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FROM THE EDITOR

THOMAS R. FENN

Spring is here again, and the weather is changing. Speaking of weather changing, an area starting to receive more publicity in the media is the impacts of climate change on cultural heritage and on archaeological and historical sites. These changes include increased erosion of coastal sites due to increased storm activity as well as the long-term effects of sea-level rising. Likewise, in other parts of the world, sites and archaeological remains long frozen in high altitude and Polar regions are thawing out, leading to increased and accelerated deterioration and loss of evidence and information, along with a corresponding increase in looting activities at these sites.

While we as individuals, and collectively as citizens of state level societies, have and are trying to reduce the accelerated degradation of our local and global environment and climate, as is often that case, there are not enough people on the ground monitoring these processes and identifying sites/regions where global climate change, combined with socio-economic shifts and cultural attitude changes are leading to expanded loss of our cultural heritage. Likewise, as these environmental and climate changes are new for many of us, the challenges we face moving into the future are unclear and evolving as conditions, policies and cultural attitudes also change and evolve. As is often the case, new rounds of evaluation of these changing circumstances are needed to determine what we can do to reduce the losses. Increased education on both climate change and the local and broader impacts on the environment are needed to

help archaeologists and local/state/national cultural heritage managers to better preserve and/or mitigate losses from these forces. Please take some time to learn about these issues and see if there are ways that you, as individuals, but also as mentors and teachers, can help understand the problem and what we all can do better to help fight the loss off our collective archaeological heritage.

SAS-UKAS STUDENT PAPER AWARD WINNER

The Society for Archaeological Sciences selected a student paper presented at the 2017 annual United Kingdom Archaeological Science (UKAS) conference as winner of a SAS Student Paper Award. The title, authors and abstract are presented here. Congratulations to Katie Hemer and colleagues for a job well done!

Oh we do like to be beside the seaside: A bioarchaeological study of the early medieval cemetery of St Patrick's Chapel, Pembrokeshire

By K.A. Hemer, P. Verlinden, K. Murphy, M. Shiner
University of Sheffield, and Dyfed Archaeological Trust
April 2017

Abstract

The early Christian cemetery of St Patrick's Chapel is situated in sand dunes overlooking Whitesands Beach, Pembrokeshire. As part of a collaborative project between the University of Sheffield and Dyfed Archaeological Trust, three seasons of excavation took place between 2014 and 2016 after human remains were exposed from the dunes during the severe winter storms of 2013/2014. Excavation of the cemetery has revealed a significant burial site with over 80 burials excavated to date, and radiocarbon dating suggests the cemetery was in use between the 7th and 11th centuries AD. There was considerable variation in the burial forms, including the use of stone-lined cist graves, double burials, cross-inscribed grave markers, and the use of quartz-topped burials reserved specifically for non-adults. Indeed, there appears to be a high concentration of non-adults buried at

IN THIS ISSUE

| | |
|--|----|
| From the Editor (T.R. Fenn) | 1 |
| SAS-UKAS Student Paper Award Winner (K. Hemer et al.) | 1 |
| Archaeogenetics (O. Lebrasseur) | 2 |
| Archaeological Ceramics (C.C. Kolb) | 4 |
| Archaeometallurgy (B. Kaufman) | 19 |
| Maritime Archaeology (N. Ciarlo) | 25 |

this site, including a number of fetuses and infants. This poster presents the latest results of the osteological analyses undertaken on the human remains from St Patrick's Chapel, and provides a unique insight into this rural early medieval coastal community.

ARCHAEOGENETICS
Ophélie Lebrasseur, Associate Editor

News

First of all, I would like to wish you all a Happy New Year. 2018 started off rather excitingly with the online publication of Moreno-Mayar et al.'s "*Terminal Pleistocene Alaskan Genome reveals first founding population of Native Americans*" on the 3rd of January. Published in *Nature*, this research is an important stepping stone to deciphering the peopling of the Americas, a topic of much speculation.

At the tender age of six weeks, two infant girls died at the now-called 'Upward Sun River' site in Alaska. 11,500 years later, these two have become some of the most important individuals, key to our understanding of the peopling of the Americas. One of them in particular nicknamed 'Sunrise Girl-child' by the local indigenous people, and given the individual ID 'USR1' for scientific analyses, contained a high amount of endogenous DNA. This allowed for a high sequencing depth coverage of her genome (17x). Following multidimensional scaling and admixture analyses, the infant girl revealed her surprising ancestry: she did not belong to any known ancient or modern Native American groups, not even the two early indigenous populations known as Northern Native Americans and Southern Native Americans. Rather, she was a member of a previously unknown Native American population henceforth identified as 'Ancient Beringians'. Her buried 'partner', USR2, sadly was not as well-preserved and took her secrets with her; yet Moreno-Mayar and his team were able to conclude the two baby girls were close relatives.

Sunrise Girl-child's ancestry and story began to provide clues as to the migrations and settling of early populations throughout North America. She belonged to the same population as the one which had given rise to contemporary Native Americans; the ancestral source carrying a mixture of East Asian and Mal'ta-related ancestry. For Moreno-Mayar and his team, the descendants of this source represented the basal group that first migrated into the Americas.

The authors then began to place all these clues with existing data within the broader context of the Pleistocene

people of the Americas and came up with two possible scenarios. The first scenario sees the following: around 36,000 years ago, when Beringia and Northwestern North America were still devoid of human presence, Sunrise Girl-child's ancestors (the founding population of Native Americans) began to diverge from ancestral Asians, through high gene-flow remained between them and other Asians until 25,000 years ago. Around 24,000 years ago, evidence in the archaeological record of human presence in Siberia become scarce, implying that this same founding population became isolated probably due to the harsh climatic conditions of the Late Glacial Maximum. It is not until approximately 20,900 years ago that the Ancient Beringians and the common ancestor of Northern Native Americans and Southern Native Americans began to diverge. The split between these two Native American groups then occurred around 15,000 years ago south of Eastern Beringia. At that particular point in time, the ice sheet represented an impenetrable barrier, making movement between the two Native American Groups and the Ancient Beringians impossible. The Ancient Beringians never ventured out of Alaska, while the Native American groups gave rise to today's Native American population. The second scenario would imply that two distinct populations originally made it across Beringia prior to 15,000 years, giving rise to the Ancient Beringians and the Native Americans group.

Needless to say the Sunrise Girl-child provided us with the first direct genomic evidence that all Native American can be traced back to the same source population from a single Late Pleistocene founding event. While it is important to remind ourselves that Moreno-Mayar et al.'s research heavily relies on genetic analysis and lacks archaeological evidence with robust dating, this discovery is one of the most important in human population history.

For the original publication and work, please see: Moreno-Mayar et al. *Nature* 553, 203–207 (11 January 2018). doi:10.1038/nature25173

Meetings

In the world of zooarchaeological genetics, a major meeting recently took place, allowing archaeogeneticists, geometric morphometrics researchers and other researchers interested in these areas to come together from across Europe and beyond and discuss the latest research. Below is a glimpse of the various high-quality and high-impact research being undertaken at the present time. If you are interested in collaborating on any of the projects or using the new techniques mentioned below, please drop us a line and we will happily put you in touch with their respective heads.

The 7th Meeting of the ICAZ Archaeozoology, Genetics and Morphometrics Working Group (ICAZ-AGM) was held at the University of Liverpool, United Kingdom, October 13-15, 2017. See more at the meeting website: <https://icazagm2017.wordpress.com>. Prof. Keith Dobney, Carly Ameen, Dr. Kimberly Plomp, Dr. Ardern Hulme-Beaman and Dr. Linus Girdland-Flink made up the organizing committee. The meeting brought together 50 international delegates with ancient/modern genetics and/or geometric morphometrics expertise for the presentation of 33 papers and three posters across two days. The meeting began on Friday 13th with the Plenary Event held at the Victoria Gallery and Museum, Liverpool which focused on “Pets, Pests & People”. The public event was attended by over 80 people, and chaired by Prof. Mark Thomas (UCL, UK). Invited speakers included Dr. Camilla Speller (University of York, UK), Dr. Jacqui Mulville (University of Cardiff, UK), Prof. Ian Barnes (Natural History Museum, London, UK) and Dr. David Ashmore (University of Liverpool, UK).

The main two days of the meeting comprised seven sessions. The first session focused on ‘answering archaeological questions with animal data’. Among these, Prof. Greger Larson (University of Oxford, UK) discussed through historical, archaeological and genetic data how the canonical story of rabbit domestication was a misconception, and addressed the issues related to dating domestication. Prof. Mark Thomas from University College London (UK) highlighted some of the issues with archaeological age-at-death profiles including small sample sizes and rare sexing information. He presented a full Bayesian Markov Chain Monte Carlo method for inferring sex-specific survival curves using explicit models accounting for sampling uncertainty. Dr. David Orton, from the University of York (UK), introduced his upcoming project *The story of the black rat in Europe*, a species which despite being very well known due to its popular association with the Plague, has seen remarkably limited archaeological study. The project will consist of a coordinated program of zooarchaeological, morphometric and genetic investigation funded by the Leverhulme Trust.

The second session introduced ‘new methods and approaches’. Some of these exciting upcoming methodologies include Antonios Dimopoulos’ accurate, lightweight and user-friendly pipeline for the detection of specific microbial species in archaeological metagenomic datasets (University of Oxford, UK). Antonios’ research has the potential to inform on past health and has already proved useful in identifying bacterial species from the dental calculus of the English Victorian-era population. Dr. Anna Linderholm (Texas A&M University, US) gave

us an overview of her next project which aims to analyze soil samples from across North America from some of the earliest human occupation sites. This will provide her with additional better information on the surrounding environment as well as the animals and humans who lived there.

The third session looked at ‘identifying domesticates’ and heavily relied on the use of geometric morphometrics (GMM). Past studies have shown the importance of this technique both for investigating morphological variation in ancient faunal remains and for the valuable addition it brings to genetic datasets to better identify wild/domestic individuals as well as distinguish between populations. Among the speakers, Fabien Belhaoues (Université Paul-Valéry, France) explained how he conducted GMM analysis on 40 modern dog breeds, grey wolves and red foxes, showing that a total discrimination between dogs and foxes is possible for any complete element, and that up to more than 90% of large dogs and wolves can be identified. Meanwhile, Dr. Ardern Hulme-Beaman (University of Liverpool, UK) explored the extent of the morphological divergence between modern domestic dogs, modern wolves and Pleistocene wolves.

‘Beyond Domestication’ was the theme of the fourth and last session of the first day. Dr. Aurélie Manin (University of York, UK) combined isotope, genetic and morphometric analyses to understand the management of the turkey in a pre-Hispanic Mesoamerican village and the associated husbandry practices. Following a similar inter-disciplinary approach, Carly Ameen (University of Liverpool, UK) reconstructed the individual and population life-histories of prehistoric domestic dogs from two sites in Alaska. Finally, Evan Irving-Pease (University of Oxford, UK) presented on the ancient genomics of pre-Columbian North American dogs, the details of which will be provided in an upcoming *SAS Bulletin*. Stay tuned!

The second day began with the fifth session of the meeting on ‘palaeopathologies and pathogens’. Eve Rannamäe from the University of York (UK) started the day with her research on investigating the pathogenic Jaagsiekte sheep retrovirus to shed light on the origin of the Kihnu native sheep and their relation to other ancient populations. Dr. Joel Alves (University of Cambridge, UK) continued with and investigation of rabbits and the myxoma virus. Released in the 1950s in Australia, France and the UK to cull the invasive European rabbit population, cases of resistance quickly sprung among rabbits in all three populations. By looking at pre-pandemic museum specimens, Joel showed that selection on an interferon increased its antiviral activity. The sixth

session targeted ‘animals on the edge’, where of note Themistoklis Giannoulis (University of Thessaly, Greece) tried to decipher the reason for the observed lack of introgression between European and Anatolian brown hare lineages.

Finally, the last session looked at ‘mobility and migration’. Dr. Julie Daujat (University of Nottingham, UK) combined GMM and DNA data to retrace the trajectories and entanglement of the two subspecies of fallow deer (the Mesopotamian fallow deer and the European fallow deer), but also to inform on the dynamics of human-deer relationships. Tom Fowler (University of Nottingham, UK) presented the ‘Easter E.g. Project - Changing Perceptions of Cultural and Biological “Aliens”’, a project which we will hear more about in an upcoming SAS Bulletin. Finally, the meeting came to a close with K. Papayianni’s research on the house mouse (MNHN, Paris, France), looking at its unintentional diffusion from the Levant to the Balkans and Aegean region during the Neolithic.

With many thanks to the sponsorship by Oxbow Book and Blackwells, two student prizes and one poster prize were handed out. Evan Irving-Pease from the University of Oxford (UK) won the 1st Place Student Talk Prize with his paper on “Ancient Genomics of pre-Columbian North American dogs” (paper submitted to *Science* and in review), while Margherita Zona from the University of York (UK) took the 2nd Place Student Talk Prize with “Testing new methods to solve old problems? Identifying salmon and trout vertebrae using geometric morphometrics”. Matti Heino, from the University of Oulu in Finland won the Poster Prize with his poster on “Genetic subspecies identification of historical tiger samples”.

The next meeting will be held in Paris, France, dates to be confirmed. We will be providing details in due time.
Ophélie Lebrasseur and Carly Ameen

ARCHAEOLOGICAL CERAMICS
Charles C. Kolb, Associate Editor

This issue contains five topics: 1) Previous Professional Meetings; 2) Forthcoming Professional Meetings; 3) Research Program Note; 4) Book Note; and 5) Book Reviews on Ceramics.

Previous Meetings:

The European Association of Archaeologists 23rd Annual Meeting was held August 30 to September 3, 2017, in Maastricht, Limburg Province, The Netherlands.

The separate *Programme Book* (348 pp.) and *Abstract Book* (564 pp.) are available at <http://www.eaa2017maastricht.nl/>. There were 445 sessions and ca. 3,300 oral presentations or posters. Two symposia had ceramic-related content; overall there were 32 oral papers and 7 posters on ceramics. *Craft: Reconsidering Social Context, Production and Division in Prehistoric and Non-Literate Societies* Symposium Organizer: Sophia Adam, Krista Vajanto, and Riina Rammo. Format: Session, made up of a combination of papers, max. 15 minutes each; 28 presentations (ceramics: seven oral papers and one poster). “The social context of the ceramic remains of non-ferrous metalworking,” (S. Adams); “Of a Mastery of Fire: engaging with the production of Late Iron Age/Early Romano British Black Burnished Ware” (E. Wilkes, P. Trim, D. Pitman); “Bowl food: A culinary perspective on the introduction and establishment of pottery in Early Neolithic Britain” (E. Sibbesson); “Tracing Ancient Craft Identities through Technological Choices and Technical Behaviours: the Copper Age pottery production of central Italy” (V. Forte); “Understanding ‘Ceramic Identity’ Through Analysis of Manufacture and Consumption of Iron Age Ceramics from Bulgarian Thrace” (A. Hart); “The process of Hallstattization the south-western part of Poland from the viewpoint of the ceramic manufacture research” (D. Laciak); “The Fine Grey Ware Pyxis: Evidence for a Localized Crossover?” (E. Miller Bonney); and, POSTER: “Methods of the rims shaping from Dubovy Loh 5 Neolithic site (South-Eastern Belarus): common features and special aspects” (M. Tkachova).

What Has Happened in Ceramic Studies since Brugge 1997? Symposium Organizer: Derek Hall and Koen De Groote. Format: Session, made up of a combination of papers, max. 15 minutes each (15 papers and one poster). “Is the cup half full? Quality and Standards in Pottery Studies in Britain” (D. Brown); “An interrupted path? Rethinking medieval ceramic studies in Italy in the last 40 years” (C. Citter); “The network ICERAMM ‘Information for Medieval and Modern Ceramics’ and its website database: results and prospects 10 years after creating” (P. Husi); “Too Much Truffling? Returning to the Big Picture in Medieval Ceramic Studies” (Ben Jervis); “Early modern ceramics in Flanders (Belgium): pain or pleasure?” (M. Poulain); “Pottery research in Flanders: a balance of the past 20 years” (K. De Groote); “The fabric of our being? Scotland’s Medieval ceramics in the 21st Century” (D. Hall); “Mineral Pigments and Ceramics Decoration: A Story of Contacts, Transmission of Know-How and Exchanges” (M. Caroscio); “Imports and local production – new views on an extensive pottery collection from Lödöse, a medieval town in western

Sweden” (S. Jeffery, T. Brorsson); “The early medieval ceramics in French Coastal Flanders: technical and typological analysis” (V. Vincent, J.-C. Routier); “Pottery from southern lower Saxony and its impact on the Norwegian ceramic sequence in late medieval and early modern period Mag” (V. Demuth); “Paffrath, Pingsdorf or Breitscheid? – A review of medieval greyware production in the Rhineland” (C. Keller); “The early-modern town of Nya Lödöse - Ceramic studies within a large-scale contract archaeology project” (J. Gustavsson, V. Forsblom Ljungdahl); and “The influence of the Roman market in the Lazio region: comparison of two case studies” (B. Brancazi, M. Stella Graziano).

Other Oral Papers: “Artistic pottery market in Silesia (South-Western Poland) in Late- and Post-Medieval period. Filling the gap” (M. Mackiewicz); “An Age of Transition: Ceramic innovations and Social Changes in the Mirabello Gulf during the Middle Minoan Period” (G. Doudalis); “Lost in transition? Questioning sub-divisions of the Dutch Iron Age (c.800-50 BC)” (K. de Roest); “Pottery production and cultural processes in the Trans-Uralian steppe: the case study” (S. Panteleeva); “Petrographic analysis of domestic wares, technical ceramics and building materials from the Chalcolithic site of Las Pilas (Mojácar, Almería) Del Pino” (M. Curbelo, P. Day, M. D. Camalich Massieu, D. Martín Socas, F. Molina González); “From magical pots to horse skulls and sacrificed dogs - ritual deposits at rural settlements in early medieval Hungarian Kingdom” (D. Szabó); “Chicken, pots and ritual deposits: folk religion and socio-political identities during the High Middle Ages in the Basque Country (Spain)” (I. Grau-Sologestoa, J. A. Quirós Castillo); “Modelling Clay: Examining London and New World pipe clay figurines from the 16th to 19th centuries using 3D modelling techniques” C.-E. Crichton-Turley); and “Tracing the Potter’s Wheel – 3D techniques for visualising, analysing and interpreting technological innovation in the Bronze Age Aegean” (J. Hilditch, C. Jeffra, L. Ogenhaffen).

