminations (Chapter 5 - Trentelman, Patterson and Turner), historical paper (Chapter 6 - Barrett, Shannon, Wade and Lang), and on heavy metal pesticides in ethnographic collections (Chapter 9 - Shugar and Sirois). These chapters exemplify the very broad range of materials and applications that the pXRF may be used for.

I found this book to be extremely well organized, edited

and formatted, figures in good resolution and tables easy to read, and not too many typos or grammar issues as distractions (although more than I would have liked to notice). The cost for this hardcover book published by Leiden University Press is affordable considering its size and today's prices. The great variety of material applications covered makes this an excellent resource for teaching purposes, as well as an important reference for scholars with a specific focus, and I very highly recommend it for all potential users of XRF for archaeology or art conservation. Especially if you don't know, for example, matrix effects, or the difference between Si-PIN and SDD detectors, or Compton and escape peaks.

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MARITIME ARCHAEOLOGY

Nicolás Ciarlo, Associate Editor

Archaeological evidence of maritime activities, especially those located underwater, is threatened by a wide variety of cultural and natural agents. This is particularly the case with many historical shipwrecks. Due to their irreplaceable nature, many archaeologists —based on the UNESCO *Convention on the Protection of the Underwater Cultural Heritage*, 2001— tend to focus on *in-situ* methods and techniques when facing shipwreck research and preservation. Within this scenario, the archaeological sciences have much to contribute. Indeed, new methodologies and instrumentation allow us to obtain previously unthinkable results. The following research notes represent exemplary cases of the application of non-destructive means for monitoring, recording and stabilizing underwater cultural heritage (UCH) from Australia. I am deeply grateful to the authors for their valuable contributions.

Current Research

Australian Historic Shipwreck Preservation Project 2012-2015

The Australian Historic Shipwreck Preservation Project (AHSPP) is a multi-organizational maritime archaeology research program involving four Australian universities and ten agencies from the Australian Commonwealth, and State and Territory governments, as well as the Australasian Institute for Maritime Archaeology. The project is a landmark study for *in-situ* preservation of submerged maritime archaeological sites, and builds on the Reburial and Analysis of Archaeological Remains Project underway in Scandinavia.

Two protected historic shipwreck sites are being used for the project: the excavation and *in-situ* reburial of *Clarence* (1850) and the reburial of *James Matthews* (1841). Both sites were selected as examples of shipwrecks at risk of total loss due to cultural and environmental impacts such as fishing anchors, scouring, erosion and marine borer activity, as well as numerous other factors (see http://www.ahspp.org.au). The sites had also been subjected to a range of conservation interventions over many years to slow or prevent their total loss, with varying short-term success.

The reburial aspects of the project are being led by conservation scientist Vicki Richards of the Western Australian Museum (WAM), who developed the methodologies in conjunction with the AHSPP team and colleagues and volunteers at the Western Australian Museum. Two different reburial methodologies are being trialed at the sites.

The first case study site, *Clarence*, is located off the coastal township of St. Leonards on Victoria's Bellarine Peninsula. Following a month-long excavation and artifact reburial program in April/May 2012, a small team later laid 250 m^2 of shade cloth and 294 m^2 of polyvinyl chloride (PVC) tarpaulins over the wreck, completely

covering the remains and making it the largest-scale *in-situ* shipwreck reburial program ever attempted in the southern hemisphere. Furthermore, 3,500 sandbags backfilled excavation areas and secured the shade cloth and tarpaulins to the seabed. Much of the technical aspects of deploying the materials were undertaken with the invaluable assistance of experienced commercial divers.

James Matthews, located in Cockburn Sound in Western Australia, was added to the project in 2013. It was extensively researched and excavated during the 1970s but has recently been subjected to increasing deterioration due to extensive and continuing sediment loss. *James Matthews* has been reburied using a submerged cofferdam with a shade cloth cover. The cofferdam consists of interlocking polyethylene road crash barriers surrounding the wreck, weighted internally with blue metal (construction aggregate). The interior of the cofferdam is filled with sand and covered with shade cloth to prevent sediment loss.

