SAS Bulletin

Newsletter of the Society for Archaeological Sciences

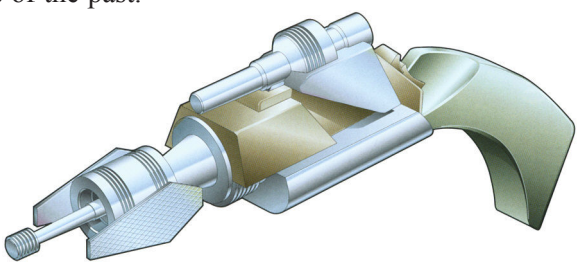
Volume 32 number 4 Winter 2009

pScience

At a trade show and expo for analytical chemists I recently attended, there were more vendors hocking portable (p) XRF "guns" and other devices one might expect to see on Star Trek than Leonard Nimoy could have imagined. What's all the fuss about 'pScience' anyway? After all, there's nothing sexier than a benchtop ICP, right? For this—my *final*—issue of the *SAS Bulletin*, I would like to offer a commentary on the good, the bad, and the ugly of portable scientific instruments for archaeologists. This is my "parting shot," if you will.

First, the good. Given the growing awareness of the world's population concerning the importance of protecting cultural heritage, especially in nascent nation states that are increasingly linking their present to their past, archaeological objects are much less free to travel today than in recent times. Portable analytical devices allow archaeologists to study materials *in situ* (non-destructively and at low cost), even when the *situ* is a museum display case. Score one for pScience.

Now for the bad. With the enhanced portability of physico-chemical instruments, everyone and their grandmother are using them. This is fine, of course, except that many archaeologists have developed a "point and shoot" mentality, where anything and everything at an archaeological site is fair game. This "laser tag" approach to archaeological science is resulting in a dramatic increase in inductive research designs, where the aim is to collect as many data as possible and then figure out the research question back in the armchair. I'm afraid of this kind of science, because it teaches students that hypothesis testing and deductive reasoning, like artifacts themselves, are becoming things of the past.



The "next generation" of pXRF? A mainstay of the Klingon arsenal—the directed-energy Klingon Disruptor, ca. AD 2266. (Be careful, Klingons don't take prisoners.)

And finally, the ugly. I was at a conference last month and heard several presentations on pXRF analyses of *in situ* soils at archaeological sites. I was amazed at how patterns of chemical compositional data were being interpreted *sui generis*—without the archaeological context and broader understanding of soil chemistry that is required to understand the data. Enrichments in this or that combination of elements were inferred as human induced changes to the soilscape having behavioral significance. How can interpretations of soil chemical data be justified in the absence of understanding the soil environment? My point: there is a danger inherent in the application of pScience in that it discourages the kinds of scientific collaborations between archaeologists and geologists and chemists and biologists and the like that are truly necessary for archaeological science. (In this issue, I am proud to highlight the work of Katherine Hayes, whose research in this domain is an excellent example of how one *should* proceed.)

Don't get me wrong—I love portable stuff. I just bought a portable fiber optic spectrometer. But I hope that we as a community of archaeological scientists can stick together and demand that such instruments be used properly in the aid of empirical science. And with that, I curmudgeonly conclude five years of commentary in the *SAS Bulletin*. It has been a remarkably wonderful and highly valuable experience. I look forward to hearing your pScience presentation in Tampa at the 2010 ISA.

E. Christian Wells, Editor

In This Issue

Employment Opportunities

The Department of Archaeology at Boston University seeks a **distinguished Classical Archaeologist to fill the James R. Wiseman Chair of Archaeology**. The ideal candidate, who will be appointed with tenure effective 1 September 2010, will be a leader in the discipline with substantial experience in field research and a commitment to excellence in teaching. Preference will be given to candidates with active research in the historical periods of Greece, Italy, and the Western Mediterranean. Application letter, curriculum vitae, and the names of three referees should be sent by 15 December 2009 to Professor Ricardo J. Elia, Boston University, Department of Archaeology, 675 Commonwealth Avenue, Boston, Massachusetts 02215, USA.