Other Posters: “Sourcing the Provenance of Corsican Final Bronze Age Ceramics through pXRF Analysis of Clay Building Material” (A. Tafani, K. Von Peche-Quilichini, R. H. Tykot); “Mud bricks and ‘concotti’ from nuragic settlement of Palmavera (Alghero, Sardinia). Preliminary archaeometric results” (M. Pais); “Developing pottery making skills in local rural community of Sultana-Malu Rosu” (A. Theodor, L. Catalin); “The ritual pottery deposit of Roza das Aveas (Outeiro de Rei, Lugo)” (P. Prieto Martínez, F. Alonso Toucido, O. Lantes Suarez, P. Vazquez Liz); “Statistical analysis of chemical components among pottery samples from a Middle Bronze Age site in Caltagirone (Sicily,

Italy)” (D. Tanasi, R. H. Tykot, G. Caso); and “Characterization of ceramic sherds from Bulgaria in terms of firing temperatures determined by rock-magnetic studies” (M. Kostadinova-Avramova, D. Jordanova, D. Jordanova, V. Grigorov, D. Lesigyarski, P. Dimitrov, E. Bozhinova).

Workshop: *Detecting and Explaining Technological Innovation in Prehistoric Europe*, November 23-24, 2017, Christian Albrechts Universität zu Kiel, Kiel, Germany. The scope of this international workshop, organized by Michela Spataro, included 15 *invited specialists* from different disciplines: field archaeology, anthropology, archaeometry, ethnoarchaeology, and experimental archaeology. The workshop focused on changes at relatively fine temporal scales in the *chaîne opératoire* for the production of *ceramic, lithic, and organic artefacts*. The presenters discussed social matters of technological transformations from a diachronic perspective with an aim to observe the process of innovation, from the initial appearance of new technologies to their adoption and diffusion. Using case studies from across the globe, the contributors examined changes in the *chaîne opératoire* of artefacts, with papers organized in five groups: innovations, initial appearance, adoption and diffusion, transmission of technical skills, and factors promoting innovation. The proceedings will be published in a co-edited peer-reviewed volume. Ten of the 15 presentations concerned ceramics. The contributions in order of presentation were: “Welcome” (J. Müller, M. Furholt); “Introduction” (M. Spataro); from the session *Definitions of Innovation*, “The acceptance of new technical skills: ethnographic and theoretical insights from Latin America” (D. E. Arnold); “Innovation or transmission? Socio-economic factors and technological change in early Neolithic pottery” (L. Gomart); and “Change that matters – reading history through pottery” (Å. M. Larsson); from the session *Detecting the Initial Appearance of Innovations*, “The onset of wheel-throwing in Middle Asia: a late Neolithic innovation?” (M. Vidale); “Culture change and 6th /5th millennia BC innovations in ceramic technology north of the Carpathians” (S. Kadrow); and “Technological changes and innovations in the Neolithic osseous industries” (S. Vitezovic); from the session *Adoption and Diffusion of Innovations*, “Technological innovation in the Indus civilization” (H. Miller); “Changes in the Linearband culture pottery production – origin and directions of ideas” (A. Rauba-Bukowska); and “Revolution reloaded: reinvention and innovation in the first agricultural expansion in Europe” (M. Ivanova); from the session *Transmission of Technical Skills*, “A cultural contact zone: later 6th millennium BC ceramic technology in Transdanubia” (A. Kreiter); “Skill in high-temperature

crafts: an artisanal perspective on fire” (K. Botwid); from the session *Factors Promoting Innovation*, “Innovation, craft specialization and social networks in the 5th millennium Southern Levant” (V. Roux); “Technological innovation and social change: Early-Late Neolithic pottery making in the Central Balkans” (J. Vukovic); and “Innovation in Neolithic and Chalcolithic pottery production in south-eastern and eastern Europe” (R. Hoffman).

The 83rd *Annual Meeting of the Society for American Archaeology* is scheduled for Washington, DC, April 11-15, 2018. The following sessions related to ceramics have been proposed: *Poster Session: Ceramic Petrographers in the Americas: Promoting the advancement and application of petrography in archaeology*; *General Session Ceramic*; *Poster Session Ceramics and Textiles*; and *Symposium: Pottery in Practice: the Production and Use of Ceramics in the Ancient Southwest*.

Workshop: *Ceramic Wares of Turkey from the Archaic to the Roman Eras (7th c. BCE-6th c. CE)* sponsored by the Levantine Ceramics Project (LCP) and Ege University will be held at Ege University, Izmir, Turkey, 12-18 May 2018. The organizers invite brief (15 minute) oral presentations to begin developing a kind of illustrated dictionary of wares and ware families of Archaic, Achaemenid, Hellenistic, and Roman Turkey; each session will include a long portion devoted to discussion. Proceedings will be published in *Colloquia Antiqua*, the monograph supplement to *Ancient West & East*. For additional information visit www.levantineceramics.org and kindly let the organizers know if you would like to attend by replying to keramoslcp2018@gmail.com.

The Izmir Center of the Archaeology of Western Anatolia (EKVAM) is organizing an international symposium entitled *Unguentarium: A terracotta vessel form and other related vessels in the Hellenistic, Roman and early Byzantine Mediterranean* that will take place 17-18 May 2018 at the Dokuz Eylul University (DEU) in Izmir, Turkey. An unguentarium is a small ceramic or glass bottle, found in relatively large quantities in the entire Mediterranean, from Spain to Syria and Egypt to France, where they were produced from the early Hellenistic to the early Medieval periods. In this symposium we only focus on terracotta unguentaria between c. mid fourth century BC and mid sixth century AD, and attempt to set out a comprehensive model for the study of terracotta unguentaria, including their definition, typology, chronology, contexts, function, regional characteristics, and distribution patterns in the whole Mediterranean geographies, including eastern Mediterranean, Roman

provinces in the western Mediterranean, north of Alps (Germania and Britannia etc.) and north Africa. Contributions are invited by scholars and graduate students from a variety of disciplines of ancient studies related to this vessel form. The symposium is free of charge. A post-symposium excursion is planned to Lesbos, Greece through Ayvalik. Contact gulserenkan@hotmail.com or terracottas@deu.edu.tr for further information.

The 42nd *International Symposium on Archaeometry, 2018*, is scheduled for Merida, Yucatan, Mexico, 20-26 May 2018. A review of the ceramic content will be published in a subsequent issue of the *SAS Bulletin*.

Research Program Note

Follow the Pots. <http://followthepotsproject.org/>. The ‘Follow the Pots’ research program explores two interconnected sides of an archaeological looting story: the conventional archaeological investigation of the emergence of prehistoric urbanism and increasing social complexity in the Early Bronze Age of the southern Levant, and the multiple and contested values of this archaeological heritage to multiple stakeholders today. What this means is that we study how archaeologists, people living in the southern Ghor, looters, middlemen, museum administrators, government officials, antiquities dealers, and collectors think about, acquire, and use pots and other grave goods from the Early Bronze Age (EBA) cemeteries of Fifa, Bab adh-Dhra’ and en-Naqa/es-Safi. Follow the Pots (FTP) emerges from several years of archaeological fieldwork and analysis by Chesson and Kersel, and more broadly the Expedition to the Dead Sea Plain. In this examination of the social lives of archaeological objects, the artifacts have at least two lives as: (1) grave goods in 5,000 year old tombs; and (2) looted and excavated artifacts in the present, where they are launched on new lives as museum pieces, tourist trinkets, and archaeologically studied objects. FTP arises from our realization that only by integrating ethnography and archaeology can we hope to produce a holistic and cohesive story about the use and reuse of these EBA materials. Directors: Dr. Morag M. Kersel, Dept. of Anthropology, DePaul University: mkersel@depaul.edu; Dr. Meredith S. Chesson, Dept. of Anthropology, University of Notre Dame: mchesson@nd.edu; and Dr. R. Thomas Schaub (EDSP): rtschaub@verizon.net.

Book Note

Innovative Approaches and Explorations in Ceramic Studies. Sandra L. López Varela (ed.). Archaeopress Archaeology. Oxford: Archaeopress, 2018. vi + 144 pp., illustrated throughout in color and black & white (44 color plates). ISBN 9781784917364. £28.00 / \$56.00

(paper); available 14 February 2018. This volume celebrates thirty years of Ceramic Ecology, an international symposium initiated at the 1986 American Anthropological Association meeting following a suggestion of Frederick R. Matson. For twenty-five years, Dr. Charles C. Kolb organized the symposium to discuss multiple theoretical and methodological approaches to ceramic studies around the world. By fostering interdisciplinary interactions, the symposium has pushed the boundaries of what can be understood about the human experience through the creative and systematic study of ceramics. Prominent themes in the chapters of this volume include instrumental explorations and novel technologies such as FORS, UV/VNIR, pXRF, NAA, and PIXE. Other approaches include ceramic classification analysis, vessel volume calculations, the distribution of vessel forms, innovations in petrography, studies of an abandoned pottery workshop, and reviving handmade ceramics as a part of cultural heritage. The 21 contributors to this volume explore the application of instrumental techniques and experimental studies to analyze ceramics and follow innovative approaches to evaluate our methods and theories in our quest to learn about the societies about which we dedicate our studies.

Chapter 1 “Innovative Approaches and Explorations in Ceramic Studies” by Sandra L. López Varela and Philip J. Arnold III. Chapter 2 “What is a Ceramic Assemblage: Chronology and Belongings of the Late Classic Maya” by Sherman Horn III and Anabel Ford. Chapter 3 “Investigating Maya Ceramic Figurines: challenges to the use of non-invasive portable technologies in archived collections” by Sandra L. López Varela. Chapter 4 “Documenting Accommodation and Change in the Tarascan Ceramic Economy” by Amy J. Hirshman. Chapter 5 “Forming Pots and Community: Pottery Production and Potter Interaction in an Ancestral Wendat Village” by Sarah Striker, Linda Howie and Ronald Williamson. Chapter 6 “Clay Choice: the Impacts of Ceramic Formation Methods and Cultural Behavior” by Mary F. Ownby. Chapter 7 “Complementary Approaches for Understanding Mazapan Pottery” by Destiny L. Crider. Chapter 8 “Sherds of Spartans Past: Ceramics from the Michigan State University Campus Archaeology Program” by Lynne Goldstein, Lisa Bright and Jeffrey Painter. Chapter 9 “The Ethnoarchaeology of an Abandoned Potter’s Workshop in Ticul, Yucatán, México” by Dean E. Arnold. Chapter 10 “Making Traditional Pottery Sustainable Today: Three Case Studies in Akita Prefecture, Japan” by Cara L. Reedy and Chandra L. Reedy.

Book Reviews on Ceramics

Ceramic Analysis in the Andes, Isabelle C. Druc (ed.), Madison, WI: Deep University Press, 2015. 190 pp., 85 color figures, maps and diagrams, ISBN-10 1939755115, ISBN-13 978-1939755117, \$19.99 (paperback). Druc (University of Wisconsin-Madison) specializes in ceramic studies, Andean archaeology and ethnoarchaeology and is coauthor with Bruce Velde of *Archaeological Ceramic Materials: Origin and Utilization*, Natural Science in Archaeology Series, Berlin, Heidelberg, and New York: Springer Verlag, 1999; reviewed by Kolb in *SAS Bulletin* 23(1):17-21 (Spring 2000). More recently she authored *Portable Digital Microscope Atlas of Ceramic Pastes: Components, Texture, and Technology* with the technical assistance of Bruce Velde and Lisenia Chaves, Blue Mounds, WI: Deep University Press, 2015; reviewed by Kolb in *SAS Bulletin* 38(4):3-6 (Winter 2015).

The genesis of this volume began with a session titled “Characterization of Andean Ceramics” organized for the 2014 Society for American Archaeology annual meeting in Austin, Texas. The session was designed to offer a perspective on the state of ceramic analysis in Andean archaeology, including recent views about manufacture, production and circulation of wares in the ancient Andes, and on the technological traditions characterizing each region. The focus of that symposium was: “Ceramic analysis using mineral and chemical approaches are becoming more frequent in Andean Archaeology allowing to build up [sic.] a large data set about ceramic production and distribution in the Andes and South America at large. The aim of this session is to reach a global vision of current characterization studies of Andean ceramics and discuss present knowledge of manufacture and circulation of pots in the Andes at large. Session themes include production loci, paste types, expected mineral and chemical signatures, geological settings impacting research, and sampling strategies of ceramics and comparative materials. The session will also focus on the interpretation of the characterization data to reach a higher understanding of the organization of ceramic production, as a community of practice embedded in and influenced by social, political and economic networks.”

The published volume has ten chapters, a Table of Contents, a List of Contributors (17 scholars with their affiliations and email addresses), but no list of figures or index; each chapter has its own bibliography. The contributions highlight the research of leading scholars and younger archaeologists conducting investigations mostly in Peru and Chile, combining a variety of mineral and chemical studies to investigate socio-political and cultural questions, issues of political control, intra- and

inter-valley interactions, and expressions of cultural traditions and social identities in the ancient Andes. The different chapters cover a large time frame, from the 1st millennium BC to the Inca period, while ethnographic and experimental studies supply additional invaluable information for the interpretation of the archaeological data. Among various topics, the authors provide an overview of the sampling strategies and analytical techniques currently used in Andean material analysis.

1. "Ceramic Analysis in the Andes: Linking Technology and Society: An Introduction to the Volume" Isabelle C. Druc (pp. 7-14, 18 references). Druc discusses the background of the volume, the importance of ceramic studies and past and emerging research. Summaries (or abstracts) of each chapter are also provided and salient discussion comments made by Cathy Costin at the 2014 meeting are reported. 2. "Pottery and Social Complexity in Tarapacá: Reviewing the Development of Ceramic Technology in the Atacama Desert (Northern Chile)" Mauricio Uribe Rodríguez and Estefanía Vidal Montero (pp. 15-35, 2 color map, 1 monochrome maps, 9 color figures, 1 table, 43 references). The authors provide a description of Tarapacá pottery and discuss characteristics of the vessels and forms, such as "comma rims," and basketry imprints on some vessel bases. Macroscopic and petrographic analysis of 66 sherds representing six fabric groups, 64 thermoluminescence dates, and INAA ((conducted at MURR) were employed to discern stylistic variants, determine chronologies dating 900 BC-AD 900 in northern Chile. The social dynamics of local coastal communities and the significance of regional interactions, and technological innovations are elucidated through their analysis. 3. "Charophytes in My Plate: Ceramic Production in Puémape, North Coast of Peru" Isabelle C. Druc. (pp. 37-56, 1 color map, 1 monochrome maps, 10 color figures, 2 tables, 43 references). Druc initially provides contextual data and an overview of the ecological and geological environments of Puémape a first millennium Formative ceremonial site of the Cupisnique littoral. The petrographic thin section analysis of 21 sherds defined minerals, bioclasts and allochems, and biogenic and non-biogenic components as well as algae and voids in the pastes. These inclusions indicated a coastal ceramic production. Non-local wares are rare and point to a particular set of vases with graphite decoration produced inland and distributed or traded over to different sites in the Jequetepeque and Cupisnique areas.

4. "External vs. Internal: An Examination of Moche Politics through Similarities and Differences in Ceramic Style" Michelle L. Koons (pp. 57-82, 1 color map, 1 monochrome map, 52 color figures, 3 tables, appendix,

72 references). Moche ceramics from three valleys (dating 200 BC-AD 600) in north-central Peru were studied to elucidate aspects of the Moche political landscape and craft production by examining external (surface decoration) vs. internal (technological) style. Design and petrographic thin-section analysis of Moche IV, V and Late Moche ceramics from the Chicama Valley (Licapa II – a lynchpin site, El Brujo, and Cerro Mayal), Jequetepeque Valley (San José de Moro), and Moche Valley (Huacas de Moche) indicate that similar surface designs, but different internal composition indicated probable local ceramic production and but an overall shared ideology among the centers. Political alliances and/or religious affiliations likely existed but that each center was locally managed and controlled within a complex dynamic network. Ceramic exchanges also occurred and radiocarbon dates associated with Moche IV, V, and Late Moche ceramics indicates where different ceramic styles initially appeared and when they were adopted at other Moche sites. 5. "The Preliminary Residues of Power: Women, Chicha, and Agency in the Middle Horizon Andes c. AD 600-1100" Ann O. Lafferty (pp. 83-101, 3 color maps, 9 color figures, 45 references). Archaeometric data obtained by GC-MS and GC-IRMS and iconographic evidence from 400 + earthenware vessels and sherd materials from the contemporaneous Middle Horizon (MH) empires of Wari and the Tiwanaku (ca. 600-1100 CE) are included in this initial examination. Wari earthenware hybridity is attributed to multi-scalar political alliances made manifest through affine relationships, whereas iconographic heterogeneity data is associated with mosaics of meaning linked to women's identity, expressions of ethnicity and alterity, "secret" sacred knowledge, and intent to imbue vessels with mana. Chicha (maize beer) brewing and consumption is assessed and patterns of polygynous social organization and gendered political affiliation are discernible, especially at large-scale sociopolitical events. Women skilled in the production of earthenwares and chicha could attain a relatively higher status, for it was the distribution of these goods formed the cornerstone of the chicha-based economy that sustained Middle Horizon Andean states. 6. "Inferring Ceramic Production and Social Interaction and Political Dynamics in the Moqueaga Valley through Geochemical Analysis" Matthew Piscatelli, Sofia Chacaltama Cortez, Nichola Sharrat, Mark Golitko, and Patrick Ryan Williams (pp. 103-121, 2 color maps, 1 monochrome map, 6 color figures, 66 references). The authors provide an introduction to regional geology and culture history, and a synthesis of their geochemical analyses of clays and ceramics collected from the Moqueaga Valley which had been co-occupied by Wari and Tiwanaku states during the Middle (AD 600-1000) and Late (1475-1532) Horizons.

They employed INAA and LA-ICCP-MS analyses of ceramics and clays, characterize prior research, and create a dataset and Bivariate Plots. Two distinct districts of raw material procurement within the same valley are discerned.

7. Ceramic Exchange and Community Interaction in the Late Prehispanic Cajamarca Basin, North Peru” Jason L. Toohey (pp. 123-138, 2 color maps, 1 monochrome map, 4 color figures, 54 references). Ceramic exchange at the inter-communal level at a time of regional polities contact and exchange are studied. The excavation of both decorated and utilitarian ceramics, both elite and utilitarian pottery in domestic and public contexts, from the heavily fortified village site of Yanaorco located at the southern edge of the Cajamarca Basin illustrate possible patterns of ceramic production and exchange during the Late Intermediate Period (AD 1000-1472). INAA (at MURR) of 93 ceramic fragments recovered from excavated contexts revealed patterns in compositional variation and homogeneity. Analytical groups are discerned and Principal Components Analysis employed. The results suggest the local production of domestic wares and the possible import of many fineware types, probably produced on pastes whose sources are elsewhere in the basin. These exchange wares are believed to have been produced at other LIP Cajamarca sites and brought to Yanaorco within so far not well understood exchange networks.