Both sites are being regularly monitored throughout the post-reburial program. Sediment core samples are being collected annually at each site for physico-chemical and microbiological analysis. The analyses include the chemistry of the seawater, pore water and sediments [pH; redox potential (E_{redox}); salinity, dissolved oxygen levels, total iron and organic content; sulphide and sulphate concentrations; nutrient (nitrogen and phosphorus) levels], the type and nature of the sediments (loss on ignition; particle size distribution; porosity) and the level and type of microbiological activity within the sediment. In addition, more frequent visual inspections are being undertaken. At both sites, a series of sacrificial samples of timber and metals were also placed on site pre-reburial for annual recovery and analysis, to examine the rate of corrosion and deterioration under the protective coverings, which may then be extrapolated to the degradation rates of the original wreck remains. The sacrificial wood samples will be subjected to the following analyses: pH profiles, pilodyn measurements, maximum water content (U_{max}), microscopic and Fourier transform infra-red spectrometric (FTIR) analysis. Analyses performed on the metal samples will include pH and corrosion potentials (E_{corr}) of the residual metal, total depth of concretion and corrosion (d_{total}) and the total depth of corrosion (d_c), weight loss, scanning electron microscopic/energy dispersive X-ray analysis (SEM/EDAX) and X-ray diffraction spectroscopy (XRD).

Over the course of three years, based on the results of the monitoring program, AHSPP will systematically test the two *in-situ* preservation methodologies to provide a critique of practical protocols for the assessment and *in-situ* management of 'at-risk' historic shipwreck sites.

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Perth Region Maritime Archaeology 3D Mapping Project

The Maritime Archaeology Association of Western Australia (MAAWA) recently initiated the first stage of its *Perth Region Maritime Archaeology 3D Mapping Project*, with the support and supervision of the Western Australian Museum (WAM). This project is intended to facilitate the development of a low-cost photogrammetry package for rapid metric recording of UCH in the Perth region and provide training for MAAWA members in underwater photogrammetric recording and image processing techniques.

While a considerable number of UCH sites have been identified and investigated in the Perth region through the initiative of WAM and MAAWA, the current status and condition of many remains somewhat uncertain, owing to a lack of any up-to-date inventory or systematic monitoring and management framework. This is compounded by several factors, including a paucity of detailed documentation for many UCH sites, limited means to monitor the cause(s), nature, and scale of changes in sites and their immediate environments, and a reliance on avocational involvement, with concomitant pressure on time, money, and expertise. Given these issues and the considerable constraints and limitations inherent in traditional (manual) survey and recording techniques, there is a clear need for alternative approaches to be adopted if the on-going management of UCH is to be both timely and effective.

A detailed literature review indicated that multi-image 3D photogrammetry (a term that describes the use of large 2D image datasets to reconstruct the 3D geometry of an object or scene) best met the project's requirements of time and cost effectiveness, ability to employ off-the-shelf hardware and software systems, minimal technical overheads, and accuracy. Currently, MAAWA is field-testing different hardware/software configurations at a number of target sites in riverine and marine contexts across the Perth region. These trials have been designed to identify appropriate image acquisition/processing techniques, methods of establishing spatial controls, and to assess the technique's ability to generate data that conforms to current spatial standards. While still early in the evaluation process, the results obtained to date —particularly those from the wreck of the iron barque *SS*

Omeo (1858-1905)— have nevertheless been encouraging.

The evaluation on the wreck of *SS Omeo* was undertaken in May 2014. The wreck itself is located some 40 m offshore in 2-4 m of water, and offered both ease of access and excellent visibility (typically better than 10 m). Recording was undertaken by a single diver using a GoPro Hero 3+ Black Edition camera, with the resolution reduced to 7MP in order to reduce the effective field of view and minimise any fisheye distortion that might affect 3D reconstruction. Initially, the diver swam a series of closely-spaced parallel transects over a target area towards the aft section of the wreck, capturing a continuous sequence of overlapping vertical still images. The diver then made a circular sweep around the target area, this time capturing a sequence of oblique images oriented towards the approximate centre of the target area so as to capture details of areas of features might otherwise be occluded.

The resulting set of 560 images was imported into Adobe Photoshop, where simple color correction and histogram stretching was undertaken to improve image quality. The images were then imported into Agisoft Photoscan at full resolution and image rectification/alignment, geometry extraction and dense point cloud generation carried out. This yielded a model comprising 3,444,578 points that appears (in the absence of ground control points) to be geometrically accurate and shows considerable detail of the wreck and its environment (Fig. 1).

Figure 1. 3D mapping of the SS Omeo *(1858-1905).*

The next stage of the project will involve the establishment of spatial controls, testing of additional camera configurations, and the capture of a much denser set of photographic images across a larger portion of the wreck.

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Recent Publications

International Journal of Nautical Archaeology. From *IJNA* 2014, Vol. 43, No. 1: "The 5th-century BC shipwreck at Tektaş Burnu, Turkey: Evidence for the ship's hull from nail concretions (W. van Duivenvoorde); "The Dor 2001/1 Byzantine shipwreck, Israel: Final report" (Y. Kahanov & H. Mor); "Naval battlefield archaeology of the Lost Kublai Khan fleets" (J. Kimura et al.); "Tree-rings, timbers and trees: A dendro-chronological survey of the 14th-century cog, Doel 1" (K. Haneca & A. Daly); and "A 15th-century wreck of an ordnance-carrying ship from Atlit North Bay, Israel" (E. Galili & B. Rosen).