Boston University's Department of Archaeology announces a **tenure-track opening for an Assistant Professor in Mesoamerican Archaeology** effective 1 September 2010; regional and period specializations open. Ph.D. is required, together with an ongoing research program. Candidates should be prepared to teach general archaeology courses in addition to courses in their special field at both the undergraduate and graduate levels. Application letter, curriculum vitae, published paper or sample of writing, and the names of three referees should be sent by December 15, 2009 to: Professor Mary C. Beaudry, Boston University, Archaeology Department, 675 Commonwealth Avenue, Boston, Massachusetts 02215, USA.

The Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, invites applications for a **Leader of an Independent Junior Research Group** on "The Origin of Human Subsistence." Over the last several million years, hominins have developed diverse strategies to extract energy from their environment. New questions and models have arisen to address the relationship between this evolution and the evolution of life histories, technological adaptations and, more broadly, social organization and economy of ancient humans. From the origin of meat consumption to the intensification of the environmental exploitation by late Paleolithic hunter-gatherers, subsistence involves the continuous interaction between cultural and biological changes. For the new group, multidisciplinary approaches, with a broad range of methods ranging from classical zooarchaeology, to isotopic studies and modeling, are preferred. The Max Planck Institute for Evolutionary Anthropology has five departments, including the Department of Human Evolution (Director: Jean-Jacques Hublin) with which the Independent Junior Research Group will be associated. More information may be obtained at http://www.eva.mpg.de/ and http://www.eva.mpg.de/evolution. This is a fulltime research position. The salary will be at the W2 level on the German university scale, equivalent to an assistant/associate professor. Funds for conducting research, including salaries for a second post-doctoral scientist and two technical assistants are available. The appointment will be for a term of 5 years. Applicants should have demonstrated outstanding research potential and clear evidence of achievement. Applicants should have a Ph.D. obtained within the last 5 years. The Max Planck Society is committed to employing more handicapped individuals and to increasing the share of women in areas where they are underrepresented, and therefore expressly encourages applications from such qualified individuals. Applications should include a CV, a detailed research plan, and the names of three referees and must be received at the address below by December 31, 2009: Max Planck Institute for Evolutionary Anthropology, Personnel Department, Deutscher Platz 6, 04103 Leipzig, Germany.

The Department of Sociology and Anthropology and the Program in Archaeology at The College of Wooster invite applicants for a **one-year position as visiting assistant professor of Anthropology** for 2010-11. We are seeking an anthropological archaeologist who can teach introductory courses in anthropology (four-field approach) and archaeology, a mid-level course in archaeological method and theory, and two of the following: introduction to physical anthropology, political anthropology, and a cultural area course (other than East Asia). Geographical and topical areas of expertise are open. Successful candidate will also advise students in Junior and Senior Independent Study theses. Ph.D. in anthropology and teaching experience are desirable. Candidates should submit applications by January 4, 2010 to P. Nick Kardulias, Department of Sociology and Anthropology, College of Wooster, 1189 Beall Avenue, Wooster, Ohio 44691, USA. Applications should include a cover letter, cv, and teaching evaluations if available; in addition, applicants should have three referees submit letters of recommendation on their behalf.

Eastern New Mexico University seeks applications for a **full-time, tenure-track Assistant Professor of Anthropology position** beginning August 2010. We seek a Southwest archaeologist specializing in ceramic analysis, preferably a materialist with an active research agenda. The successful candidate must be willing to run a summer field school in alternate summers. Candidates must have a Ph.D. completed by August 2010. Our program has a strong graduate component, and candidates must be willing to help supervise Master's theses. Applicants should submit a faculty application, letter of interest outlining qualifications, current curriculum vitae, transcripts (unofficial for application purposes), and contact information for three references to: Search Committee, Department of Anthropology and Applied Archaeology, Human Resources Station #21, Eastern New Mexico University, Portales, New Mexico, 88130, USA. Review of applicants will begin January 4, 2010. For more information go to http//www.enmu.edu.

Northwestern University Department of Anthropology invites applications for a **senior position in the archaeology of complex societies**, at the rank of tenured associate or full professor, to begin in Fall, 2011. Geographical area and methodological focus open. Research on either historic or prehistoric periods will be considered. Candidates should have a strong record of publication and research, external grants, mentoring graduate and undergraduate students, and a commitment to a four-field approach in anthropology. Minorities

and women are especially encouraged to apply. The deadline for the submission of application materials is March 1, 2010. Send a letter of application, a vita, and the names of three referees to: Elizabeth Brumfiel, Chair, Archaeology Search Committee, Department of Anthropology, Northwestern University, 1810 Hinman Ave, Evanston, Illinois, 60208-1310, USA.