8. “Networks of Ceramic Production and Exchange in the Late Horizon: Characterization of Ceramic Styles and Clays on the Central Coast of Peru” Krzysztof Makowski, Ivan Ghezzi, Hector Neff, and Gabriella Ore (pp. 139-155, 4 color maps, 7 color figures, 2 tables, 41 references). The authors’ goal is to reconstruct networks of ceramic production and exchange during the Late Horizon (Intermediate period AD 1000-1475 to the Early Colonial period AD 1533-1580) in the Lurin Valley through LA-TOF-ICP-MS, INAA, and petrographic characterization of ceramic styles and clay sources from the central coast of Peru. A corpus of 40,000+ sherds from three sites was studied and 16 paste-ware groups identified. Contrasting compositional groups with clay sources and pottery pastes, wares, and styles were previously defined by macroscopic methods. The data suggests that the Inca Empire created the conditions of a mini-world system. The products and networks of exchange connected heterogeneous populations, and thus the identities of producers, traders, and builders of public and domestic spaces did not coincide. Imperial ideology materialized in official architecture and paraphernalia, but not always in vernacular versions. Its producers continued to follow local and regional styles and technologies – a co-existence of local traditions, with production that imitated

foreign styles, and the forced displacement of potters.

9. “Paste Analysis for Petrographic Research: An Andean Case Study Revealing Macroscopic Variability of the Initial Steps of Petrographic Research” Laura G. Marsh and Isabelle C. Druc (pp. 157-170, 1 color map, 1 monochrome figure, 3 color figures, 20 references). Petrographic thin-section analysis can yields information about the manufacture and origin of archaeological ceramic material. However, associated costs and destructiveness to samples affect sampling. The careful selection of sherds plays a large role in determining the quality of the following analysis. The case study involves 284 ancient and 69 modern ceramic specimens from the monumental center of Chavín de Huántar, Peru. Specimen selection, macroscopic identification, and the use of Polarized Digital Microscope for paste identification are documented. Analysis of the matrices and inclusions led to the delineation of 22 groups.

10. “Ceramic Perspectives” Mary F. Ownby (pp. 171-180, 1 color map, 1 monochrome map, 12 references). Ownby, a specialist on Eastern Mediterranean and Southwestern North American ceramics, provides a non-Andeanist critique of the mineralogical and petrographic assessments presented in the previous contributions. She discusses petrographic analysis, extensive research in the Tucson Basin of Arizona, the creation of petrofacies, and comments on each of the symposium presentations.

The importance of the research contributions in *Ceramic Analysis in the Andes* add to our understanding of Andean archaeology and sociocultural interpretations of the data. The volume is well-illustrated and the quantities of color figures and especially the microphotographs of sherd cross-sections quite valuable. Druc and her colleagues have made a valuable contribution to South American archaeological research and petrographic studies.

The Social Lives of Figurines: Recontextualizing the Third Millennium BC: Terracotta Figurines from Harappa (Pakistan), by Sharri R. Clark, 2016. Papers of the Peabody Museum of Archaeology and Ethnology 86, Cambridge, MA: Peabody Museum of Archaeology and Ethnology in association with the American School of Prehistoric Research, Harvard University. xv + 346 pp., 122 figures (789 color illustrations, 10 line illustrations, 3 maps), 13 tables, 90 endnotes, 600 references, no index, 6 Appendices (A-F). ISBN-13: 978-1842174555, hardcover plus CD of Appendices A-F (the Appendices are also available online: https://www.peabody.harvard.edu/Clark_Harappa_App), \$85.00 / £62.95 / €76.50. Alas, there is no index. The entire volume has also been posted with *gratis* access on *Les Carnets de l'ACoSt* (Association for Coroplastic Studies) 16 | 2017, online since 1 June 2017, URL:

<http://acost.revues.org/1009>. This pioneering study is based on her unpublished 2114-page Ph.D. thesis: Sharri R. Clark, *The Social Lives of Figurines: Recontextualizing the Third Millennium BC Terracotta Figurines from Harappa (Pakistan)*, Harvard University, 2007. She has conducted extensive archaeological and ethnoarchaeological fieldwork in Israel and Pakistan. Previously Clark was a computer systems specialist in the private sector, a cultural heritage / technical consultant for UNESCO in Pakistan, and an archaeological computer consultant for the Harappa Archaeological Research Project at the Peabody Museum of Archaeology and Ethnology at Harvard University and in Pakistan. She has also been an American Association for the Advancement of Science (AAAS) Science and Technology Diplomacy Policy Fellow and currently works as a Foreign Affairs Officer for the US Department of State.

This volume has a long publication history as it has been postponed several times. It was initially announced for November 2011, then May 2013, and again November or December 2013 (the list price at that time was \$29.95). A new announcement projected publication in June 2015 and finally another for December 2016. I am pleased to see that it has at last been published since it is a magnificent book and the definitive source on Indus figurines, and well worth the wait. When I spoke with a Harvard University Press representative last year, I inquired if they knew that another book with the same title had been advertised in 1985 but not published by that name – they were not aware. That volume was written by Israeli archaeologist Raz Kletter, whose research focuses on the eastern Mediterranean. His book, originally *The Social Lives of Figurines*, was apparently retitled as *The Judean Pillar-figurines and the Archaeology of Asherah*, British Archaeological Reports International Series S-636, Oxford: Tempus Reparatum / John and Erica Hedges, 1996, 292 pp., ISBN-10: 086054818X, ISBN-13: 978-0860548188, published on December 31, 1996. It is now out-of-print but a few copies with the original title have been advertised on the Internet from vendors asking for more than US \$500.00 for a second-hand copy.

Clark's *The Social Lives of Figurines* has seven chapters plus "Acknowledgments" (pp. xiii-xv); "Notes" (315-321) and "Bibliography" (pp. 323-346) are the concluding material in the hardcopy volume. The accompanying CD contains six appendices. Chapter 1. "Introduction" (pp. 1-21, 2 figures, 1 table, 5 endnotes). The author provides an introduction to Indus or Harappa civilization (ca. 2600-2900 BC) noting that there is a large corpus of terracotta figurines at urban Indus sites. The "social life" of figurines is a "document of life" and a

concept borrowed from Ananda Coomaraswamy (1927, 1928). Clark also reviews other Indus characteristics such as scripts and tablets recovered from the Bronze Age "twin-cities" of Harappa and Mohenjo Daro, as well as Neolithic period Mehrgarh cemeteries. She points out five issues regarding the figurines (p. 19): 1) the figurines have not been studied systematically as a large corpus; 2) prior assessments did not relate the figurines to associated artifacts from securely dated archaeological contexts; 3) greater Near East contexts have not been related to the figurines; 4) no prior studies have critically evaluated the corpus with regard to ethnohistoric or ethnographic analogs (especially religious); and 5) previous research has not systematically evaluate representations and functions. Chapter 2. "Materials and Methodologies" (pp. 23-64, 5 figures, 7 tables, 9 endnotes). Clark's fieldwork and research (ethnoarchaeology, archaeology, and museum collection analyses) spans the period from 1997 through 2001. Theoretical considerations regarding analogy and functions are reviewed as is data collection strategy, the history of excavations at Harappa, the nature and constraints of the archaeological record, sampling and recording strategies, and methodological issues related to the development of typologies. In Chapter 3. "Manufacturing Meaning" (pp. 65-111, 40 figures, 2 endnotes), Clark focuses on "reconstructing" terracotta figurines, production using archaeological and ethnographic evidence, and experimental archaeology (making and firing reproductions); the assemblage consists of 8,500 fragments and whole figurines. The manufacture, hand modeling versus molding and mass production sequence are considered and types of figurines and production estimates are made. Scientific analyses of ancient and/or modern figurine specimens (p. 96-103) included: petrographic analysis, fingerprint analysis, thermoluminescence dating for authentication, radiographic studies (Eugene Farrel), pigment analysis by spectrography (Eugene Farrel and Steve Weiner), and gas chromatography (GC/MS) for residues (Nora Reber and Carl Heron). These studies are, alas, minimally documented. She determines that the figurine construction reflects ideological rather than practical choices by the producers and asks a key question: Who made the Indus terracotta figurines? Chapter 4. "Embodying Indus Life: Social Difference and Daily Life at Harappa" (pp. 113-181, 38 figures, 3 tables, 29 endnotes) focuses on Indus life social differences, sex and gender, dress and ornamentation, probably occupations, and daily activities. Both anthropomorphic and zoomorphic figurines are discussed.

Chapter 5. "A Provisional Chronological Typology for Figurines from Harappa" (pp. 183-261, 23 figures, 3 tables, 13 endnotes). Clark sees meaningful diachronic

trends in her analysis. Six chronological periods are documented for the figurine assemblage: Period 1: Ravi Phase (ca. 3300-2800 BC); Period 2: Kot Diji Phase (ca. 2800-2600 BC); Period 3: Harappa Phase (ca. 2600-1900 BC); Periods 4/5: Transitional/Late Harappa Phase (ca. 1900-1300 BC); and Post-Indus (ca. 1300-300 BC) and Historic (ca. <300 BC). “Attributes of Typological Classification Protocol” are detailed in Table 5.1 (pp. 186-187). Anthropomorphic figurines (female standing and seated and other; males first appear in Period 3 and afterward), zoomorphic (cattle, zebu, buffalo, sheep, birds, other, and unidentified), and special forms (movable head, composite, whistle, and wheeled) are characterized. Clark also considers chronological trends and connections. Chapter 6. “Figurines and Religion in the Indus Civilization: The View from Harappa” (pp. 263-299, 14 figures, 31 endnotes). She discusses cultic interpretations in archaeology and problems in inferring shamanism and magic from terracotta figurines and speculated about the Indus Civilization as a source of later religious traditions. The “Mother Goddess” cult, other Hindu analogies, and figurines and cult, magic, and shamanism at Harappa are also reviewed. Chapter 7. “Concluding Remarks” (pp. 301-314, 1 endnote). Clark’s narrative also considers the significance and contributions of her research, commenting that she considers her research results to be preliminary and a “case study.” In addition she challenges 13 long-standing ideas and misconceptions regarding Indus figurines (pp. 307-309), commenting that she considers her research results to be preliminary and a “case study.” In a section entitled “The Indus ‘veneer’ and indigenous regional traditions” she points out that the development of so-called Harappa figurine traits likely came from elsewhere. In “Directions for future research” she calls for additional petrographic and/or neutron activation analyses to verify provenance and for further iconographic and Vedic literature comparanda.

“Appendices” A through F are on the enclosed CD: A. “Attributes of Functional Classes and Associated Predicted Patterns of Wear, Damage, and Disposition Based on Ethnographic and Ethnohistorical Sources for Figures and Figurines.” B. “Preliminary Catalog of Figurines from Harappa (by Storage Location).” C. “Iconographic Database Layout for Attribute Analysis.” D. “Terracotta Figurines Ritual Additive Chromatography Experiment.” E. “Analytical Report: FT-IR and Gas Chromatography Analyses of Pigment Samples from Harappa Terracotta Figurines.” And, F. “Provisional Chronological Typology for the Terracotta Figurines from Harappa.”

Your reviewer has excavated and studied a large corpus of Classic period Teotihuacan Mesoamerican ceramic figurines, both handmade and moldmade, and can appreciate the effort that Clark has put into this analysis. She has examined and recontextualized this diverse corpus of 8,500 handmade anthropomorphic and zoomorphic figurines from urban Harappa (ca. 3300–1700 BCE) and reveals new information about Indus ideology and society. These figurines are one of the richest sources of information regarding Indus ideology and society. In the past, the figurines were considered selectively without evaluating their archaeological or sociocultural contexts, resulting in biased interpretations. The author focuses on the figurines as artifacts whose “social lives” can be at least partially reconstructed through this systematic analysis of stylistic and technological attributes and spatial and temporal contexts. Manufacturing choices, including modeling from vertical halves and targeting bone pigments, rather than readily available mineral pigments, also suggest ideological significance. Her study also focuses on the great variety of figurines rather than just the selected, more complete, and frequently female, figurines. Comparisons with ethnographic data, historic texts, reproduction studies, some scientific analyses, and contemporaneous ancient societies enrich and inform the reader. This compendium provides a significant benchmark for Indus civilization studies and provides a model that should be emulated in ceramic figurine studies elsewhere in the world. A great deal of additional archaeometric work remains to be done on such topics as clay sourcing and figurine provenance via pXRF and thin-section petrography.

A Standard for Pottery Studies in Archaeology, Alistair Barclay and David Knight (PCRG), Paul Booth and Jane Evans (SGRP), Duncan H. Brown and Imogen Wood (MPRG), Prehistoric Ceramics Research Group, Study Group for Roman Pottery, and Medieval Pottery Research Group. Funded by Historic England. Published by Medieval Pottery Research Group, 2016. 32 pp. ISBN: 9780950610597, 0950610593; OCLC Number: 983461273. Original draft and final versions are available free online: https://www.archaeologists.net/sites/default/files/Standard_for_Pottery_Analysis_Full_Draft_v4.pdf; https://www.academia.edu/26976045/A_Standard_for_Pottery_Studies_in_Archaeology. This important collaborative effort has produced a significant standard for dealing with archaeological ceramics. The document was compiled by the three period-specific pottery study groups (PCRG, SGRP, and MPRG -- detailed below) with the aim of creating the first, comprehensive, inclusive standard for working with pottery in the UK. The standard is intended for use in all types of

archaeological projects, including those run by community groups, professional contractors, and research institutions. It is designed to be used in the following ways: 1) By pottery specialists working on assemblages from any type of archaeological project, with the intention of ensuring that pottery is collected, processed, recorded, analyzed, and reported in a consistent manner. 2) By project managers, or anyone managing the processing and analysis of a pottery assemblage, who should require excavators/finds personnel and pottery specialists to apply the standard throughout an archaeological project, including the analysis and re-interpretation of pottery studied previously and now in storage, for instance in a museum collection. 3) To monitor the quality of pottery assessment, analysis and reporting, for example in peer review, or development control archaeologists overseeing planning led projects, or museum curators receiving project collections and archives. And 4) In combination with existing standards for processing, recording and reporting of other types of finds or with standards for the compilation and transfer of archive materials.

This well-written, informative document, designed primarily for users in the UK, synthesizes fundamental concepts and can be used by amateur and non-professional archaeologists, students, and seasoned professionals. There are five sections and two appendices. An “Introduction” (pp. 1-4) clearly defines aims and purposes of the standard, provides salient definitions and how the standard should be used, and reviews basic project tasks. Section 2: “The Standard” (pp. 5-19) focuses on aspects of project planning (design or written scheme of investigation and the tasks of the qualified pottery specialist); collecting and processing the pottery (including cleaning, marking, packing for shipment to the laboratory, recording data, and, documentation); artifact assessment (detailed data recording procedures, quantification, and the role of pottery specialists); specific analyses (fabric types, characterization, quantification [counts, weights, Estimated Vessel Equivalents, digital recording, etc.] and selecting materials for further scientific study; reporting the results following the project’s data management plan; and archiving data and the ceramic assemblage. Section 3: “Glossary of Terms (pp. 20-21) has 26 entries while Section 4: “References” (pp. 22-23) provides 30 citations. Among the latter are Kathy Perrin et al. (11 others) *A Standard and Guide to Best Practice for Archaeological Archiving in Europe*, European Archaeological Council Guidelines 1, 2014, <http://archaeologydataservice.ac.uk/arches/Wiki.jsp?page=The%20Standard%20and%20Guide%20to%20Best%20Practice%20in%20Archaeological%20Archiving%20in%20Europe>

[20Europe](http://archaeologydataservice.ac.uk/archives/view/alanvince_eh_2010/downloads.cfm?archive=tsdb), and the late Alan Vince’s *United Kingdom Thin Section Database*. Archaeological Data Service, 2010, http://archaeologydataservice.ac.uk/archives/view/alanvince_eh_2010/downloads.cfm?archive=tsdb. See also: “Obituary: Alan G. Vince” *SAS Bulletin* 32(2):24-25. (Summer 2009). The standard has several references written by Clive Orton, notably *Pottery in Archaeology*, 2nd, edited by Clive Orton and Michael Hughes, Cambridge Manuals in Archaeology, Cambridge: Cambridge University Press, 2013), reviewed in *SAS Bulletin* 37(1):7-9 (Spring 2014).

The document concludes with Section 5: “Acknowledgements” (p. 24) plus appendices. “Appendix 1: Approaches to Analysis” (pp. 25-30) elaborating fabric types, vessel form, decoration, vessel size, surface treatment, evidence for manufacture, post-firing modifications, quantification, date, sherd selection (for drawing, photography, and scientific analysis), and data recording. “Appendix 2: Approaches to Recording” (pp. 30-32) focuses on how to describe assemblages, further quantification, and addressing a variety of topics such as range of sources for the pottery, distribution across a site, use and disposal, taphonomy, placement in local and regional contexts, and standards for illustration, such as scale.

Your reviewer is providing some context about the collaboration of the three pottery study groups: PCRG, SGRP, and MPRG. The Prehistoric Ceramics Research Group was formed in November 1988 to promote regular contacts between those with interests in prehistoric ceramics, combining the membership of the Iron Age Pottery Research Group, which had been operating in eastern England since 1976, and the First Millennium BC Ceramic Research Group covering central southern England since 1985. In 1994, the scope of the group was widened to include ceramics from the Neolithic and Earlier Bronze Age periods, <http://www.pcr.org.uk/>. The PCRG has prepared five publications: numbers 1-4 published by Oxbow Books and number 6 from Archaeopress. The Study Group for Roman Pottery was founded in 1971 to further the study of pottery of the Roman period in Britain. It provides a forum for the presentation and discussion of the latest research, and of issues affecting the subject and its practitioners. An annual conference and regional meetings promote contact between specialists and the opportunity to handle pottery from different regions. This group has members, from all over the British Isles, Europe, and further afield, <http://romanpotterystudy.org/>. Their primary publication is the *Journal of Roman Pottery Studies* with 16 volumes through 2017 and *Research Strategy and Updated*

Agenda for the Study of Roman Pottery in Britain, 2011. Six volumes of the *Journal* (10, 11, 13, 14, 15, and 16) have been reviewed in the *SAS Bulletin*: 27(4):25-27 (Winter 2004); 28(4):14 (Winter 2005); 30(3):21 (Fall 2007); 33(3):13 (Fall 2010); 36(2):16-18 (Summer 2013); and 39(3-4):12-14 (Fall-Winter 2016). The Medieval Pottery Research Group was formed in 1975 to bring together people with an interest in the pottery vessels that were made, traded, and used in Europe between the end of the Roman period and the 16th century. It was subsequently expanded to include the pottery of the 17th, 18th, and 19th centuries from both sides of the Atlantic and beyond, as well as post-Roman ceramic building materials, <http://www.medievalpottery.org.uk/>. Their major publication is an annual, *Medieval Ceramics* with 31 issues through 2010, plus an Occasional Papers Series.