Journal of Maritime Archaeology. From *JMA* 2014, Vol. 9, No. 1: "Deep-water shipwreck initial site formation: The equation of site distribution" (R. A. Church); "Digital photogrammetry for documentation of maritime heritage" (M. Martorelli et al.); and "Multi-image photogrammetry for underwater archaeological site recording: An accessible, diver-based approach" (J. McCarthy & J. Benjamin).

Journal of Archaeological Sciences. Among other exciting papers published during the first part of 2014 it is worth mentioning: *JAS*, Vol. 41: "Geoarchaeology confirms location of the ancient harbour basin of Ostia (Italy)" (J.-P. Goiran et al.); "Species identification of archaeological marine mammals using collagen fingerprinting" (M. Buckley et al.); "Long-distance oak supply in mid-2nd century AD revealed: the case of a Roman harbour (Voorburg-Arentsburg) in the Netherlands" (M. Domínguez-Delmás et al.); "High-precision dating the Akko 1 shipwreck, Israel: wiggle-matching the life and death of a ship into the historical record" (B. Lorentzen et al.); Vol. 42: "Isotope evidence for the use of marine resources in the Eastern Iberian Mesolithic" (D. C. Salazar-García et al.); and "The discovery of New Zealand's oldest shipwreck – possible evidence of further Dutch exploration of the South Pacific" (J. Palmer et al.); Vol. 43: "A trace element study for the provenance attribution of ceramic artefacts: The case of Dressel 1 amphorae from a late-Republican ship" (C. M. Belfiore et al.); and "Tracking ancient ship routes through the analysis of caulking material from shipwrecks? The case study of two 14th century cogs

from Doel (northern Belgium)" (K. Deforce et al.); Vol. 44: "A Roman barge in the Ljubljanica river (Slovenia): wood identification, dendrochronological dating and wood preservation research" (K. Čufar et al.); Vol. 45: "The role of computational fluid dynamics in understanding shipwreck site formation processes" (T. A. G. Smytha & R. Quinn); and "Palaeobotanical, chemical and physical investigation of the content of an ancient wine amphora from the northern Tyrrhenian sea in Italy" (D. Arobba et al.); Vol. 46: "Response: The discovery of New Zealand's oldest shipwreck" (W. van Duivenvoorde); and "Evaluation of the state of preservation of waterlogged archaeological wood based on its physical properties: basic density vs. wood substance density" (L. Babiński et al.).

Geoarchaeology. From 2014, Vol. 29, No. 1: "Sourcing olive jars using U-Pb ages of detrital zircons: A study of 16th century olive jars recovered from the Solomon Islands" (S. J. Kelloway et al.); Vol. 29, No. 2: "The purpose and age of underwater walls in the Bay of Elaia of Western Turkey: A multidisciplinary approach" (M. Seeliger et al.); and Vol. 29, No. 3: "Beach ridges as favored locales for human settlement on Pacific Islands" (W. R. Dickinson).

British Archaeological Reports (BAR). Archaeopress has published the following works related to the field so far: "Late Roman Coarse Wares, Cooking Wares and Amphorae in the Mediterranean. Archaeology and archaeometry. The Mediterranean: a market without frontiers" (N. Poulou-Papadimitriou et al., eds.), 2 Vol., xx + 1071 pages, BAR S2616; "Proceedings of the XVI IUPPS World Congress (Florianopolis, 4–10 September 2011) / Actes du XVI Congrès Mondial UISPP (Florianópolis, 4–10 Septembre 2011)", Vol. 5 (A. Figueiredo et al., eds.), v + 60 pages, BAR S2631; and "Arqueometalurgia de un naufragio del siglo XVIII: la corbeta de guerra HMS Swift (1770), Puerto Deseado, provincia de Santa Cruz (Patagonia)" (N. C. Ciarlo), xv + 204 pages, in Spanish with English summaries, BAR S2596.