The Adelphi University Department of Anthropology invites applicants for a **North American archaeologist**, trained in four-field approach, with research and teaching interests in New World prehistory and environmental archaeology focus to teach archaeology courses at all undergraduate levels, conduct archaeological fieldwork, laboratory analysis, and engage students in research projects. Ability to offer graduate Environmental Studies Program courses preferred. Ph.D., excellence in teaching, record of publication, active research program and commitment to involve students in research required. Expectation to develop/maintain program of fundable research and publication. Apply online at: http://www.adelphi.edu/positions/faculty.

Post-Doctoral Fellow in Material sciences - Applications to Archaeology. The Nanomaterials group at the Center for Material Elaboration and Structural Studies (CEMES) invites applications for a post-doctoral research position (15 months) in the framework of an ANR (French Agency for Research) project entitled "Processes and environments of heat treatment of barremo-bedoulian flint during the Chassey culture (4th mill. Cal BC; western Mediterranean area)". The objective of the project is to better understand the organization of Chassey culture societies by addressing the question of greater specialized craftsmanship, which is one of its most striking aspects. To tackle this issue, we chose to study what forms the most remarkable production in terms of technical investment: the production of blade in heated barremo-bedoulian flint. Our aim is to evaluate, for the first time, the know-how lost of these artisans. Within the production line, the heat treatment of flint, which currently raises more questions. More precisely, the applicant will be in charge of the study of the structural modifications of flint during the heating phase and of the relationships between heating transformations and mechanical properties. The aim is to identify the nature of microstructural and flaking properties modifications. For this purpose, several investigation techniques (X-ray diffraction, transmission electron microscopy, Raman spectroscopy ...) will be used in our laboratory and at synchrotron facilities (XRD, SAXS and/or SANS). The applicant will also take part to archaeological experimentations. A Ph.D. degree in material science, physics, chemistry or geology with knowledge in X-ray diffraction/scattering and/or transmission electron microscopy is preferred. Candidates with both material science and archaeology backgrounds are strongly encouraged to apply. For consideration, submit, in electronic form, curriculum vitae, a list of publications along with the names of referees (minimum 2), and a cover letter outlining research interests to Dr. Philippe Sciau, CEMES-CNRS, 29 rue J. Marvig, 31055 Toulouse, France (philippe.sciau@cemes.fr).

Applications are invited for a postdoctoral position (maximum three years) to join the ARCHGLASS team as part of a European Research Council Starting Grant research project, lead by professor Patrick Degryse, in collaboration with international research groups. **A postdoctoral researcher in archaeology** is expected to carry out the subproject on glass material culture, typology and chronology. This scholar will prospect for ancient texts on glass production and its raw materials and will identify specific forms of glass that have been assigned archaeologically (on typo-chronological or historical grounds) to a specific region of production, next to suggesting original, own research topics. His/her input is imperative for the integrated reconstruction of the Hellenistic-Roman glass economy and to guarantee true interdisciplinarity in the project. Other tasks are to take part in the activities of the research team as a whole, including co-organizing international meetings, joint editorial projects and grant applications, presenting papers at international conferences and publishing in international peer-reviewed (top) scientific media. A PhD in anthropology, archaeology, ancient history or archaeological sciences and a background in archaeological science research are required. Having worked previously on material culture studies and/or glass studies is likewise required. The candidate must be highly motivated, able to work in a team and possess good social and communicative skills. A profile of outstanding international (journal) publications as measured against research years is looked for. However, candidates who are about to receive their PhD are also welcome to apply. Fluent English and good ICT skills are required. Written applications should be addressed to professor Patrick Degryse and should include: a curriculum vitae (please separate clearly work in progress from actual results); a copy of the PhD certificate or a letter from the thesis supervisor indicating the expected date of completion; a letter of motivation accompanied by a separate research proposal containing a first attempt to specify in more detail how the candidate intends to carry out the subproject (research topic, objectives and approach); names for two academic references. The preferred starting date is 1 May 2010. Further information can be obtained by contacting professor Patrick Degryse, Geology, Earth and Environmental Sciences, Katholieke Universiteit Leuven, Celestijnenlaan 200E, bus 2408, BE-3001 Leuven, Belgium; email contact: Patrick.Degryse@ees.kuleuven.be.