This useful standard takes the reader through the various stages of an archaeological project, from planning and data collection through to report writing and archiving, with the intention of informing not only pottery specialists but also those who manage and monitor projects. The document provides a valuable check list for use by professional archaeologists and would be an important pedagogical guide for students. Current textbooks do not normally provide such a synthesis of standards in this informative manner; see *Pottery Analysis: A Sourcebook*, 2nd ed., by Prudence M. Rice, Chicago: University of Chicago Press, 2015, reviewed in *SAS Bulletin* 38(3):3-7 (Fall 2015). I was especially struck with the idea that such a guidebook would be quite useful for regional and state archaeological societies in the United States and Canada. The authors and members of the three UK pottery study groups can take pride in having prepared and disseminated this document.

Ancient Old World Pottery: Materials Technology, and Decoration, by Walter Noll and Robert B. Heimann. Stuttgart, Germany: Schweizerbart / Borntrager Science Publishers, 2016. xvi + 311 pp., 93 figures (2 in color), 16 color plates, 36 tables. ISBN 978-3-510-65336-2, paperback, 44.80 € / \$54.22. The authors summarize the development of ceramic technology in the Old World focusing on the “Fertile Crescent” during Neolithic/Chalcolithic/Bronze Ages, basing their study on mineralogical and chemical analyses of typical pottery fragments collected by the first author, Walter Noll (1907-1987), a during the last quarter of the past century. Noll, a chemist and mineralogist with a significant interest in ancient pottery, was Honorarprofessor für Mineralogie und Petrographie an der Universität Köln, died in November 1987. Jürgen Letsch, his former doctoral student, edited Noll’s manuscript that became *Alte Keramiken und ihre Pigmente: Studien zu Material*

und Technologie, posthumously published by E. Schweizerbart’sche Verlagsbuchhandlung, Stuttgart (334 seiten) in January 1991. [He should not be confused with Walter Noll (1925-2017), a German-born Carnegie Mellon University mathematician known for his work in thermodynamics and continuum mechanics who had studied mathematics at the Technical University of Berlin.] Readers and reviewers of the original German edition often suggested the need for an updated English edition of this important work, now undertaken by Robert B. Heimann. Heimann obtained his academic degrees from Freie Universität (FU) Berlin, worked in Canada as a research associate (McMaster University), staff geochemist (Atomic Energy of Canada Ltd.), and research manager (Alberta Research Council). Currently he is professor emeritus of technical mineralogy and materials science at Technische Universität Bergakademie Freiberg, Freiberg. Like Noll, he has an interest in ancient ceramics. Professor Heimann has authored over 260 scientific publications, several books and book chapters, including Robert B. Heimann and Marino Maggett, *Ancient and Historical Ceramics: Materials, Technology, Art and Culinary Traditions*. Stuttgart, Germany: Schweizerbart / Borntrager Science Publishers, 2014. xxii + 550 pp., 303 figures, 47 tables. ISBN 978-3-510-65290-7, hardbound, 79.00 €. Hence, the volume under review is written by authors who shared a common interest in ancient ceramic technologies from the perspectives of mineralogy and petrography. Heimann has significant experience with science-based ceramic analyses in archaeology which he uses to update the original book.

Ancient Old World Pottery has a “Preface I” by Heimann (pp. v-vii); “Preface to the German edition (1991)” (p. viii), “Preface II” by Thilo Rehren (pp. ix-xi); an essay “About the authors” (p. xii); and five chapters, two appendices, and “References.” The “References” (pp. 259-293) contains 545 entries including 32 publications by Noll and 16 by Heimann. On page 285 the entry: “C. Opton, P. Tyres, and A. Vince (1993) *Pottery in Archaeology*, Cambridge: Cambridge University Press,” contains errors”; C. Opton should be Clive Orton. The newer edition of this book is Clive Orton and Michael Hughes (2013) *Pottery in Archaeology*, 2nd ed. (see my review in *SAS Bulletin* 37(1):7-9 (Spring 2014). On page 291 the entry “M. Tite, I. C. Freestone, N. D. Meeks, and M. Bimson (1982), The use of scanning electron microscopy in the technological examination of ancient ceramics, in *Ceramics as Archaeological Material*, Washington, DC: Smithsonian Institution,” has several errors. Initially I thought that this entry had been confused with Mike Tite’s book *Methods of Physical Examination in Archaeology*, London: Seminar Press,

1981, but it actually refers to a chapter in Alan D. Franklin and Jacqueline S. Olin (eds.) (1982) *Archaeological Ceramics: Papers presented at a seminar on ceramics as archaeological material, held at the National Bureau of Standards and the Smithsonian Institution, Washington, D.C., September 29-October 1, 1980*, Washington, DC: Smithsonian Institution Press, pp. 109-120. Lastly, page 283: “Meunier, Alain and Bruce D. Velde (2013), *Illite: Origin, Evolution and Metamorphism*,” Berlin and Heidelberg: Springer-Verlag. The publication date should be 2004; 2013 is a reprint of the earlier volume rather than a new edition. *Ancient Old World Pottery* also has 16 color plates (pp. 261-268) and, uniquely, a “Subject Index” (pp. 294-297), and “Location Index” (pp. 298-300).

Chapters one to four comprehensively describe the principles of ancient ceramic technology largely based on Walter Noll’s own work, demonstrating the chemical, mineralogical and materials science background of this subject matter. Chapter 5 reviews the results of Noll’s analytical work on a limited number of ancient ceramic objects from Mesopotamia, Anatolia, Iran, Sistan, the Indus Valley, and Egypt to complement the scientific foundation elucidated in the first chapters. The authors describe and explain in an intuitive and plausible way the sometimes very complex and erudite physicochemical relationships among minerals during processing of clays and the firing of ceramics. They clearly explain the intricate interplay of the mineralogy of clays, and their processing, shaping, firing and painting to produce ceramic vessels fabricated in the distant past.

“Chapter 1: Introduction” (pp. 1-7, 2 figures). The authors characterize the janiform (i.e. “two-faced”) nature of ceramics (cultural historic versus archaeometric/scientific analyses), origins of ceramics, and early pyrotechnology. “Chapter 2: Methods of investigation” (pp. 8-22) provides and outline of instrumental analytics, notably chemical compositions (WDXS, EDXS, XRFS, TXRF, AAS, EMPA, LIBS, XANES, and PIXE); phase content (XRD, CRT, TEM, FIB, and IS), and micromorphology and texture (SEM, AFM, and PFM). Other topics include the reconstruction of manufacturing process based on material analyses, chemical and phase composition, the detection of forgeries, antique sources and pictorial documentation, and contemporary pottery techniques as interpretive tools. “Chapter 3: Ancient ceramics” (pp. 23-109, 24 figures [2 in color], 15 tables) is an overview of the fundamentals of ancient and modern ceramics, clay classifications following Hennicke (1967), ancient ceramic materials (chemical composition, lime-rich and lime-poor clays, phase composition, CTE [coefficient of thermal expansion], texture, and color). Table 3.2

considers mineral phases detected by XRF. They discuss contemporary autochthonous [indigenous] ceramics as proxy for ancient materials and clays (examples from Crete, Mainland Greece, Mesopotamia, Egypt, and the Roman Rhineland). In addition the reconstruction of green clay processing methods (clay preparation, forming, decoration, the application of handles, and drying) are reviewed. XRF and XRD studies of contemporary versus Minoan pottery are presented. Lastly, the ceramic firing process focuses on ceramics as a heterogeneous system out of equilibrium, the influence of the gas atmosphere, phase formation in calcareous and in non-calcareous clays, the development of ceramic texture during firing, and thermometry of the ancient ceramic firing process. “Chapter 4: Décor, design, and pattern” (pp. 110-200, 19 figures, 7 tables). The authors focus on ceramic painting (iron oxide black/iron reduction technique, manganese black/manganese black technique, carbon black/C-black technique, iron oxide red/iron oxidation technique, copper red, white pigments, mixed pigments, and bi- and polychrome colors). They contend that red pigments are rather “monotonous” in comparison to the diversity of black pigments (p. 142). Another section documents smoking (carbon content, the nature of carbon, methods of decoration by smoking, and the distribution of C-black technique) as well as “cold” painting (pigments and organic and inorganic adhesives documented through XRD; Table 4.6 presents data on colors, formulae, and uses), and metallic appliqués (tin, tin alloys and lead, and gold and silver).

“Chapter 5: Regional ceramic developments” (pp. 201-260, 31 figures, 13 tables). For Mesopotamia (Neolithic to Chalcolithic, 6th-early 3rd millennium BCE) (pp. 201-216) the authors provide data on the ceramic body, painting (the iron reduction technique used in Samarra, Halaf and Ubaid), white “slip,” and C-black techniques. In Anatolia (Neolithic-Chalcolithic to Phrygian, 5500 BCE ff.) they review the ceramic body and painting, while for Iran (first half 7th millennium-2000 BCE) data on the ceramic body and painting come from Tepe Sialk and Tepe (pp. 222-228). Ceramics from Sistan (3100-1800 BCE), notably the Shahr-i Sokhta site; Southern Turkmenistan (6000-1800 BCE); and the Indus Valley cultures (3600-2600 BCE), particularly the sites of Mehrgarh, Mohenjo Daro, and Harappa, and relationships to the Iranian Plateau, are reviewed. For Egypt (4th millennium to the Roman era) (pp. 236-259) ceramics are documented for the Predynastic, Early Dynastic, Old Kingdom, Middle Kingdom, New Kingdom, and Nubia and Coptic eras. The authors discuss the role of pottery in ancient Egypt, the ceramic body and its raw materials (Nile mud and marl clays with SEM analyses), colored decoration, and specifics of ancient Egyptian ceramic

technology. The analyses presented herein would be useful for a needed update of *Ancient Egyptian Materials and Technology* edited by Paul T. Nicholson and Ian Shaw, Cambridge, New York, and Melbourne: Cambridge University Press, 2000, reviewed in *CHOICE: Current Reviews for Academic Libraries* 38(2):384 (October 2000) and especially add important information to *A Manual of Egyptian Pottery*, 4 vols.: *Vol. 1: Fayum A-Lower Egyptian Culture*, *Vol. 2: Naqada III-Middle Kingdom*, *Vol.3: Second Intermediate through Late Period*, *Vol.4: Ptolemaic through Modern Period*, all by Anna Wodzinska, AER Field Manual Series 1-4, Boston: Ancient Egyptian Research Associates, Inc., 2009-2010, reviewed in *SAS Bulletin* 33(3):12-13 (Fall 2010). Lastly Noll and Heimann provide two appendices: "Appendix I: Important mineral phases present in ancient ceramics and detectable by X-ray diffraction" (p. 301) and "Appendix II: Compositions of ancient ceramics, plotted in [20] ternary phase diagrams: SiO₂/Al₂O₃/(CaO+MgO)" (pp. 302-311).

This volume provides a thorough analysis of procedures for studying ancient pottery and especially painted ceramics (it causes me to rethink my own research on painted pottery from northern Afghanistan). Portions of the treatise reminded me of the comprehensiveness of *Archaeological Ceramic Materials: Origin and Utilization* by Bruce Velde and Isabelle C. Druc, Berlin, Heidelberg, and New York: Springer, Natural Science in Archaeology Series, 1999, reviewed in *SAS Bulletin* 23(1):17-21 (Spring 2000), but also aspects of texts focused on chemistry rather than mineralogy. See "Comparative review of Three Books on Archaeological Chemistry: *Analytical Chemistry in Archaeology* (A. M. Pollard, C. M. Batt, B. Stern, and S. M. M. Young; Cambridge Manuals in Archaeology, Cambridge and New York: Cambridge University Press, 2007; *Archaeological Chemistry*, 2nd ed. (A. M. Pollard and C. Heron; 2nd ed., Cambridge, UK: RSC Publishing (The Royal Society of Chemistry), 2008; and *Archaeological Chemistry*, 2nd ed. (Zvi Goffer, Hoboken, NJ: Wiley-Interscience, a John Wiley & Sons, Inc. Publication; Volume 170 in *Chemical Analysis: A Series of Monographs in Analytical Chemistry and Its Applications*, 2007)," *SAS Bulletin* 32(1):22-25 (Spring 2009), and *An Introduction to Archaeological Chemistry* by T. Douglas Price and James H. Burton, New York: Springer, 2011, reviewed in *SAS Bulletin* 34(1):2-4 (Spring 2011). Likewise, comparisons can be made to Pru Rice's monumental *Pottery Analysis: A Sourcebook*, 2nd ed., Chicago: University of Chicago Press, 2015, reviewed in *SAS Bulletin* 38(3):3-7 (Fall 2015). Nonetheless, Noll and Heimann's up-to-date combination of chemical and mineralogical analyses provides an

especially compelling review of archaeological ceramics but with a focus on several regions of the Old World (Eastern Mediterranean, Southwest Asia, Iran-Indus, and a bit on the Roman Rhineland). The authors present in a logical manner many procedural details about the fabrication of ancient ceramics by addressing geographical, local geological, stratigraphic, and socioeconomic constraints the ancient potters faced. This volume deserves a place on our bookshelf next to the aforementioned studies. Heimann and Marino Maggetti's *Ancient and Historical Ceramics: Materials, Technology, Art and Culinary Traditions* (2014) is also worth reading.

Tarascan Pottery Production in Michoacán, Mexico: An Ethnoarchaeological Perspective, by Eduardo Williams, 2017. Archaeopress Archaeology. Oxford: Archaeopress Publishing Ltd, vii + 290 pp, 115 figures, 7 tables. ISBN 9781784916732 (paperback) £28.00 / \$56.00; eBook ISBN 9781784916749, from £16.00 + VAT if applicable. See:

<http://www.archaeopress.com/ArchaeopressShop/DMS/FD7AF9791D724571AE6F4267BC116E1F/Williams-contents.pdf> \$53.20. The monograph (with older pagination) has also been posted gratis by the author at: https://www.academia.edu/29530048/TARASCAN_POTTERY_PRODUCTION_IN_MICHOAC%C3%81N_MEXICO_An_Ethnoarchaeological_Perspective_2016

Eduardo Williams studied archaeology in the Universidad Autónoma de Guadalajara (B.A. 1982), and the Institute of Archaeology, University College, London (M.A. 1984, Ph.D. 1989). He is professor in the Centro de Estudios Arqueológicos, El Colegio de Michoacán, in Zamora, Estado de Michoacán, México, where he began his academic career in 1990. Williams focuses on West Mexican subsistence activities, ethnohistory, ethnoarchaeology, ecology, the archaeology of the Protohistoric Tarascan state, and modern Purépecha cultural manifestations and materiality (i.e., crafts and artistic styles, notably in ceramic production). He is a prolific author and regarded as an expert on the region having worked with potters, saltmakers, fishers, basket-makers, reed-mat weavers, and other craftspeople for over three decades: 34 articles/chapters, book reviews, and a dozen books. Among his most significant publications are: *Las piedras sagradas: escultura prehispánica del Occidente de México* (El Colegio de Michoacán, 1992); "The Ethnoarchaeology of Salt Production at Lake Cuitzeo, Michoacán, México" in *Latin American Antiquity* 10(4):400-414, 1999; *Estudios cerámicos en el occidente y norte de México* (Williams and Weigand, eds., El Colegio de Michoacán, 2001); "Salt Production in the Coastal Area of Michoacán, México: an Ethnoarchaeological Study" in *Ancient Mesoamérica*

13(2):237-253, 2002); and the award winning *La sal de la tierra: etnoarqueología de la producción salinera en el Occidente de México* (El Colegio de Michoacán, 2003). The latter is published in English as *The Salt of the Earth: Ethnoarchaeology of Salt Production in Michoacán, Western Mexico* (British Archaeological Reports. BAR International Series S2725. Archaeopress, Oxford). Other works include *Bienes estratégicos del antiguo Occidente de México* (El Colegio de Michoacán, 2004); “Prehispanic West Mexico: A Mesoamerican Culture Area” published by FAMSI [Foundation for the Advancement of Mesoamerican Studies, Inc.] in English and Spanish. http://www.famsi.org/research/williams/wm_classicperiod.html; and *Etnoarqueología cerámica en Huáncito, Michoacán, México* (El Colegio de Michoacán, 2013). A majority of his publications are available online, including the entire texts of several of his books: <https://colmich.academia.edu/EduardoWilliams>; https://www.researchgate.net/profile/Eduardo_Williams. Eduardo has been visiting scholar at the University of California at Los Angeles and the Middle-American Research Institute (Tulane University). He is also a member of the Mexican National Research System and the Mexican Academy of Sciences. I have had the opportunity to review two of his edited works: *Estudios cerámicos en Occidente y Norte de Mexico* (Eduardo Williams and Phil C. Weigand, eds.; Zamora, Michoacán, México: El Colegio de Michoacán, Instituto Michoacano de Cultura, 2001) reviewed in *Old Potter's Almanack: Joint Newsletter of the Prehistoric Ceramics Research Group and The Ceramic Petrology Group* (British Museum, London) 11(1):8-9 (March 2003) and *Etnoarqueología: Ex contexto dinámico de la cultura material a través del tiempo* (Eduardo Williams, ed.; Zamora, Michoacán, México: El Colegio de Michoacán, 2005) in *SAS Bulletin* 29(4):23-24 (Winter 2005).

Tarascan Pottery Production is the English-language version of his 361-page *Etnoarqueología de la producción de cerámica en las region tarasca de Michoacán* (El Colegio de Michoacán, 2017); the illustrations are identical but collected at the end of the Spanish edition rather than at the ends of appropriate chapters in the English-language version. Some of the images in the Spanish edition are in color but all 113 line drawings and photographs in the English edition are monochrome black-and-white. (Subsequent comments focus on the 2017 Archaeopress edition). The volume contains a “Preface” (pp. v-vi), “Acknowledgments” (p. vii), five chapters, and “References Cited” (pp. 256-290) with 406 entries – including 27 of Williams’ own publications. There is no index. He examines a contemporary pottery tradition in Mesoamerica and

retrospectively assesses the earliest examples of cultural development in the Tarascan area. Williams employs ethnographic analogy and ceramic ecology to shed light on a modern indigenous community and on the theory, method, and practice of ethnoarchaeology, a significant aspect of archaeological research in Mexico today. The book is based on more than 26 years of ethnoarchaeological work in Michoacán, beginning with Williams’ arrival in the Tarascan or Purépecha community of Huáncito in the summer of 1990. His goal was to initiate a research project that would enable him to understand all aspects of an indigenous pottery-making tradition from an anthropological and archaeological perspective. In the initial fieldwork, he points out that ethnoarchaeology was a relatively unknown discipline in Western Mexico, and he was “was more or less alone in my chosen field.” When he joined the faculty of the Center for Anthropological Research of the Colegio de Michoacán (Zamora) in 1990, he met American anthropologist and archaeologist Phil Weigand who offered advice and support. Weigand already had significant experience in ceramic ethnoarchaeology in Western Mexico dating back to the late 1960s (for example: Phil C. Weigand, *Modern Huichol Ceramics*, Mesoamerican Studies, Research Records of the University Museum. Carbondale: Southern Illinois University, 1969). Phil became Eduardo’s good friend and interlocutor and inspired Eduardo; they worked together and coauthored and edited publications until Phil died in 2011.