Other journals —some of them, dedicated to physical and applied sciences— have published archaeometric studies which can be of particular interest for maritime archaeologists. It is worth mentioning the following papers: ***Applied Physics A***, Vol. 114, No. 3: "Diagnostic analysis of stone materials from underwater excavations: the case study of the Roman archaeological site of Baia (Naples, Italy)" (P. Aloise et al.), and "Laboratory tests addressed to realize customized restoration procedures of underwater archaeological ceramic finds" (C. M. Belfiore et al.); ***Archaeological Prospection***, Vol. 21, No. 1: "A remote sensing perspective on shoreline modification, canal construction and household yrajectories at Pineland along Florida's Southwestern Gulf Coast" (V. D. Thompson et al.), and Vol. 21, No. 2: "Historic shipwreck study in Dongsha Atoll with Bathymetric LiDAR" (P. Tian-Yuan Shih et al.); ***European Journal of Mineralogy***, Vol. 26, No. 2: "Mosaic marble tesserae from the underwater archaeological site of Baia (Naples, Italy): Determination of the provenance" (M. Ricca et al.); ***Materials Characterization***, Vol. 92: "Metallurgical characterization of brass objects from the Akko 1 shipwreck, Israel" (D. Ashkenazi et al.); ***Mediterranean Archaeology and Archaeometry***, Vol. 14, No. 1: "A marine geoarchaeological survey, Cape Sounion, Greece: preliminaryresults" (G. Papatheodorou); ***Open Journal of Archaeometry***, Vol. 2, No. 1: "Assessment of portable X-ray fluorescence analysis for the evaluation of slate procurement and exchange: A maritime Archaic case study from Newfoundland and Labrador" (C. B. Wolff et al.); and ***Quaternary Science Reviews***, No. 88: "Fish otolith geochemistry, environmental conditions and human occupation at Lake Mungo" (Long et al.).

Previous Meetings and Conferences

47th Annual Conference on Historical and Underwater Archaeology. The Society for Historical Archaeology Annual Conference was held in Quebec City, Canada, from January 8th to 12th. Several intriguing papers were presented at the following symposiums: Marine Geoarchaeology; Conservation for Underwater Archaeology; Dendrochronology: Social and Cultural Aspects of Wood in Archaeology; What's in the toolbox? A Critical Look at remote Sensing and recording Systems Used for Underwater Archaeology; Deepwater Archaeology: Advancements, opportunities, and Limitations; Recent Developments in Ship Reconstruction. The Program and Book of Abstracts is available at:
http://sha2014.com/program.html

2nd Asia-Pacific Regional Conference on Underwater Cultural Heritage. This conference was held from May 12th to 16th in Honolulu, Hawaii. The studies presented at the session "Preservation and Conservation of Wet Archaeological Materials and Site Management Collection" (V. Richards & J. Carpenter, chairs), are dedicated to sedimentological analysis, metal corrosion, conservation of materials, and *in-situ* monitoring and preservation of ships. Proceedings are available at:
http://www.themua.org/collections/collections/show/13.

Courses and Seminars

Nautical Archaeology Program. The Nautical Archaeology Program (NAP) of the Anthropology

Department at Texas A&M University (TAMU) specializes in training graduate students in the archaeology and history of ships and seafaring. Courses are focused primarily on maritime activity in the ancient Mediterranean and Medieval Europe, as well as world-wide seafaring in the post-Medieval era. The faculty members of the NAP have an outstanding scientific expertise in ship construction, old world seafaring, new world seafaring, and conservation and recording of archaeological material.

For instance, the leading research conducted at one of the laboratories of the Centre for Maritime Archaeology and Conservation, the *J. Richard Steffy Ship Reconstruction Laboratory* (ShipLAB), has widely contributed to the knowledge of seafaring history. The investigations conducted around the world cover different interrelated analytical fields: computer science (for ship modeling and 3D reconstruction), quantitative methods, material culture studies (including cannons, astrolabes, bells, &c.), historical documents analysis, photogrammetry, and dendrochronology. For further information about previous and current research at ShipLAB, see https://tamu.academia.edu/FilipeCastro, or contact Dr. Filipe Castro to fvcastro@tamu.edu

The application deadline for fall 2015 is January 1st 2015. All necessary documents can be found at: http://nautarch.tamu.edu/academic/admissions.shtml. Applicants that wish to be considered for funding must submit their application by December 1st, 2014. For more information on course requirements and degree plan procedures, please contact the graduate advisor, Marco Valadez to mlvaladez@tamu.edu, Tel 979-845-9333.