Applications are invited for a postdoctoral position (maximum three years) to join the ARCHGLASS team as part of a European Research Council Starting Grant research project, lead by professor Patrick Degryse, in collaboration with international research groups. **A postdoctoral researcher in archaeological sciences** is expected to carry out the subproject on isotope chemistry. This scholar will develop analysis protocols for the different isotopes dealt with in this project (Sr, Nd, Sb, Cu, B), custom-made to the physical-chemical properties of archaeological glass next to sand and fluxes. His/her input is essential for the introduction and application of (new) analytical techniques. Other tasks are to take part in the activities of the research team as a whole, including co-organizing international meetings, joint editorial

projects and grant applications, presenting papers at international conferences and publishing in international peer-reviewed (top) scientific media. A PhD in archaeometry, archaeological sciences or exact sciences (chemistry, physics, geology etc) and a background in archaeological or archaeological science research are required. The candidate must be highly motivated, able to work in a team and possess good social and communicative skills. A profile of outstanding international (journal) publications as measured against research years is looked for. However, candidates who are about to receive their PhD are also welcome to apply. Experience with state-of-the-art geochemical equipment is required. Having worked previously on isotope geochemistry, material culture studies and/or glass chemistry are advantages. Fluent English and good ICT skills are required. Written applications should be addressed to professor Patrick Degryse and should include: a curriculum vitae (please separate clearly work in progress from actual results); a copy of the PhD certificate or a letter from the thesis supervisor indicating the expected date of completion; a letter of motivation accompanied by a separate research proposal containing a first attempt to specify in more detail how the candidate intends to carry out the subproject (research topic, objectives and approach); names for two academic references. The preferred starting date is 1 May 2010. Further information can be obtained by contacting professor Patrick Degryse, Geology, Earth and Environmental Sciences, Katholieke Universiteit Leuven, Celestijnenlaan 200E, bus 2408, BE-3001 Leuven, Belgium, Patrick.Degryse@ees.kuleuven.be.

Awards, Fellowships, and Training

Merton College invites applications for a **three-year Junior Research Fellowship** in Chinese Archaeology. The successful candidate will be based at Merton College, Oxford, and the School of Archaeology, Oxford, and will be required to work as an independent researcher in any area of Chinese Archaeology. Candidates should possess research expertise in Chinese Archaeology, and must also be fluent in spoken and written Chinese. The post is available from 1 October 2010, is for three years, and is not renewable. The closing date for applications is 18 December 2009. The salary is 20,834 GBP p.a. (current rates), plus free meals, and either a pensionable housing allowance of 5,809 GBP p.a. or free accommodation in College. For full details and application form, please see the advertisement at http://www.merton.ox.ac.uk/vacancies.

The **College of Social and Behavioral Sciences Diversity Postdoctoral Fellowship Program** at The Ohio State University supports promising scholars who are committed to diversity in the academy and to prepare those scholars to enter tenure track faculty positions. We are particularly interested in receiving applications from individuals who are members of groups that historically have been underrepresented in the American professoriate. Fellows will be affiliated with one of the eight academic units of the College of Social and Behavioral Sciences: Anthropology, Economics, Geography, Communication, Political Science, Psychology, Sociology, and Speech and Hearing Science (additional information at http://sbs.osu.edu). Applicants must have completed all requirements for a doctoral degree in the social sciences by August 2010. Preference will be given to individuals who are within five years of their degree. Applicants must be committed to an academic career. Applicants must be a citizen of the United States. Awards: Up to three fellowships will be awarded. The appointments are intended for two years, with re-appointment for the second year contingent upon a successful performance review. The appointments will begin in September 2010. The fellowships provide a $40,000 annual stipend, university medical benefits, and some support for travel and research expenses. Application Process: Required application materials: (1) Applicants should clearly identify a unit within the College of Social and Behavioral Sciences at OSU with which they would be affiliated during the Fellowship period, and are encouraged to suggest one or more tenured faculty members within that unit who could serve as a host and mentor; (2) a curriculum vitae; (3) a one page dissertation abstract; (4) a statement outlining the specific research proposed to be undertaken during the Fellowship period, and the significance of that research (four-page limit, double-spaced); (5) a personal statement describing the applicant's background and commitment to the goal of diversity in higher education (three-page limit, double-spaced). Applicants should submit all of these materials electronically in Microsoft Word. (Please identify all of the documents with the last name and document type, e.g., smithcv.doc.) In addition, three letters of recommendation should be submitted electronically. All materials must be received by February 15, 2010, and should be submitted to sbspostdocs@polisci.osu.edu. Questions can be directed to professor Kathleen M. McGraw (mcgraw.36@osu.edu).