“Chapter I: Introduction” (pp. 29, 2 figures). Williams focuses on the contemporary pottery-making tradition in Mesoamerica as well as its historical background and archaeological examples, and a detailed discussion of ethnoarchaeology and ceramic ecology. There is a valuable assessment of household ceramic production in ancient Mesoamerica. “Chapter II: Ethnoarchaeology: Archaeology as Anthropology” (pp. 30-51, 1 figure). There is an introduction to ethnoarchaeological theory and practice, and to the goals of processual archaeology in Mesoamerica. Williams explores the relationship that archaeology and general anthropology have shared through time, and the role of ethnoarchaeology as a bridge that may serve to foster and encourage contact between these two disciplines. There are excellent summaries of the Cultural-Historical approach in Mesoamerican archaeology, processual approach and the “New Archaeology.”

“Chapter III: Ceramic Ethnoarchaeology and Ceramic Ecology in Western Mexico” (pp. 52-166, 87 figures, 6 tables). In this lengthy chapter, Williams enlightens us on the method and theory of ceramic ecology (derived from

Fred Matson, Dean Arnold, Charles Kolb, and others) that he employed in Teponahuasco, Jalisco where the alternation of dry and rainy seasons presents a very serious challenge to potters. Hence, farming has been pursued as a full-time occupation. There are discussions centering on pottery production in Teponahuasco, climatic limitations, and implications for archaeological research. A subsequent section of this chapter concentrates on ceramic fabrication in Huáncito, Michoacán, and the community of potters Williams has studied over 26 years. Employing ethnoarchaeology and ceramic ecology (pp. 70-155), he begins with the geographic and cultural background. His research is also framed within the concept of ceramic ecology, with an interest in several aspects of human interaction with the natural environment, such as: (1) the potters' adaptation to local weather patterns; (2) the acquisition of raw materials (clay, temper, pigments); and, (3) the use of firewood in the kilns –still a prevalent practice in the region– and for cooking. The chapter provides a discourse on how domestic space is used in several households in Huáncito, where potting workshops share space with living quarters and cooking, storage, and other areas of people's homes. Williams' detailed assessment reminds us of the longitudinal assessment of Dean Arnold in Ticul, Yucatan, México over a 40-year period (yielding four book-length treatments). The archaeological implications of these observations are of great importance for developing a middle-range theory that links the material culture and activities of the present (the systemic context) with interpretations of the past (the archaeological context). The topics considered include processes of change and persistence in a ceramic tradition, pottery fabrication and the use of domestic space, the spatial contexts of pottery-making activities as well as archaeological Correlates, details on the structure of spatial organization, and “lessons to be learned.” Lastly, in an extremely valuable discussion, he considers Tarascan pottery-firing technology in terms of archaeological and ethnographic evidence, firing vessels in the open in Michoacán, and the archaeological implications of these choices.

“Chapter IV: Tarascan Pottery as a Strategic Resource in the Protohistoric Period (ca. AD 1450-1530)” (pp. 167-240, 22 figures, 1 table). Williams discusses pottery production, trade and use in the Tarascan area, including the manufacture and exchange of ceramic products in the Lake Pátzcuaro Basin, the seat of power of the Tarascan Empire. The strategic role of pottery in subsistence activities is also addressed in this chapter, as is the role of ceramic containers and other items in the following activities: salt-making; *pulque* production (an alcoholic beverage made from the fermented sap of the maguey

plant); the elaboration of *tesgüino* (maize beer) and other alcoholic beverages; *ixtle* (maguey fiber) and cotton-fiber spinning; and fishing. Each of these is related to pottery vessels (and potsherds as fishing-net weights) employed. These strategic activities, Williams inform the reader) depended on ceramic artifacts for their existence, as shown here through many ethnographic, archaeological, ethnohistorical, and other examples from Mesoamerica (particularly work by Jeffrey Parsons in the Basin of Mexico) and elsewhere. Williams provides us with a synthesis of Pre-Hispanic Tarascan culture, and discussions of the West-Mexican Postclassic period and Pre-Hispanic urbanization at Tzintzuntzan. The latter focuses on residential areas, production or manufacturing zones and public areas. In addition, using ethnoarchaeology and ethnohistory, he details pottery production, trade, and use in the Tarascan region and production and exchange in the Lake Pátzcuaro Basin, as well as the strategic role of pottery in subsistence activities. Lastly, in “Chapter V: Summary and General Conclusions” (pp. 241-255), Williams reviews the main aspects of the study, its implications for the field of archaeology and general anthropology, as well as the achievements, challenges and tasks that remain for future investigations.

This monograph provides the reader with a clear understanding of the diachronic interplay of archaeology, ethnoarchaeology, ethnohistory, and ethnography of Tarascan pottery-making, especially at Huáncito. His long-term assessment is similar in many ways to that of Dean Arnold and the Ticul studies; scholars' research, data collection, analyses, and detailed reporting are grounded in ceramic ecology and ethnoarchaeology. Kudos to Eduardo, a friend for more than thirty years, for this invaluable synthesis and the clarity of his discussions of methods and theory in ceramic ecology and ethnoarchaeology.

Teotihuacan: City of Water, City of Fire, by Matthew H. Robb (ed.), 2017, San Francisco: Fine Arts Museums of San Francisco and the University of California Press. Hardcover \$75.00, ISBN: 978-0520296558, \$75.00. 444 pp., with ca.400 newly created color images and 12 new maps. Editor and organizer Matthew Robb is currently curator at the Fowler Museum, UCLA. This magnificent and massive seven-pound volume was published to accompany a major exhibition with the same title held at the de Young Fine Arts Museum in San Francisco (30 September 2017-11 February 2018) and the Los Angeles County Museum of Art (25 March-15 July 2018). It features 26 essays by 21 internationally-recognized authors from Mexico, the US, Denmark, Germany, and Japan, and 183 object entries documenting artifacts

recovered from recent excavations and as long as a century ago. These works come from Mexico's Museo Nacional de Antropología and Zona de Monumentos Arqueológicos de Teotihuacan, as well as nine other US collections. Many of the artifacts have never before left Mexico's museums. The catalog focuses on the ancient metropolis of Teotihuacan, located in the northeastern corner of the Basin of Mexico, founded in the first century BCE and multiethnic city of at least 100,000 souls (estimates range up to 200,000) which became the cultural, political, economic, and religious center of ancient Mesoamerica until about 650 CE. Teotihuacan was a highly organized city, built in a grid-like plan over eight square miles, situated along the north-south axis formed by the so-called "Avenue of the Dead," and composed largely of architecturally similar single-story residential buildings varying in size and level of luxury and a civic-ceremonial center with two immense pyramids (Sun and Moon) and their associated compounds, a citadel with a pyramid (Ciudadela and Feathered Serpent Pyramid), and a market or assembly area immediately west of the citadel.

The essays and catalogue are supplemented with a "Bibliography" (pp. 419-432) with 822 entries and useful "Index" (pp. 433-439). A majority of the 26 essays (pp. 12-199) emphasize the results of excavations and artifact analyses conducted over the past fifty years and especially during the past two decades. These narratives included contributions by David M. Carballo and Matthew H. Robb "Lighting the World: Teotihuacan and Urbanism in Central Mexico" (pp. 12-19, 8 figures); George L. Cowgill "A Speculative History of Teotihuacan" (pp. 20-27, 7 figures); Saburo Sugiyama "Teotihuacan: Planned City with Cosmic Pyramid" (pp. 28-37, 8 figures); Julie Gazzola "Reappraising Architectural Processes at the Ciudadela through Recent Evidence" (pp. 38-47, 8 figures); Sergio Gómez Chávez "The Underworld at Teotihuacan: The Sacred Cave Under the Feathered Serpent Pyramid" (pp. 48-55, 6 figures); Saburo Sugiyama "The Feathered Serpent Pyramid at Teotihuacan: Monumentality and Sacrificial Burials" (pp. 56-61, 4 figures); Alejandro Sarabia González and Nelly Zoé Núñez Rendón "The Sun Pyramid Architectural Complex in Teotihuacan: Vestiges of Worship and Veneration" (pp. 62-67, 8 figures); Nelly Zoé Núñez Rendón "The Central Plaza of the Sun Pyramid: Collective Space at Teotihuacan" (pp. 68-73, 8 figures); Saburo Sugiyama and Rubén Cabrera Castro "The Moon Pyramid and the Ancient State of Teotihuacan" (pp. 74-81, 7 figures); Leonardo López Luján and Saburo Sugiyama "The Ritual Deposits in the Moon Pyramid at Teotihuacan" (pp. 82-89, 6 figures); and Nawa Sugiyama "Pumas Eating Human Hearts?

Animal Sacrifice and Captivity at the Moon Pyramid" (pp. 90-93, 5 figures).

Other essays focused on sociocultural and economic enterprises: Linda R. Manzanilla "Teotihuacan Apartment Compounds, Neighborhood Centers, and Palace Structures" (pp. 94-101, 8 figures); Sergio Gómez Chávez "Foreigners' Barrios at Teotihuacan: Reasons for and Consequences of Migration" (pp. 102-107, 5 figures); Rubén Cabrera Castro "La Ventilla and the Plaza of the Glyphs" (pp. 108-117, 6 figures); Linda R. Manzanilla "The Xalla Palace in Teotihuacan" (pp. 118-123, 5 figures); David M. Carballo "Daily Life in Teotihuacan's Southern Periphery: The Tlajinga District" (pp. 124-129, 5 figures); Christophe Helmke and Jesper Nielsen "Of Gods and Rituals: The Religion of Teotihuacan" (pp. 130-137, 6 figures); Jesper Nielsen and Christophe Helmke "The Storm God: Lord of Rain and Ravage" (pp. 138-143, 5 figures); four essays by Matthew H. Robb "The Old Fire God" (pp. 144-149, 3 figures), "The Maize God" (pp. 150-153, 3 figures), "The Water Goddess" (pp. 145-157, 3 figures), and "Space, Object, and Identity in the City of the Gods" (pp. 158-167, 5 figures); Julie Gazzola "Lapidary Work at Teotihuacan: Production and Use" (pp. 168-173, 8 figures); Diana Magaloni "The Colors of Time: Teotihuacan Mural Painting Tradition" (pp. 174-179, 6 figures); Megan E. O'Neil "Stucco-Painted Vessels from Teotihuacan: Integration of Ceramic and Mural Traditions" (pp. 180-187, 6 figures); and Hillary Olcott "Mapping Teotihuacan" (pp. 188-197, 5 figures).

The "Catalogue of the Exhibition with Maps" (pp. 204-417) is divided into 13 sections, two are introductory and 11 focus on geographical or architectural units within the urban center. "Catalogue Introduction" (p. 201); "Catalogue Sections and Site Key" (pp. 200-203); "Introduction to Teotihuacan" (pp. 205-237); "Feathered Serpent Pyramid, Tunnel, Ciudadela" (pp. 239-275); "Sun Pyramid, Palace of the Sun (Zone 5A), House of the Priests" (pp. 277-301); "Moon Pyramid, Quetzalcoatl Palace" (pp. 303-327); "East Platform" (pp. 329-333); "Tlajinga" (pp. 335-343); "Oaxaca Barrio" (pp. 345-349); "Tetitla" (pp. 351-362); "La Ventilla" (pp. 361-387); "Street of the Dead Complex, West Plaza Group" (pp. 389-397); "Techinantitla" (pp. 399-411); and "Xalla" (pp. 413-417). Teotihuacan became an economic powerhouse that controlled obsidian trade, while material culture imports came from a myriad of colonial locations throughout and beyond Teotihuacan Empire; these included ceramics from the Maya region, the Valley of Oaxaca, West Mexico, and the Gulf Coast. References to domestically-produced vessels, notably San Martin Orange cooking ware, monochrome black and brown

pottery in unique forms including Storm God jars, vases with post-fired engraving and nubbin or tripod slab supports) as well as *candeleros* (small handheld incense burners) and elaborately decorated *incensarios* (censers) with a variety of attached painted fired clay *adornos* (plaques) depicting butterflies, marine shell, other animals, and geometric forms. One unique pottery type included tripod supported vases and simple bowls with exterior lime plastered coatings further decorated with polychrome paints depicting deities and geometric and naturalistic elements. Imported ceramics, especially Thin Orange Ware from the Puebla region, Zapotec jars from the Valley of Oaxaca, pottery likely from Morelos, and Granular Ware, and Lustrous Ware demonstrated Teotihuacan's hegemony and tradecraft.

Of the 183 objects depicted in the catalogue, three (numbers 29, 31, and 130) are not displayed in the exhibition. Each artifact is described, including measurements, colors, decorations, chronological phase, catalog number, and origin of the loans. Ninety-three of the exhibited objects are of stone (18 types: mostly greenstone, andesite, tecali, serpentine, unidentified stone, and jade carvings and statuary) and obsidian blades and cores. In addition there are 19 artifacts created from marine shell (most with carvings and including shell trumpets, necklaces, and pendants), 15 examples of wall murals (fabricated from earthen aggregates coated with stucco and decorated with polychromatic pigments emphasizing red colors), and one object each of carved wood, bone, and amber. The 52 ceramic objects focus on a variety of Teotihuacan-produced and imported wares as well as locally-made molded figurines, *candeleros*, the stucco-painted vases and bowl, three *incensario* forms (*elote*, lattice, and theater), and *almenas* (ceramic and stone roof decorations or emblems).

This is the first traveling exhibition of Teotihuacan cultural materials coming to the United States since 1993 (May 26-October 31, 1993). It was also organized by The Fine Arts Museums of San Francisco, that exhibition focused on painting, sculpture, and ceramics; complemented by a catalogue with (in the words of one reviewer) a "mixed bag of essays" intended to introduce the reader to the current state of Teotihuacan scholarship. That catalogue, *Teotihuacan: Art from the City of the Gods* edited by Kathleen Berrin and Esther Pasztory (London and New York: Thames and Hudson, 1993, 288 pp.) had 11 essays and featured 178 objects. "Teotihuacan: Cité des Dieux" was an exhibit that traveled in Europe: Musée du quai Bramley, Paris (6 octobre 2009-24 janvier 2010), Museum Reitberg, Zurich (20 février-30 mai 2010), and Martin-Gropius-Bau, Berlin (20 juin-10 octobre 2010). That catalogue with 328

objects and 21 essays are contained in *Teotihuacan: Cité des Dieux*, en hommage à Felipe Solís (1944-2009) (Paris: Somogy éditions d'art, 2009, 480 pp.). All three exhibitions provide some of the same basic essay content and illustrate and document some of the same objects such as the La Ventilla Ballcourt Marker and the more elaborate ceramics.

Gazolla's chapter on the lapidary art in *Teotihuacan: City of Water, City of Fire* is splendid. However, there is no separate chapter on ceramics as there is in *Teotihuacan: Cité des Dieux*: Claudia Maria López Pérez "L'art céramique," pp. 90-97. Comments on ceramics in the 2017 volume are, in the main, scattered within the essays written by Cowgill, Gomes, S. Sugiyama, Sarabia and Rendón, and Carballo; e.g., especially those documenting the Pyramid of the Sun, sacred caves, foreigner *barrios*, and two teotihuacano *barrios*: Xalla and Tlajinga. Obviously the 2017 book provides more recent information and corrects some errors in the Solís volume, and this magnificent catalogue with essays by major art history and archaeological investigators from Mexico, the US and Europe has the additional advantage of new digital photographs. The essays and object descriptions in *Teotihuacan: City of Water, City of Fire* are concise, informative, and reflect the latest scholarship. The volume is a silent tribute to Matthew Robb's organizational and editorial skills. I have only one negative comment: The entries in the "Bibliography," "Index," and back matter are printed in very small font (8pt., I believe) and are difficult to read because the light black/grey print has little contrast from the glossy white paper.

Note: Your reviewer is very familiar with Teotihuacan and its domestic and foreign ceramic assemblages, having worked on both the Penn State rural survey and full-scale excavations and for the University of Rochester's urban survey and exploratory *sondages*. He has published more than two dozen articles and book chapters on ceramic ware, figurines, *candeleros*, marine shell, and residential structures, and ceramic thin section studies of Teotihuacan pottery. The National Endowment for the Humanities is a primary funder of the exhibition but, now as a retired NEH Senior Program Officer, had nothing to do with the grant application or its assessment.

ARCHAEOLOGICAL METALLURGY
Brett Kaufman, Associate Editor

Every few years, archaeometallurgists from across the world gather for the BUMA conference series (The

Beginning of the Use of Metals and Alloys). Primarily focusing on ancient East Asian metallurgy, BUMA also fosters cross-cultural perspectives with scholars presenting data from across Eurasia and beyond. This year, BUMA IX was held in Busan, Korea from October 16-19 (2017), hosted by Dong-A University, organized by the Korean Institute of Metals and Materials, and sponsored by several organizations (for more information including abstracts and the program please visit <http://buma9.org/>).

This year, the community mourned the loss of BUMA co-founder Professor Tsun Ko of the University of Science and Technology Beijing, who passed away this summer at the age of 101. The other co-founder, Professor Robert Maddin of the University of Pennsylvania, celebrated his 100th birthday remotely during the week of the conference, and offers a personal tribute of his friend Professor Ko in the obituary below. Condolences for Professor Ko have been offered by leaders and entities at the international level, as his activities and research in ferrous metallurgy, physical metallurgy, electron microscopy, and archaeometallurgy, as well as his pioneering efforts in international scientific exchange and education, have been widely recognized for decades. In order to celebrate the legacy of Professor Ko, we reprint here a modified obituary co-authored by Professors Mei Jianjun and Thilo Rehren, including the contribution of Professor Maddin. The full text is forthcoming in the journal *East Asian Science, Technology, and Medicine* [no. 46, 2018]. We chose to relay this testament to Professor Ko here as this latter publication may not be readily available to *SAS Bulletin* subscribers. Following this, a brief summary of the themes and talks given at the conference is reported.