UPCOMING CONFERENCES

Rachel S. Popelka-Filcoff , Associate Editor

2014

15-19 September. International Council of Museums, Committee for Conservation (ICOM-CC) 17th Triennial Meeting. Melbourne, VIC, Australia. General information: http://www.icom-cc.org/254/triennial-conferences/17th-triennial-conference-melbourne,-australia/#.Ut4ShqWZ7v0

18-20 September. 4th annual meeting of the European Society for the study of Human Evolution (ESHE). Florence, Italy. General information: http://www.eshe.eu

Sept 28-Oct 3, 2014. SciX Conference 2014. Reno-Tahoe, Nevada. General information: http://www.scixconference.org Special symposium on "Chemistry in Art and Archaeology". Contact: Mary Kate Donais (mdonais@anselm.edu)

13-15 October. 5th International Conference on Remote Sensing in Archaeology. "The Age of Sensing" Durham, NC, USA. General information: http://space2place.classicalstudies.duke.edu

19-22 October. The Geological Society of America National Meeting. Vancouver, BC, Canada. General information: http://www.geosociety.org/meetings/. Special sessions: "The Archaeological Record as a Paleoclimatic and Paleoenvironmental Archive" and "Coastal Geoarchaeology"

7-9 November. The Big Picture: Archaeology, Society and Environment Conference 2014. Plymouth UK. General information: http://estore.plymouth.ac.uk/browse/extra_info.asp?compid=1&modid=2&catid=20&prodid=619

19-22 November. American Schools of Oriental Research Annual Meeting. San Diego, CA USA. General information: http://www.asor.org/am/index.html

1-3 December. AAA (Australian Archaeological Association)/ASHA 2014 Joint Conference. Culture, Climate, Change: Archaeology in the Tropics. Cairns, Queensland, Australia. General information: http://australianarchaeology.com/conferences/aaa2014-conference/

3-7 December. American Anthropological Association 113th Annual Meeting. "Producing Anthropology" Washington DC USA. General information: http://www.aaanet.org/meetings/

15-19 December. American Geophysical Union Fall Meeting, San Francisco, CA USA. General information: http://www.agu.org/meetings/

7-12 December. Royal Australian Chemical Institute National Congress, Adelaide, SA Australia. Session on Chemical Analysis and Sensing in Conservation. General information: http://www.racicongress.com/program.htm

2015

6-11 January. Society for Historical Archaeology Conference Seattle, Washington USA. General information: http://www.sha.org/index.php/view/page/annual_meetings

8-11 January. Archaeological Institute of America Annual Meeting (AIA and APA Joint Annual Meeting), New Orleans, LA USA. General information: http://www.archaeological.org/annualmeeting
Special session: "Getting Elemental: Integrating Isotopes and Archaeology" Co-organizers: Catherine M. Kearns (Cornell University) and Jeffrey F. Leon (Cornell University) Contact: archisotope@gmail.com.

8-12 March. Pittcon Conference and Expo, New Orleans, LA USA. General information: http://www.pittcon.org/
22-26 March. 249th National Meeting and Exposition, American Chemical Society. Denver, CO USA. General information: http://www.acs.org.

25-29 March. American Association of Physical Anthropologists Annual Meeting. St. Louis, MO. General information: http://physanth.org/annual-meeting

30 March-3 April. 43rd International Conference on Computer Applications and Quantitative Methods in Archaeology (CAA). Abstract deadline: 30 September 2014. General information: http://caaconference.org

15-19 April. Society for American Archaeology. 80th Annual Meeting, San Francisco, CA USA. http://www.saa.org/Default.aspx?TabId=1419

27-30 April. GMPCA congress – Archeometry 2015. Besançon, France. Abstract deadline 30 October 2014 General information: http://chrono-environnement.univ-fcomte.fr/spip.php?article1967

3-7 May AGU-CGU-GAC-MAC Joint Assembly. Montreal, Canada. General information: http://ja.agu.org/2015

23-26 June. 8th International Workshop for African Archaeobotany. Modena, Italy. http://www.palinopaleobot.unimore.it/site/home/8th-international-workshop-for-african-archaeobotany-iwaa.html

5-10 July. Eighth Lapita Conference. Port Vila, Vanuatu. General information: http://chl.anu.edu.au/departments/archaeology/lapita8/

16-21 August. Goldschmidt Conference, Prague Czech Republic. http://goldschmidt.info/2015/

17-20 August. Canadian Quaternary Association Bi-annual Meeting. St. John's, Newfoundland and Labrador, Canada. More information TBD

8-10 September. International Symposium on Knappable Materials 2015. Barcelona, Spain. Abstract deadline: February 2015. General information: http://www.ub.edu/cherts-symp2015/

11-12 December. Middle Palaeolithic in the Desert II. Bordeaux, France. General information: https://sites.google.com/site/middlepalaeolithicdesert/home

2016

International Symposium on Archaeometry, Kalamata, Greece. http://www.ims.demokritos.gr/ISA/index.php

29 August- 2 September. World Archaeological Congress, Kyoto, Japan. http://www.worldarchaeologicalcongress.org/component/content/article/67-headlines/627-wac-8-kyoto

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