Applications are invited for a **PhD position** (four years fully funded) to join the ARCHGLASS team as part of a European Research Council Starting Grant research project, lead by professor Patrick Degryse, in collaboration with international research groups. The PhD researcher is expected to carry out the subproject on the mineralogical and geochemical characterization of flux mineral resources used in glass production. This scholar brings together information on possible flux resources used for Hellenistic-Roman glass production, and studies glass from the point of view of B isotopes (in co-operation with both post-doctoral fellows) to identify possible multiple sources of fluxes. An MA or MS degree in archaeometry, archaeological sciences, or exact sciences (chemistry, physics, geology etc) is required. Experience in archaeological or archaeological sciences research is an advantage. For the PhD position, written applications should be addressed to professor Patrick Degryse and should include: a curriculum vitae; a letter of motivation; names for two academic references. The preferred start date is 1 October 2010. Further information can be obtained by contacting Professor Patrick Degryse by email at Patrick.Degryse@ees.kuleuven.be.

Conference News and Announcements

The **38th International Symposium on Archaeometry** will be held at the University of South Florida, Tampa, May 10-14, 2010. The aim of ISA is to promote the integration of scientific techniques with archaeology and cultural heritage, with participants coming from a variety of backgrounds and subdisciplines. The website may be visited at http://isa2010.cas.usf.edu and includes detailed information on title/abstract submission and registration deadlines, as well as accommodations, travel/parking, social activities, etc. Registration costs are the same as for previous years, and very low cost on-campus housing is available. On-campus dormitory/apartment accommodations have been made available ($35 per night single room, $50 per night double room), along with discount rates for hotels on and adjacent to campus. Airline flight expenses are also reasonable for that time of year: London-Tampa-London is currently as low as $684 (= 410 GPB); Rome-Tampa-Rome as low as $868 (595 Euro). At least some discounts are expected for participants from Latin America and certain other countries. Questions may be addressed to Robert Tykot ISA2010@usf.edu). Abstract submission deadline: December 1, 2009.

A session entitled "Geomorphic response to environmental change: Coupling climate and landscape records" will be held in conjunction with the **EGU General Assembly** in May 2010. Environmental changes during the Quaternary can act as an important model for understanding the nature and impact of future global change. The oscillation of climates and environments during this period can be long-term or short-term. With respect to understanding the impacts of future climate change, establishing the magnitude of temperature and precipitation fluctuations during these events is only part of the issue, just as significant as understanding how Earth surface processes will respond to these events. An important step in Quaternary geomorphology is, therefore, being able to relate the shifts in climate records (i.e. marine, ice-core, speleothem and pollen signals) to changes in the activity of Earth surface processes. The aim of this session is to provide a forum for researchers who are working on geomorphic response to paleoenvironmental change to present their latest findings and discuss future directions. It is hoped that, as well as providing case studies of coupled records, the session will address some of the following key themes: 1) techniques for correlation (geochronology, stratigraphy etc); 2) the identification and use of suitable climate records; 3) quantifying the magnitude and timescales of change in different geomorphic settings (e.g. fluvial, glacial, aeolian, etc.); and 4) distinguishing climate driven response from other forcing factors (tectonics, complex response, intrinsic forcing). The session will have a very broad temporal and spatial scope, with submissions from authors working on Pleistocene and Holocene time frames, long-term and short-term climate forcing, in high through to low latitude environments and covering the full scope of geomorphic processes. Abstracts must be submitted by January 18, 2010 using the EGU General Assembly website: http://meetingorganizer.copernicus.org/EGU2010/session/3057.