OBITUARY

Tsun Ko 柯俊 (Ke Jun) (1917-2017)

Professor Tsun Ko (Ke Jun), a world renowned scientist and educator, academician of the Chinese Academy of Sciences, and life-long professor at the University of Science and Technology Beijing (hereafter USTB), passed away on August 8, 2017 in Beijing at the age of 101. He will be remembered for his academic rigor, abundance of wisdom, and pioneering contributions to the study of metal physics and the history of metallurgy in China.

Professor Ko was born in Changchun, Jilin Province on June 23, 1917, while his ancestral home was in Huangyan, Zhejiang Province. In 1931, at the age of

14, he went to high school in Shenyang in Liaoning Province, after attending primary and middle schools in Changchun. The Japanese invasion of China's northeastern region on 18th September 1931 forced him to flee to Tianjin, where he was given a place at the First High School of Hebei Province. In 1934, he was admitted to the Hebei College of Industry and studied chemistry. Before the completion of his university education, he had to flee again to Wuhan due to the advance into North China by the Japanese army on 7th July 1937. He was received by Wuhan University and graduated from its Chemistry Department in 1938, a few months before the fall of the city to Japanese troops. After graduation, he was offered a position in the Republican Government with responsibilities for organizing the transportation of important factories and equipment from Wuhan to southwest China. In the war years that followed, he was sent to Vietnam, Burma and India to manage the transportation of industrial materials to China. In 1944, at the recommendation of the Government, he was awarded an Imperial Chemical Industries (ICI) Fellowship and sent to the University of Birmingham in Britain to study in the Department of Metallurgy. He obtained his Ph.D. in 1948, and later became a senior lecturer there.

In 1953, together with his wife and baby son, Dr. Ko returned to China and became a professor at the newly established Beijing Industrial Institute of Iron and Steel (a predecessor to USTB). There he devoted himself to research and teaching of metallurgical theories and their industrial applications, and became the founder and first Chair of the Department of Metallurgical Physical Chemistry, the first department for this specialized subject in China. Professor Ko's important contributions to physical metallurgy began with his work on the bainite shear theory, extending to the development of martensitic transformation kinetics and the exploration of the effects of trace elements in steel. His pioneering research on super-steel had an important impact on basic scientific research and the development of the iron and steel industry in China. By introducing the required technology and equipment to China and fostering the first generation of specialists, Professor Ko made significant contributions to the establishment and development of electron microscopy in China.

During the period of the Cultural Revolution in the late 1960s and early 1970s, Professor Ko, like many others, suffered appalling and unjustified treatment, and was unable to lead a normal life as a scientist. It was not until the mid-1970s that he was allowed to participate

in some research work on the history of Chinese metallurgy. In 1974, at the request of Professor Xia Nai, Director of the Institute of Archaeology, Chinese Academy of Sciences (CAS), Professor Ko carried out a detailed examination of a bronze axe (*yue*) with an iron blade, using an optical microscope and electronic probe. Based on the identification of nickel and cobalt distribution patterns in the iron-blade sample, he concluded that it was made of meteoritic iron rather than man-made iron. This result was crucial to bringing an end to the debate on whether iron was already being smelted and used during the Shang dynasty (16th – 11th centuries BCE). His paper (in Chinese) “Studies on the iron blade of a Shang dynasty bronze axe unearthed at Gaocheng, Hebei” was published in 1976 in *Kaogu Xuebao* (*Acta Archaeologia Sinica*), the top journal for Chinese archaeology, and later translated into English, appearing in *Ars Orientalis* in 1979 (Li, C. Studies on the Iron Blade of a Shang Dynasty Bronze “Yue-Axe” Unearthed at Kao-Ch’eng, Hopei, China. *Ars Orientalis* 11, 259-289 (1979). This work marked the start of his long-lasting interest in the history of science and technology in China, and he became recognized as a pioneer in the application of materials science to the study of archaeological artifacts in China.

During this period Professor Ko played a major role in the investigation and examination of ancient metallurgical remains (both sites and artifacts) across the country. He and his colleagues collected a large number of samples from various archaeological sites and undertook systematic examinations of them in the laboratory. Based on these investigations, they published a series of important papers in Chinese, such as “The development of iron and steel technology in ancient China” (*Kaogu Xuebao* 1975.2) and “Ancient Chinese metallurgical achievements as shown by the iron artifacts from Mianchi County, Henan” (*Wenwu* [Cultural Relics], 1976.8). They also published a book entitled “*A Brief History of Metallurgy in China*” in 1978. These publications for the first time explored in great depth the development of iron and steel technology in ancient China, and expounded the role of the invention and development of China’s cast iron technology in human civilization.

During the late 1970s and early 1980s, after the Cultural Revolution, Professor Ko was able again to fully engage in academic activities, and was appointed Vice-President of the Beijing University of Iron and Steel Technology (BUIST, another predecessor to USTB). He was elected Academician of the Chinese

Academy of Sciences, as well as a member of the Standing Committee of the Department of Science and Technology of CAS in 1980. His interest in the history of metallurgy continued to grow, even while his time and energy were largely taken up by his important research work in metal physics as well as increasingly heavy administrative duties. He not only supported the enlargement of the Archaeometallurgy Group into the University’s Institute of Historical Metallurgy and Materials, but also founded the first postgraduate program in the history of metallurgy at the Institute in 1984. In the mid-1990s, he further founded a Ph.D. program in the History of Science and Technology at USTB. These strategic acts have proved most far-sighted and significant for the development of the history of science and technology as a discipline not just in USTB, but in China as a whole. The postgraduate program in the History of Science and Technology that he founded has now become one of the best in China.

Following the national policy of “Reform and Opening Up”, Professor Ko made great efforts in establishing BUIST’s international links and promoting academic exchange programs with universities in Europe, North America, Australia and Japan during the 1980s. Prior to that of most other universities in the country, BUIST was able to send some of their best teachers and students abroad. This effort had a profound impact on the development of BUIST over the next three decades, especially in terms of the fostering of generations of academic leaders at all levels in the University.

The founding of BUMA (The Beginning of the Use of Metals and Alloys) conference series in the early 1980s is one of the best examples testifying to Professor Ko’s far-sighted vision of the future development of scientific research and education in China. After hearing the news of Professor Ko’s passing, Professor Robert Maddin of the University of Pennsylvania, BUMA co-founder, wrote a condolence blog entry as follows:

“On my return to China in 1978 I met Ko Tsun in his office at BUIST; although our paths had often crossed, this was our first face-to-face meeting... Those few hours in 1978 during which he made me aware of the exciting activities and discoveries, for the most part unknown outside China, were electrifying. The disconsolate and unacceptable situation was that very little was known outside of China. The archaeometallurgical studies were all published in provincial journals and in Chinese. Ko and I

immediately realized that an international conference should occur in China. Keep in mind that this was the time labelled by the press as “ping-pong diplomacy”. On my return, I met in Washington with John Yellen, head of the Anthropology section of the National Science Foundation. He readily agreed to consider a proposal to support the travel and subsistence of ten U.S. scholar/scientists. I subsequently submitted such a proposal with the names of ten chosen from among metallurgy, art history and conservation and associated areas. The proposal was accepted after which I wrote to various scholars throughout the world inviting them to attend a conference in Beijing. That was the first of what became known as the BUMA conferences.”

The first BUMA conference was held in Beijing in 1981 and its great success paved the way for further gatherings, with the second BUMA being held in Zhengzhou, China (II, 1986), then Sanmenxia, China (III, 1994), Matsue, Japan (IV, 1998), Gyeongju, South Korea (V, 2002), Beijing, China (VI, 2006), Bangalore, India (VII, 2009) and Nara, Japan (VIII, 2013). The 9th BUMA conference was held in Busan, South Korea in October 2017. BUMA is now widely conceived as a circum-Pacific conference series, attracting broad international participation from various research backgrounds. The growing role of BUMA in strengthening East-West scientific dialogue and cooperation testifies to the pioneering contributions of its two founders: Tsun Ko and Robert Maddin. At their meeting in Bangalore in 2009, the BUMA Standing Committee decided to offer the title of “Honorary Chairperson” to both Professor Ko and Professor Maddin to acknowledge the considerable contributions the two founders had made to the BUMA community.

Professor Ko also played a key role in promoting the study of the history of science and technology as a discipline in China, especially in opening up and strengthening its links with international partners and community. He was elected President of the Chinese Society for the History of Science and Technology in 1984. During his two tenures as President (1983-1990), he guided the Society to enlarge and consolidate its membership, and to actively participate in international conferences and exchange programs. He made significant contributions to the establishment of the International Society for the History of East Asian Science, Technology and Medicine in the early 1990s, serving as its first Vice-President. From the

early 1990s, he also helped the Society to build up close links with the Division of the History of Science of the International Union of History and Philosophy of Science, leading to the holding of the 22nd International Congress of the History of Science in Beijing in 2005.

Professor Ko had a remarkable ability to spot talent and always encouraged and supported young scholars to broaden their research horizons in their own ways. He wrote numerous supporting letters for young scholars in their endeavors, such as finding a job, going abroad and applying for projects or funding. In the last two decades of his life, he actively advocated and promoted the reform of engineering education in China, and set up a pilot class of “materials in a broad sense” at USTB, which had a deep impact on engineering higher education in China.

Professor Ko’s scientific achievements have been widely recognized, as evidenced by some distinguished national honors, such as the National Natural Science Award, National Teaching Achievement Award, and the Science and Technology Progress Award (HLHL Foundation). He held important positions in a number of organizations: the Discipline Appraisal Group of the Academic Degree Committee of the State Council; the Chinese Science and Technology Association, and the Board of Education of the Chinese Academy of Engineering. His memberships included the Chinese Society for Metals; the Nonferrous Metals Society of China; the Chinese Materials Research Society; the Chinese Electron Microscopy Society; the Chinese Society for the History of Science and Technology; the China Society for Archaeometry (preparatory); the International Union of History and Philosophy of Science and Technology, and the International Society for the History of East Asian Science, Technology and Medicine. He also served as chief editor of *Acta Metallurgica Sinica*, a consultant for the China Nonferrous Metal Mining Group, and the Baosteel Education Foundation.

Professor Ko was a rigorous scholar, indifferent to fame and wealth, and enthusiastic in giving guidance and support to young people, an outstanding example for all those engaged in scientific and technological work and education. He made a great contribution to the development of science and technology in China, and the reform of China’s higher education. Professor Ko’s passing is a great loss not just for his family, colleagues and close friends, but also for his University and the wider community of science and

technology in China. He will be deeply mourned and fondly remembered by all of us.

Professor Ko is survived by his two sons, Ke Ying (柯英) and Ke Ming (柯明), two grandchildren and a brother and four sisters. His wife, Professor Qiu Xuyao (丘绪瑶), passed away in 2012.

Mei Jianjun (Needham Research Institute,
Cambridge);

Thilo Rehren (Science and Technology in Archaeology
Research Center, The Cyprus Institute, Nicosia)

BUMA IX Conference Review

The BUMA conference series has as its traditional focus a regional concentration in the metallurgy of East Asia. However, BUMA IX showcased not only an array of regional metal, alloy, and production case studies and interpretations, but the talks displayed cutting edge and state-of-the-art methods and techniques within the wider fields of archaeometallurgy and archaeometry. Furthermore, metallurgical data from across Eurasia, from East to West Asia, was communicated, offering the conference-goers comparative approaches to consider and discuss in the very social atmosphere during meals and special events. Here I present a very brief summary of each talk, in order to update those who were unable to attend the conference, as well as to show the breadth of materials, methods, and regions covered. The impressive showing of posters is not discussed here, but more information on these, as well as full abstracts and co-author details, can be found online (http://buma9.org/wp-content/uploads/2017/10/BUMA9_AbstractBook.docx%EC%B5%9C%EC%A2%85.pdf).

(October 17) Plenary speaker Hyung Yong Ra and co-authors traced the origins and fabrication techniques of Korean bronze bells in the talk “The Korean Bells: Design and Characteristics”; the session that followed was *Precious Metals and Coinage*, led off with a talk by Jonathan R. Wood and co-authors which focused on Phoenician movement of silver commodities from the Western Mediterranean to the Levant, with proposed chronology as early as the 11th century BC in a talk entitled “The Movement of Silver in the Early Iron Age: A Method to Identify Ore Sources and Mixing”; in their talk “Numismatic and Metallurgical Analysis of Korean Coins in the Ashmolean Museum,” James B. Lewis and colleagues relayed their compositional analyses of the collection to show fluctuating alloy selection over various periods of time, specifically through the amounts of lead and zinc; Marcos Martín-Torres delivered a talk on

behalf of his team that provided insight into the base and precious metal production for objects and accoutrements from the Terracotta Army entitled “Aesthetic and Technology: Gold and Silver Ornaments in the Qin First Emperor’s Bronze Chariots,” based on their long term collaboration researching this assemblage; the next session was *Casting Technology of Bronze and Iron*, beginning with a talk by Yoshiyuki Iizuka and collaborators fusing smelting experiments with metallurgical study of Anyang bronzes in their paper entitled “Experimental Investigation of Bronze Casting Technology with Cassiterite (Tin Oxide) and its Implication for Ancient Chinese Bronze Casting Technology”; in order to trace cultural transfers between various regions of the Buddhist world, Mathilde Mechling et al. presented their work “Indonesian Bronze Casting: Technical Investigations of Thirty-Nine Indonesian Bronze Statues (7th-11th c.) from the Musée National des Arts Asiatiques Guimet, Paris”; the paper “Small-Scale Iron Production in the Big Imperial Network: Technological Choice of Casting Molds from the Taicheng Iron Foundry of the Western Han Dynasty” delivered by WengCheong Lam on behalf of his co-authors explored the ability to utilize spatial patterning of discard remains to understand the cast iron chaîne opératoire of materials and labor.

Srinivasa Ranganathan highlighted the need and beneficial aspects of interdisciplinary collaboration in his Keynote Speech (I) “Crossing Borders: Metals and Materials Heritage and Materials Science Education”; the next session *History of Alloys – Brass, Paktong, and Shiromé* was led off by Chao Huang who synthesized historical documents, archaeology, metallurgy, and field interviews in his presentation “Recent Research on Paktong and Scientific Examination of Ancient Metallurgical Remains from Yunnan Province in Late Imperial China”; advances in mine mill identification and recordation were relayed by Hisao Fukuoka and collaborators in the talk “A Quantitative Analysis of Mine Mills by 3D Laser Scanner”; Eiji Izawa explored the well-known but little studied Japanese alloy of *shiromé* in his talk “The Production and use of ‘*Shiromé*’ (Copper-Arsenic-Lead Alloy and Iron-Copper Speiss) in Pre-Modern Japan”; moving on to the session *Experimental Metallurgy, Survey Methods and Conservation*, Lee Nam Kyu traced the diachronic production of iron in the southern Korean Peninsula in a lecture entitled “Traits of Iron Making Process in Ancient Korea”; Kentaro Minami explored casting and use wear of bronzes in a religious context in “About Casting Surface and Wear Seen from the Surface State of a Mold and a Product – As the Premise of Use Wear Analysis of Bronze Ware”; the final talk in this session was delivered by Daeyoun Cho on the

role of tuyères in the Korean Peninsula, “Iron Production and the Function of the Tuyère in Korea during the Three-Kingdoms Period”.

The session *Swords and Iron Artifacts I* began with a Keynote Speech (II) delivered by conference organizer Mei Jianjun, entitled “The Development of Metal Forging Technology in Pre-Qin China: Some Recent Examination Results”; Constantine Canavas delivered a lecture on the production of fine tools entitled “What Do We Know about the Sharp Penknives in Arabic, Ottoman, and Persian Calligraphy?”; On behalf of co-authors, Manako Tanaka gave a presentation on iron working with a special focus on the properties and requirements of nails with the title “Nondestructive Study of Japanese Iron Nails Excavated from Saga Castle Using X-Ray and Neutron Imaging Techniques to Clarify Material Characteristics and Manufacturing Techniques”; moving onto the next, related session *Swords and Iron Artifacts II*, Filomena Floriana Salvemini reported the work of her team entitled “Samurai’s Swords: A Non-Invasive Investigation by Neutron Techniques,” and invited colleagues to collaborative endeavors making use of instrumentation at the Australian Nuclear Science and Technology Organization; the chaîne opératoire of Japanese sword making was also discussed from metallographic, ethnographic, and historical perspectives by James Scott Lyons in the presentation “Technological Choice in a Medieval Japanese Sword”; the role of iron in Angkorian state-building processes was explored by Stéphanie Leroy and co-authors in the talk “An Integrated Archaeometallurgical Investigation of Architectural Crampons for Documenting the Iron Economy of Angkor, Cambodia (10th to 13th c.)”.

The focus returned to copper alloys with the session *Copper and Bronze Technology I*, with the lecture of TzeHuey Chiou-Peng and colleagues “Metals at Early Bronze Age Sites in Yunnan: Current Studies and Issues” discussing the chronology and technology of metal production and circulation in that region; in an ongoing attempt to understand the transmission of metallurgical technology and flow of raw materials across the Eurasian Steppe through analysis of hundreds of alloys, Thomas R. Fenn presented a talk on behalf of his collaborators entitled “The Flow of Copper Metals in Late Bronze and Early Iron Age Mongolia”; Brice Vincent presented collaborative work based on interdisciplinary analyses in the field and laboratory in the talk “Casting for the King: Archaeometallurgical Investigations of the Royal Palace Bronze Foundry at Angkor Thom, Cambodia (11th-12th century)”; additional excavations and materials characterization of Southeast Asian metallurgy was presented by Martin Polkinghorne in the co-authored talk

“Boeung Samrid: Preliminary Results from Excavations at a 16th Century Royal Bronze Foundry in Cambodia”; Dong-Ik Kim and colleagues presented gilt-bronze hammered, twisted, and drawn wires in their talk “Texture Analysis to Confirm the Ancient Craft Metal Wire Manufacturing Technology in AD 4-5 Centuries in Korea”; *Copper and Bronze Technology II* commenced with Jae Sung Lee et al.’s compositional and production research entitled “Manufacturing Techniques of Ancient Bronze Buddha Statues from Archaeological Sites in Bagan, Myanmar”; Kunlong Chen on behalf of his research team presented their analyses from a key region of metallurgical transfer in a talk entitled “Early Use and Production of Copper in the Ili Valley, Xinjiang, China”; diachronic analyses of alloy change over several centuries can lead to insights into technological and cultural contexts as argued by Ji Zhang in a talk entitled “The Research on Composition and Lead Isotope Ratio of Bronze Vessels during the Eastern Zhou Dynasty”; focusing on a specific artifact group, Kathryn M. Linduff traced metallurgical industry and trade from foundries within Dynastic China to frontier populations in her talk “Production of Metal Dragon Plaques in the Frontiers of East Asia: Buryatia and the Ordos”.