Archaeological Sciences of the Americas Symposium 2009

Daniel Seinfeld
Department of Anthropology
Florida State University

The Archaeological Sciences of the Americas Symposium was held on October 2–4 in Tampa, Florida. This student-organized conference was a rousing success, and it featured presentations on topics including molecular archaeology, geoarchaeology, DNA studies in archaeology, and three-dimensional imaging. The keynote speaker, Dr. Patrick McGovern of the University of Pennsylvania Museum, gave a talk on using scientific archaeology to rediscover recipes for ancient alcoholic beverages. Conference participants were happy to enjoy the results of Dr. McGovern's research thanks to a donation of reconstructed ancient beverages by the Dogfish Head brewing company.

We congratulate Kara Rothenberg of the University of South Florida (along with co-authors Donald Storer and Christian Wells) for winning the R. E. Taylor Poster Award from the Society for Archaeological Sciences. Kara, a graduate student in Applied Anthropology at the University of South Florida, received the award for a poster presentation entitled "Interlinking Soil Properties to Prospect for Ancient Activity Loci: An Example from Palmarejo, Honduras." For her efforts, Kara received a cash award of $100 and a complimentary one-year membership in the SAS.

Kara's abstract: "This poster compares various soil properties, including soil pH, organic matter, and extractable phosphate, from a prehispanic archaeological site in Honduras to broaden our reach in prospecting for activity loci using soil chemistry. Recent studies tend to rely on spatial differences in elemental concentrations for identifying activity patterns in the archaeological record. However, other related soil properties, including soil pH and organic matter, sometimes correlate with chemical residues, especially phosphates. The research presented here explores these interconnections with the greater goal of identifying the ways and extent to which various soil properties are linked in the formation and preservation of ancient activity loci. For this study, we collected roughly 300 soil samples from a 40 m x 40 m plaza at the site of Palmarejo in northwest Honduras. We used an electronic pH meter with glass electrode to measure hydrogen potential, the loss-on-ignition method to determine organic matter, and molybdate colorimetry using Mehlich-3 extraction to characterize phosphate concentrations. Linear correlations and regression of the resulting data suggest that certain activity zones share particular signatures of multiple soil properties. We conclude that future soil chemical studies in archaeological prospection can benefit by incorporating pH and organic matter into their research designs."

Anyone interested in obtaining session abstracts from the ASAS 2009 as well as students interested in organizing the next Archaeological Sciences of the Americas Symposium in 2012 should send an e-mail to asas2009symposium@gmail.com.

A Test of pXRF In-situ Geochemical Survey for Archaeological Prospection

Katherine Hayes
Department of Anthropology
University of Minnesota, Twin Cities

Portable x-ray fluorescence (pXRF) instrumentation has improved vastly since its introduction in the 1990s, particularly in developing the miniaturized x-ray tube source and increased detector sensitivity allowing assessment of more and lighter elements. Archaeologists have rapidly taken up the technology in the past five years. This is because, despite their lower sensitivity range and accuracy, these portable units are non-destructive and have extremely low cost per sample, making them extraordinarily useful for coarse chemical distinctions of materials that would otherwise be off-limits for chemical analysis. The Wilford Lab of North American Archaeology at the University of Minnesota, Twin Cities, recently acquired a Niton Xl3t pXRF unit for just these reasons.

It has been suggested, both by the manufacturer (Thermo Scientific - Niton) and anecdotally by a number of CRM archaeologists, that portable XRF units may also be used as an archaeological prospection tool. Many of these units were, of course, developed for on-site environmental testing purposes generally. Archaeologists who make use of geochemistry as an aid to site-use interpretations have urged testing of pXRF instruments for both prospection and in-situ interpretation of features and deposits (Oonk et al 2009). For my own interest in this potential utility, I used the Wilford Lab pXRF unit to conduct an in-situ surface survey in advance of my 2009 field excavation season at a site in central Minnesota. In this context, any spatially distinct anomalies indicated through statistically derived site characterization could then quickly be ground-truthed, and subsurface samples from both feature and non-feature sediments could be collected for comparative purposes. I do have a disclaimer on this experiment: because the test design was devised for our own curiosity, there were some inconsistencies that in retrospect I wish I had addressed, and will in any future experimentation. The results, despite these inconsistencies, were still compelling enough to indicate that the in-situ pXRF prospection survey was not a good indicator of subsurface features *at this site*. In this report I will describe the initial testing results, the ground-truth excavation results in areas of surface-identified anomalies, and the results of the ex-situ subsurface samples collected. The goal of this test was to assess if there were any correlations between A) surface anomalous geochemistry and that of subsurface features and deposits, and to a lesser extent B) in-situ and ex-situ processed samples.