(October 18) The Keynote Speech (III) “Recent Research Concerning Metalwork of Hatti and Hittite in North Central Anatolia: Raw Material, Production, and Regional Interactions” was delivered by Tayfun Yildirim and summarized work in that critical region of early metallurgy; the session *Copper and Bronze Technology III* was led off with a lecture delivered by Martin Odler on behalf of his collaborators that showcased some of the first comprehensive analysis on early Egyptian metallurgy entitled “Archaeometallurgical Study of Early Bronze Age Copper Artefacts from Egypt”; Agnese Benzonelli and colleagues have conducted informative experimentation on the various recipes to reproduce black patinated coppers and presented the results in a talk entitled “Shakudo and Wu-Tong: A Technological Comparison Based on Archaeology and Experiment”; tin plating techniques were explored in Quanyu Wang and colleague’s talk “A Scientific Study of Eastern Zhou Bronze Weapons with Tin Enriched Surface Decoration”; results from the massive copper works at Tonglushan were presented by Chen Shuxiang in his presentation “Archaeological Excavations of Sifangtang Site and Cemetery at Tonglushan in Hubei Province, China”.

Copper and Bronze Technology V was kicked off by a talk delivered by Siran Liu on behalf of his colleagues detailing manufacture, alloying, and raw material circulation of a Shang era site entitled “A Shang Bronze Casting Foundry on the Huai River: Archaeometallurgical

Investigation of Copper Processing Remains from the Site of Taijiasi”; Brett Kaufman relayed the metallurgical results of collaborative research on the earliest monumental Israelite architecture in the talk “Palatial Metal Production at the Davidic Iron Age I/IIA Large Stone Structure”; armor strips recovered from excavations of the mausoleum of Emperor Qin Shi Huang were analyzed by Chunxu Pan and team for a talk entitled “Processing Techniques of Several Chinese Ancient Bronzes from Materials’ Perspective”; Thomas Oliver Pryce highlighted the metallurgical data now accumulating from the relatively poorly understood region of Southeast Asia in “An Outline of Early Southeast Asian Non-Ferrous Base Metal Exchange Networks and Reflections on the Début of Regional Metal Technologies”; non-destructive analysis on an historical collection of copper-based vessels was communicated by Alessandra Giumlia-Mair in her talk “Surface Treatment on Later Chinese Vessels”; the next few talks returned to a focus on iron and steel metallurgy, led off by Francesco Grazi and co-presenters who carried out neutron imaging to study various steel metallurgy traditions in weaponry, presented in the talk “The Ancient Steel Sword Technology Revealed through Neutron Imaging”; S. Jaikishan also presented research on the technology and mechanisms of metal weaponry in “An Innovative System in Cannon Operation was a Detachable Trunnion and Swivel on Stone Pedestal Introduced in Bijapur Kingdom in Medieval Deccan”; Kazuo Miyamoto investigated early Japanese iron metallurgy and trade in the talk “Decarbonized Technique of Cast Iron to Make Wrought Iron Products of the Yayoi Period in Northern Kyushu”.

The session *Iron and Steel Technology II* began with an interregional Keynote Speech (IV) by Jang Sik Park entitled “A Comparative Study on Iron Traditions in Korea, Mongolia, and India”; Niwa Takafumi highlighted technical ceramics in the talk “A Transformation of the Curbed Tuyère in Ancient East Asia”; Tomotaka Sasada presented collaborative work entitled “Two Types of Iron Smelting Furnaces in Ancient Mongolia” which relayed remarkable furnace preservation at the investigated sites; *Iron and Steel Technology IV* began with a talk by Jianli Chen on behalf of his colleague on Han Dynasty iron bloomery and cast iron metallurgy in Shandong Province, China entitled “A Criterion to Distinguish Puddling Steel Based on Slag Analysis”; Paul Craddock synthesized the use of manganese as a flux and as an alloying component in 19th century Britain as well as earlier contexts in the talk “The Many and Varied Roles of Manganese in the Production of Iron and Steel”; David Larreina-Garcia presented a synthesis of historical and archaeological data with economic models in the co-authored talk “Bloomery

Iron Production in Qing China: Rational Economy vs. Economy of Scale”.

The conference drew to a close with two final sessions, *Ores and Metal Production I and II*; Eunwoo Lee combined archaeological research and archaeometric analyses to study diachronic ironworks in the talk “Characterization of the Early Iron-Production Technologies in Chungju, Korea”; Reynaldo R. Avellana chronicled the chronology and metallurgy of the Philippines Metal Age in the talk “New Data for Old Issues: The Metallurgical Case of First Millennium A.D. Bicol, Philippines”; Wenli Zhou on behalf of colleagues presented an in-depth study of zinc hearths, workshops, technical ceramics, and alloys in the talk “Distilling Zinc with Sulphidic Lead-Zinc Ores: The Technology of Zinc Production in Guiyang, Hunan, in Ming and Qing China”; the conference was brought to a close with a collaborative talk delivered by Miljana Radivojević on localized innovations in peripheral steppe zones of early Eurasian metallurgy in the talk “Mining, Metals, and Mountain Corridors: Bronze Age Metallurgy in Semirechye, Kazakhstan”.

MARITIME ARCHAEOLOGY
Nicolás Ciarlo, Associate Editor

Featured in this issue are a note on the behavior of copper and manganese at a copper-sheathed shipwreck in the deep Gulf of Mexico (M. L. Brennan) and an account of recent papers and books, theses, past conference presentations and future meetings.

Current Research

The behavior of Cu and Mn at a copper-sheathed shipwreck in the deep Gulf of Mexico

On December 9, 2017, NOAA ship *Okeanos Explorer* conducted an ROV dive on a reported sonar target in the northern Gulf of Mexico provided by BOEM. Through telepresence, a team of archaeologists and scientists participated in the dive in real time and together made the discovery of an early-mid nineteenth century shipwreck at a depth of 686 m, the hull of which had been sheathed with copper plating. This was common on wooden vessels between c. 1780-1870 to act as a biofouling agent and to prevent growth of barnacles and destruction of the hull by wood-boring mollusks (McCarthy 2005:109). This shipwreck is not the first copper-sheathed wreck found in deep water in the Gulf of Mexico. In 2012 and 2013, three shipwrecks were found during expeditions of *Okeanos Explorer* and E/V *Nautilus* that are within 5 miles of each other and believed to have sunk as a group

(Irion et al. 2014). Monterrey A and C are both wrecks of copper-sheathed ships at depths of 1330 and 1308 m.

During the 2013 expedition to Monterrey A, which focused on targeted excavation, key artifact recovery, and scientific sampling, sediment push cores were collected with an ROV adjacent to the copper sheathing on the outside of the wreck and 60 m away from the site as a control. Geochemical analysis showed both Cu and Pb enriched in the cores from the wreck relative to the control, with the highest concentrations in the upper 5 cm, suggesting ongoing corrosion and flux of those metals to the sediments. In addition, Mn was found to be elevated in the upper 5 cm of the sediment near the wreck, but depleted in those at the control site, which is also caused by the presence of the copper sheathing. The copper continues to act as a biofoulant in the deep sea and causes a suboxic halo where it forces Mn to act in its suboxic state. The depletion in oxygen near the copper remnants releases manganese from reduced oxyhydroxides (Muñoz et al. 2012). Manganese is highly mobile in reducing sediments and can transport other metals across both the sediment/water and oxic/suboxic interfaces, the latter of which was measured at ~7 cm in the Monterrey A cores. The elevated concentration of Mn in the upper section of the cores from the wreck reflects the reduction of oxyhydroxides by the suboxic halo around the copper and sinking of Mn into the sediments.

Part of the objectives of this multidisciplinary research at the Monterrey wrecks, and soon to include the new wreck discovered by *Okeanos Explorer*, is to conduct environmental characterization of these wrecks to determine the site formation processes in the deep sea. The uncommon presence of copper sheathing at these wrecks adds an additional characteristic that has an important impact on how organisms colonize and behave at these sites. Further investigations of copper-sheathed shipwrecks will help define the role of Cu and Mn in site formation processes in the deep ocean.

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Recent Publications

International Journal of Nautical Archaeology. From *IJNA* 2017, Vol. 46, No. 2: "The Hull Construction of Yenikapı 14 (YK 14), a Middle Byzantine Shipwreck from Constantinople's Theodosian Harbour, Istanbul, Turkey" (M. R. Jones); "Warwick: report on the excavation of an early 17th-century English shipwreck in Castle Harbour, Bermuda" (P. Bojakowski & K. Custer-Bojakowski); "*H. L. Hunley* Revealed: documentation, deconcretion, and recent developments in the investigation of an American Civil War submarine from 1864" (M. P. Scafuri); "The Opening and Closing Sequences of the Battle of Jutland 1916 Re-examined: archaeological investigations of the wrecks of HMS *Indefatigable* and SMS *V4*" (I. McCartney); "Using Sector-Scan Sonar for the Survey and Management of Submerged Archaeological Sites" (J. C. Henderson & B. Abbott); and "Seamen on Land? A Preliminary Analysis of Medieval Ship Graffiti on Cyprus" (S. Demesticha et al.).

Journal of Archaeological Sciences: Reports. From Vol. 14: "Artillery and rigging artefacts from the Megadim wreck-site, Israel" (D. Ashkenazi et al.); "The influence of fish bone morphology on aquatic transport: An experimental approach through elements of Creole perch (Percichthyidae: *Percichthys trucha*; [Valenciennes, 1833])" (M. Corbat et al.); "Chemical composition and provenance of Chinese porcelain shards recovered from Old Goa, west coast of India" (S. Tripathi et al.); "Combining chert provenance and least-cost pathway analyses to reconstruct Pre-Dorset and Dorset mobility on southern Baffin Island" (R. E. ten Bruggencate et al.); and "Resilience or wipe out? Evaluating the convergent impacts of the 8.2 ka event and Storegga tsunami on the Mesolithic of northeast Britain" (C. Waddington & K. Wicks); Vol. 15: "Late Pleistocene-Holocene shoreline reconstruction and human exploitation of molluscan resources in northern Pieria, Macedonia, Greece" (A. Krahtopoulou & R. Veropoulidou); "The population of Can Reiners. Demography and life conditions on Mallorca (Balearic Islands, Spain) during the Middle Ages" (E. Fiorin et al.); "Coastal subsistence and settlement at the Hane dune site, Ua Huka (Marquesas Islands): New insights from Pacific rat (*Rattus exulans*)

stable isotope analysis" (J. A. Swift et al.); "Genomic and proteomic identification of Late Holocene remains: Setting baselines for Black Sea odontocetes" (V. Biard et al.); "Oyster paleoecology and Native American subsistence practices on Ossabaw Island, Georgia, USA" (I. H. Lulewicz et al.); "The contribution of Late Pleistocene megafauna finds to submerged archaeology and the interpretation of ancient coastal landscapes" (S. Claesson et al.); and "Quantifying variability in stable carbon and nitrogen isotope ratios within the skeletons of marine mammals of the suborder Caniformia" (C. T. Clark et al.); and Vol. 16: "Thermodynamics of a brazier cooking system modeled to mimic the lead brazier of a Roman ship" (A. Mosyak et al.); "DNA analysis of human skeletal remains from the 1845 Franklin expedition" (D. Stenton et al.); and "Hartnell's time machine: 170-year-old nails reveal severe zinc deficiency played a greater role than lead in the demise of the Franklin Expedition" (J. R. Christensen et al.).

Quaternary International. From Vol. 443, Part B: "Cyanobacteria and testate amoeba as potential proxies for Holocene hydrological changes and climate variability: Evidence from tropical coastal lowlands of SW India" (R. B. Limaye et al.); "Holocene environmental changes as recorded in sediments of a paleodelta, southwest coast of India" (A. C. Narayana et al.); and "Holocene climatic vicissitudes and sea level changes in the south western coast of India: Appraisal of stable isotopes and palynology" (S. Vishnu Mohan et al.); Vol. 444, Part A: "Testing the numerical models for boulder transport through high energy marine wave event: An example from southern Saurashtra, western India" (D. Gandhi et al.); Vol. 444, Part B: "Early colonization of Beringia and Northern North America: Chronology, routes, and adaptive strategies" (B. A. Potter et al.); Vol. 447: "A high resolution record of rare earth element compositional changes from the mud deposit on the inner shelf of the East China Sea: Implications for paleoenvironmental changes" (B. Mi et al.); and "Climate of the late Pleistocene and early Holocene in coastal South China inferred from submerged wood samples" (K. Fang et al.); Vol. 449: "Late Quaternary sea-level changes and early human societies in the central and eastern Mediterranean Basin: An interdisciplinary review" (J. Benjamin et al.); Vol. 452: "Palaeotsunami in the East China Sea for the past two millennia: A perspective from the sedimentary characteristics of mud deposit on the continental shelf" (W. Yang et al.); and "ENSO variability around 2000 years ago recorded by *Tridacna gigas* $\delta^{18}\text{O}$ from the South China Sea" (H. Yan et al.); Vol. 456: "Radiocarbon dating of coastal boulders from Kouzushima and Miyake islands off Tokyo Metropolitan Area, Japan: Implications for coastal hazard

risk" (A. Kitamura et al.); and "Reconstruction of tsunami history based on event deposits in the Niigata area, eastern coast of the Sea of Japan" (A. Urabe); Vol. 459: "Mineral magnetic properties of Holocene sediments in the subaqueous Yangtze delta and the implications for human activity and early diagenesis" (D. Pan et al.), and other papers of this special issue, titled "Marine Geology in Asian Marginal Seas: ICAMG-8" (G. Y. Kim, S. Yang & Y. J. Lee, eds.).

The following articles published in journals on Archaeology-related topics up to December 2017 are worth mentioning: *American Antiquity*, Vol. 82, No. 3: "Aquatic adaptations and the adoption of arctic pottery technology: results of residue analysis" (S. L. Anderson et al.); and "The earliest shell fishhooks from the Americas reveal fishing technology of Pleistocene maritime foragers" (M. R. Des Lauriers et al.); *Anthropocene*, Vol. 19: "Anthropogenic overprints on natural coastal aeolian sediments: A study from the periphery of ancient Caesarea, Israel" (G. Shtienberg et al.); *Antiquity*, Vol. 91, No. 359: "Understanding the layout of early coastal settlement at Unguja Ukuu, Zanzibar" (T. Fitton & S. Wynne-Jones); and Vol. 91, No. 360: "Exploring the emergence of an 'Aquatic' Neolithic in the Russian Far East: organic residue analysis of early hunter-gatherer pottery from Sakhalin Island" (K. Gibbs et al.); *Archaeological and Anthropological Sciences*, Vol. 9, No. 5: "Zanzibar and Indian Ocean trade in the first millennium CE: the glass bead evidence" (M. Wood et al.); and "Strontium isotope evidence for long-distance immigration into the Byzantine port city of Aila, modern Aqaba, Jordan" (M. A. Perry et al.); Vol. 9, No. 6: "Palaeoenvironmental analysis of large-scale, high-resolution GPR and magnetometry data sets: the Viking Age site of Gokstad in Norway" (P. Schneidhofer et al.); and "Iron artefacts from the Akko Tower Wreck, Israel, and their contribution to the ship's characterization" (M. Cohen et al.); *Archaeological Research in Asia*, Vol. 11: "Trade and consumption of fine paste ware in Southeast Asia: Petrographic and portable X-ray fluorescence analyses of ninth- to fourteenth-century earthenware" (K. Ueda et al.); and Vol. 12: "Methodological considerations for ichthyoarchaeology from the Tron Bon Lei sequence, Alor, Indonesia" (S. C. Samper Carro et al.); *Archaeometry*, Vol. 59, No. 5: "The Resinous Cargo of the *Java Sea Wreck*" (J. B. Lambert et al.); *Arqueología*, Vol. 23, No. 3: this dossier compiles a series of presentations from the symposium "Zooarqueología de ambientes acuáticos continentales y marinos" (*IV Congreso Nacional de Zooarqueología Argentina*, October 2016, Ushuaia, Tierra del Fuego), focused on the analysis of archaeofaunistic remains associated with past human

activities in different aquatic scenarios of Argentina (P. D. Escosteguy & R. Frontini, eds.); *Environmental Archaeology*, Vol. 22, No. 4: “An Ethnoarchaeological Study on Anthropogenic Markers from a Shell-midden in Tierra del Fuego (Southern Argentina): Lanashuaia II” (D. Zurro et al.); *Geoarchaeology*, Vol. 32, No. 6: “Formation processes of coastal archaeological sites: A changing prehistoric scenario on the Atlantic shore of Uruguay” (H. Inda et al.); *Heritage Science*, Vol. 5: “Porcelain shards from Portuguese wrecks: Raman spectroscopic analysis of marine archaeological ceramics” (E. A. Carter et al.); *Historical Archaeology*, Vol. 51, No. 3: this dossier is dedicated to “The Mardi Gras Shipwreck: The Archaeology of an Early Nineteenth-Century Wooden-Hulled Sailing Ship” (C. E. Horrell & A. A. Borgens, eds.); along with other remarkable papers, the following can be highlighted: “The Mardi Gras Shipwreck Project: Overview of Methods and Tools” (J. B. Irion); and “The Mardi Gras Shipwreck Project: A Final Overview with New Perspectives” (C. E. Horrell & A. A. Borgens); *Journal of Archaeological Method and Theory*, Vol. 24, No. 3: “Multi-Image Photogrammetry to Record and Reconstruct Underwater Shipwreck Sites” (K. Yamafune et al.); and “Exploring Accumulation Rates of Shell Deposits Through Seasonality Data” (N. Hausmann & M. Meredith-Williams); *Journal of Archaeological Sciences*, Vol. 86: “Radiogenic and ‘stable’ strontium isotopes in provenance studies: A review and first results on archaeological wood from shipwrecks” (F. Hajj et al.); Vol. 87: “Little Ice Age catastrophic storms and the destruction of a Shetland Island community” (M. Bampton et al.); and Vol. 88: “Artists before Columbus: A multi-method characterization of the materials and practices of Caribbean cave art” (A. V. M. Samson et al.); *Journal of Cultural Heritage*, Vol. 28: “The ancient metallurgy in Sardinia (Italy) through a study of pyrometallurgical materials found in the archaeological sites of Tharros and Montevecchio (West Coast of Sardinia)” (T. de Caro); and “The importance of cellulose content and wood density for attack of waterlogged archaeological wood by the shipworm, *Teredo navalis*” (A. M. Eriksen et al.); *Journal of Human Evolution*, Vol. 112: “Dental phenotypic shape variation supports a multiple dispersal model for anatomically modern humans in Southeast Asia” (J. Corny et al.); *Journal of Maritime Archaeology*, Vol. 12, No. 2: “Rapid, Quantitative Assessment of Submerged Cultural Resource Degradation Using Repeat Video Surveys and Structure from Motion” (J. R. Mertes et al.); and “The Plurality of Harbors at Caesarea: The Southern Anchorage in Late Antiquity” (A. Ratzlaff et al.); *Quaternary Science Reviews*, Vol. 168: “Early human occupation of a maritime desert, Barrow Island, North-West Australia”

(P. Veth et al.); Vol. 170: “Pottery use by early Holocene hunter-gatherers of the Korean peninsula closely linked with the exploitation of marine resources” (S. Shoda et al.); and “The fluvial evolution of the Holocene Nile Delta” (B. T. Pennington et al.); and Vol. 171: “Oldest human occupation of Wallacea at Laili Cave, Timor-Leste, shows broad-spectrum foraging responses to late Pleistocene environments” (S. Hawkins et al.); and “A late Quaternary record of seasonal sea surface temperatures off southern Africa” (E. Loftus et al.); finally, from *The Journal of Island and Coastal Archaeology*, Vol. 12, No. 4: “Revealed by Waves: A Stratigraphic, Palaeoecological, and Dendrochronological Investigation of a Prehistoric Oak Timber and Intertidal Peats, Bay of Ireland, West Mainland, Orkney” (S. Timpany et al.); and “Modeling Breastfeeding and Weaning Practices (BWP) on the Coast of Northern Chile’s Atacama Desert During the Formative Period” (E. K. Smith et al.).

There are also some interesting papers from other non-archaeological journals: *Arms and Armour*, Vol. 14, No. 2: “Flintlock brass fittings from the 19th-century Akko 1 shipwreck, Israel” (Cvikel et al.); *Australian Journal of Earth Sciences*, Vol. 64, No. 6: “Late Holocene inter-annual temperature variability reconstructed from the $\delta^{18}\text{O}$ of archaeological *Ostrea angasi* shells” (S. Tynan et al.); *Computers and Electronics in Agriculture*, Vol. 141: “Automatic system for improving underwater image contrast and color through recursive adaptive histogram modification” (A. S. Abdul Ghania & N. A. Mat Isa); *Corrosion Science*, Vol. 123: “A method of conserving ancient iron artefacts retrieved from shipwrecks using a combination of silane self-assembled monolayers and wax coating” (D. Ashkenazi et al.); *Current Biology*, Vol. 27, No. 20: “Genetic Discontinuity between the Maritime Archaic and Beothuk Populations in Newfoundland, Canada” (A. T. Duggan et al.); *Dyes and Pigments*, Vol. 147: “Decorated floor tiles from the 19th-century Akko Tower shipwreck (Israel): Analysis of pigments and glaze” (D. Ashkenazi et al.); *IEEE International Instrumentation and Measurement Technology Conference (2017)*: “Investigation of artefacts retrieved from a shipwreck of Vasco da Gama using X-ray Computed Tomography” (J. M. Warnett et al.); *Journal of Analytical and Applied Pyrolysis*, Vol. 126: “Potential of pyrolysis-GC-MS molecular fingerprint as a proxy of Modern Age Iberian shipwreck wood preservation” (M. Traoré et al.); *Journal of Radioanalytical and Nuclear Chemistry*, Vol. 311, No. 2: “Development of a multi-analytical approach for the characterization of ancient Roman lead ingots” (M. Clemenza et al.); *Marine Geology*, Vol. 389: “Reciting the layers: Evidence for past tsunamis at Mataora-Wairau

Lagoon, Aotearoa-New Zealand” (D. N. King et al.); *Materials Characterization*, Vol. 131: “Metallurgical characterization of brass sheet from the 19th-century Akko Tower Wreck (Israel)” (D. Cvikel et al.); *Metallography, Microstructure, and Analysis*, Vol. 6, No. 1: “Two Nails 2400 Years Apart: Metallurgical Comparison Between Copper Nails of the Ma‘agan Mikhael Ship and Its Replica” (D. Cvikel et al.); and Vol. 6, No. 2: “Iron-Bound Deadeyes from the Nineteenth-Century Akko Tower Wreck, Israel: Metallurgical Investigation of the Manufacturing Technology” (I. Voiculescu et al.); *Microchemical Journal*, Vol. 135: “A multivariate approach to the study of orichalcum ingots from the underwater Gela’s archaeological site” (E. Caponetti et al.); *Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 482: “Foraminifera as markers of Holocene sea-level fluctuations and water depths of ancient harbours — A case study from the Bay of Elaia (W Turkey)” (M. Seeliger et al.); Vol. 484: “Shell sclerochronology and stable isotopes of the bivalve *Anomalocardia flexuosa* (Linnaeus, 1767) from southern Brazil: Implications for environmental and archaeological studies” (A. C. Colonese et al.); and “Investigating $\delta^{18}\text{O}$ of *Turbo sarmaticus* (L. 1758) as an indicator of sea surface temperatures” (M. Galimberti et al.); and Vol. 487: “Holocene sedimentology and coastal geomorphology of Zakynthos Island, Ionian Sea: A history of a divided Mediterranean island” (P. Avramidis et al.); *Palynology*, Vol. 41, No. 4: “Insights into the manufacture of laced watercraft through a pollen analysis of the fibrous materials from Roman-era laced boats of the upper Adriatic, Italy” (S. Willis); *Quaternary Geochronology*, Vol. 42: “The local marine reservoir effect at Kalba (UAE) between the Neolithic and Bronze Age: An indicator of sea level and climate changes” (S. Lindauer et al.); *Radiocarbon*, Vol. 59, No. 2: “Iron Bar Trade between the Mediterranean and Gaul in the Roman Period: ^{14}C Dating of Products from Shipwrecks Discovered off the Coast of Saintes-Maries-de-la-Mer (Bouches-du-Rhône, France)” (E. Delqué-Količ et al.); *Review of Palaeobotany and Palynology*, Vol. 246: “Studying the preservation of plant macroremains from waterlogged archaeological deposits for an assessment of layer taphonomy” (F. Antolín et al.); finally, from *Science of the Total Environment*, Vol. 609: “Biodeterioration of marble in an underwater environment” (B. Cámara et al).

A Cromwellian Warship wrecked off Duart Castle, Mull, Scotland, in 1653 (C. J. M. Martin), ISBN 978-1908332110. This volume covers the complete archaeological research of a warship, believed to be the *Swan*, wrecked in 1653 off Duart Point, Mull, Scotland. The investigation, carried out by a team of maritime

archaeologists from St Andrews University over 25 years, includes the excavation and record of the hull remains, as well as a comprehensive study of the associated materials. This research shed light on its architectural characteristics, functionality and life on board, and site formation processes. The historical and archaeological data around the shipwreck is carefully integrated with information provided by different specialists involved in the characterization of the remains. The following chapters are worth mentioning: “Ballast” (J. McManus); “Animal bones” (C. Smith); “Fish bones” (R. L. Parks & J. H. Barrett); “The composition and properties of ‘refined’ iron: a metallurgical analysis of Gun 8” (I. MacLeod); “Isotopic composition of human remains” (W. Meier-Augenstein); and “Stable isotopic data analysis for rib and femur collagen” (P. Ditchfield).

British Archaeological Reports (BAR). The following book published in late 2017 by Archaeopress is of particular interest: *Shipwrecks and Provenance: In-Situ Timber Sampling Protocols, with a focus on wrecks of the Iberian shipbuilding tradition* (S. Rich, N. Nayling, G. Momber & A. Crespo Solana), Access Archaeology No. 42, ISBN 978-1784917173. The book abstract, kindly provided by S. Rich, is presented below.

Two of the questions most frequently asked by archaeologists of sites and the objects that populate them are ‘How old are you?’ and ‘Where are you from?’ These questions can often be answered through archaeometric dating and provenance analyses. As both archaeological sites and objects, shipwrecks pose a special problem in archaeometric dating and provenance because when they sailed, they often accumulated new construction material as timbers were repaired and replaced. Additionally, during periods of globalization, such as the so-called Age of Discovery, the provenance of construction materials may not reflect where the ship was built due to long-distance timber trade networks and the global nature of these ships’ sailing routes. Accepting these special challenges, nautical archaeologists must piece together the nuanced relationship between the ship, its timbers, and the shipwreck, and to do so, wood samples must be removed from the assemblage. Besides the provenance of the vessel’s wooden components, selective removal and analysis of timber samples can also provide researchers with unique insights relating to environmental history. For this period, wood samples could help produce information on the emergent global economy; networks of timber trade; forestry and carpentry practices; climate patterns and anomalies; forest reconstruction; repairs made to ships and when, why, and where those occurred; and much more. This book is a set of protocols to establish the need for wood samples from shipwrecks and

to guide archaeologists in the responsible removal of samples for a suite of archaeometric techniques. While these protocols will prove helpful to archaeologists working on shipwreck assemblages from any time period and in any place, this book uses Iberian ships of the 16th to 18th centuries as its case studies because their global mobility poses additional challenges to the problem at hand. At the same time, their prolificacy and ubiquity make the wreckage of these ships a uniquely global phenomenon.

Ed Rachal Foundation Nautical Archaeology Series.

The Series book: *La Belle: The Archaeology of a Seventeenth-Century Vessel of New World Colonization*, edited by J. E. Bruseth, A. A. Borgens, B. M. Jones & E. D. Ray, Texas A&M University Press, ISBN 978-1623493615, is the final monograph of the research conducted at *La Belle* (1686). This exploratory ship was one of the four vessels used in 1685 by Robert Cavelier, Sieur de la Salle, in his failed attempt to settle a French colony at the mouth of the Mississippi River. The *La Belle* sunk in Matagorda Bay, Texas. The ship's structure and over 1.8 million artifacts recovered from the site were thoroughly studied since 1996-1997, under a project led by James E. Bruseth, former archaeologist at the Texas Historical Commission. Regarding specialized analyses, the following chapters are of special interest: "Human Skeletal Analysis" (G. Steele & M. J. Raisor); "Facial Reconstruction and DNA Analysis of Skeletal Remains" (W. Smith et al.); "Pigments" (M. Mekoli et al.); "Organic Contents from Storage Containers" (D. W. Von Endt et al.); and "Ballast Stone" (J. E. Bruseth); along with other intriguing chapters.

Ships and Maritime Landscapes. This book, edited by J. Gawronski, A. van Holk & J. Schokkenbroek, ISBN 978-9492444141, compiles a selection of papers from the *Thirteenth International Symposium on Boat and Ship Archaeology* (ISBSA 13) held at Amsterdam in 2012. Chapters cover a wide range of themes, including the spatial analysis of shipwrecks, documentation and digital modelling, dating by means of dendrochronology, characterization of artifacts, and geophysical survey. Among others, the following contributions can be mentioned: "Physical and digital modelling of the Newport medieval ship original hull form (England)" (T. Jones et al.); "Connecting maritime landscapes. Or early modern news from two former 'Baltic Cogs' (Mecklenburg-West Pomerania, Germany)" (M. Belasus); "Moulds and architectural signs in the skeleton first construction. A methodology to reconstruct the original hull shape of the Cais do Sodr  shipwreck (Lisbon, Portugal)" (M. Nicolardi & F. Castro); "Timber-regionality and temporality in Northern Europe's

shipbuilding resource" (A. Daly); "A Sticky Business. Characterizing non-wooden shipbuilding materials using intensive analytical techniques" (L. White & B. Stern); "3D Survey of the Archaic ship model H90 from Samos (Greece)" (K. A. Damianidis & A. Valanis); "The Roskilde 6 ship (Denmark). Reconstructing the longest warship find of the Viking Age" (M. G thche & K. Str tkvern); "The Arles-Rh ne 3 project (Arles, France). From the excavation and raising of a Gallo-Roman barge to its documentation and 3D-modelling (2011-2012)" (S. Marlier et al.); "The Skjern ysund 3 wreck (Norway). An example of long distance timber trade in the late 14th century" (J. Auer); "Mapping two shipwrecks in the Fehmarn Belt (Baltic Sea). Results of geophysical surveys prior to underwater research" (S. van den Brenk et al.); "The Akko 1 shipwreck (Israel). New evidence on the ship and its wrecking" (D. Cvikel).

Studying Scientific Archaeology. The Series No. 3: *Molluscs in Archaeology. Methods, approaches and applications*, edited by M. J. Allen, ISBN 978-1785706080, deals with the study of land, freshwater and marine mollusks from archaeological sites. The chapters cover the analysis and interpretation of mollusks remains found both as food waste and as tools and ornaments, examining diet, economy, and land-use of past populations, among other topics. In particular, the section 'Marine and food and diet' includes the following works: "Marine molluscs from archaeological contexts; how they can inform interpretations of former economies and environments" (L. Somerville et al.); "Oysters in archaeology" (J. Winder); "Shell middens" (K. Hardy); and "The collection, processing and curation of archaeological marine shells" (G. Campbell). In the final section, titled 'Science and Shells', the chapter "Radiocarbon dating of marine and terrestrial shell" (K. Douka) is worth mentioning.

Theses

In late 2017, the Ph.D. dissertation *Analysis of 16th to 19th Century Silver Coins* was presented by Liesel Gentelli at the University of Western Australia. Abstract (submitted by the author): This thesis demonstrates the application of a number of analytical techniques on a selection of silver coins from the Western Australian Museum. Results of analysis are used to appraise the applicability of surface analytical techniques on samples that have been corroded. Analyses have also been used to determine when, where and how coins too heavily corroded to visually identify were minted. Four hundred shipwreck silver coins and a selection of silver artifacts were provided for analysis from the collection of the Western Australian Museum. The coins represent 22 mints in Spain, Spanish America, the United Netherlands,

Germany, and the Spanish Netherlands, minted between 1560 and 1816. Samples were analyzed using non-destructive analytical techniques: inductively coupled plasma mass spectrometry (ICP-MS) and scanning electron microscopy (SEM). These non-destructive techniques were chosen in order to demonstrate their effectiveness in gleaning further information from items of cultural heritage significance, than is possible through a visual analysis alone. Silver coins and artifacts were chosen for analysis due to the large assemblage of silver coins held by the Western Australian Museum, making it possible to create a database of analytical results from coins of both known and unknown mint of origin and year of minting for the sake of effective comparison. This research provides new information about economic networks, including trade between the Americas, Europe and the Far East during the 16th, 17th and 18th centuries, the height of the great maritime empires, and more specifically, the procurement, manufacture and trade of silver as a global commodity at this time. Further, the techniques used in this study are applicable to many other items of cultural heritage significance for future analysis.

Previous Meetings and Conferences

Mediterranean Maritime Archaeology. Under the Mediterranean: 100 years on... The Honor Frost Foundation Conference was held from 20th to 24th October 2017 in Nicosia. Alongside several lectures in memory of Honor Frost and her extensive research career on Mediterranean maritime archaeology, a wide range of presentations on ongoing projects took place at this meeting. It is worth to mention the following communications: “Geoarchaeological Investigations on the Roman Harbour of Pollentia (Bay of Alcúdia, Mallorca, Spain)” (M. Giaime et al.); “Geo-Archaeological Investigations at the Submerged Remains of Ancient Olous (Crete): Preliminary Results from 2015” (T. Theodoulou et al.); “Marine Geophysical Implications in the Ancient Harbour of Byblos, Lebanon” (G. Papatheodorou et al.); “The Geoarchaeology of Natural Hazards in Ancient Harbours” (C. Morhange et al.); “Marine Biofouling and Wreck-Site Formation Processes of the Kyrenia Shipwreck (Cyprus)” (C. Jimenez et al.); “Post-Depositional Underwater Processes in Ceramics Found in an Oxygenated Environment at the Byzantine Anchorage of Dor, Israel” (R. Shahack-Gross et al.); “Dead vs. Med.: Characterization of Waterlogged Wood Finds from the Dead Sea and the Mediterranean” (A. Oron et al.); “The 3D Technologies for the Archaeology in the Deep Sea: the Danton French Battleship (Cagliari, Italy)” (M. L’Hour et al.); “The RAM3D Database Project: A Web Portal for the Study of Ancient Mediterranean Warships and Ramming” (W. M. Murray); and “Looking for the Harbour of Classical Torone:

Underwater Exploration and Geophysical Prospection” (T. Hillard & L. Beness); along with other oral presentations and posters about research on maritime cultural landscapes; applications of geoarchaeology, photogrammetry, and materials characterization for the analysis of shipwrecks; and new approaches to ports, harbors and anchorages in the Ancient Mediterranean.

3rd Asia-Pacific Regional Conference on Underwater Cultural Heritage (APCONF). *The Maritime Cultural Landscapes and Seascapes of Asia-Pacific: Voyaging, Migration, Colonisation, Trade, and Cross-Cultural Contacts.* This meeting was held from 27th November to 2nd December 2017, at the Hong Kong Maritime Museum –Major Sponsor and Venue Partner (see <http://www.apconf.org/>). Among a wide variety of presentations, the following can be highlighted: “Some Methodologies of Photogrammetric Recording on Underwater Cultural Heritage Sites” (K. Yamafune); “Development of Sledge-Type Underwater Metal Detection System for Underwater Cultural Heritage Exploration” (Y. H. Jung et al.); “Seeing the forest for the trees: A holistic study of Southeast Asian shipwreck assemblages” (B. Fahy); “On-site monitoring of wooden shipwrecks found in Korea’s intertidal zone” (M. Y. Cha & T. Kim); and “Archaeological Scientific Analysis of Underwater Excavation Ceramics” (M. N. Kyung & H. J. Yong).

Call for papers

15th International Symposium on Boat and Ship Archaeology (ISBSA 15). This meeting will be held from 22nd to 27th October 2018 in the MuCem Museum, Marseilles, France. The 15th ISBSA is organized by Centre Camille Jullian (Aix Marseille University, French National Center for Scientific Research, Ministry of Culture). The main theme will be *Open Sea – Closed Sea. Local and inter-regional traditions in shipbuilding.* During this meeting, the particular characteristics of local and regional shipbuilding traditions in enclosed seas, the interregional influences at a broader open sea scale, as well as the processes of change and technological transfer, will be discussed. Apart from this theme, other contributions will be especially welcome: recent discoveries of significant ship finds, studies in ship construction, advances in research methods, experimental nautical archaeology, and nautical ethnography. For further information, visit the ISBSA website www.isbsa.org | www.facebook.com/ISBSA, or contact the secretariat at isbsa15@isbsa.org.

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