Initial Survey

The site of Little Round Hill, located in Wadena County in central Minnesota, was investigated archaeologically for the purposes of defining an late 18th- early 19th century component and locating any extant structural or defensive features relating to a fur-trade encampment site. The site is located at the confluence of two rivers, the hill between formed as a drumlin with a somewhat flattened area at the top and sloping away to the southwest. A previous survey (Birk 1992) had identified two concentrations of artifacts dating to the period of interest, but was unable to discern any site structure through features. Our geochemical survey grids were thus placed in these two broad areas of artifact recovery: one grid of 15 m^2, completely surveyed, and a second of 30 m^2 in which only half, extending eastwards from the northwest-southeast diagonal, could be investigated due to extensive growth of prickly ash. Test locations were marked on a 2m interval on the grids, except when they were offset due to tree growth. At each location, the surface debris and root mat were cleared to expose the underlying soil or sediment for testing. Of note, the exposed soils and sediments did retain moisture, and we recognize that this may have "dampened" the resulting energy signal.

The Niton Xl3t was set to a mode which cycles through four filters, each optimized for a different set of elements. This unit also includes a helium purge which lowers the detection limits for the light elements that it does read. The helium purge was used for the survey, as many of these elements have been noted to be characteristic of archaeological features, although with varying stability in soils (Oonk et al 2009, Wilson et al 2008). These include phosphorous (P), calcium (Ca), potassium (K), and magnesium (Mg). The depth of the reading was also a concern, although the previous survey had recovered artifacts from even the uppermost levels, and I felt it was possible that features might be relatively shallow here. In total, 210 readings were taken over the course of several days in which the overall site grid was established and the area cleared.

The results of the 210 readings were downloaded from the unit and linked to their grid coordinates. The "raw data" of the readings are energy spectra, but software on the unit "interprets" these spectra to give assessments of the elements in parts per million, when the algorithms indicate that the assessment is within the 95% confidence threshold (2 sigma). If this is not met, the reading is considered below the limits of detection (<LOD). The survey dataset was scanned to identify those elements that were often <LOD, and those columns were removed. Most of these elements were of unknown correlation to anthropogenic deposits, and were not considered important for the present study. Mg, unfortunately, was an element that was excluded as it was never above detection limits. Those elements with infrequent readings <LOD were converted to zero-values because a null value would eliminate the entire record from the statistical test. Two elements with limited rates of successful detection were considered exceptional, however: phosphorus (P) was indicated in approximately half of the readings, but is one of the best-known markers of human waste and organic decay, and was kept in the dataset. Copper (Cu) was detected in only five readings, but can be both a trace element indicator of human activity, and an important artifact material for the period of interest in this investigation. Its appearance in the five readings was considered an important factor. The resulting dataset included Zr, Mn, Si, P, Sr, Cd, Ca, Cu, Rb, V, K, Zn, Ti, Cl, Fe, Al, and Si.

Two main statistical tests were run on the survey dataset: paired correlations of elements, and k-means cluster analysis of all element variables. The strongest paired correlations indicate something of the locale of the site although not directly related to the archaeological context. Aluminum (Al) and silicon (Si), with a correlation coefficient of 0.949, likely derive from the common feldspar component of the site's rather sandy glacial subsoil. Their covariance should reflect the greater or lesser exposure of sand in relation to organic topsoil, a hypothesis supported by the tendency to see higher Al and Si readings on the sloped areas of the site affected by erosion. The second strongly correlated pair is calcium (Ca) and sulfur (S), with a correlation coefficient of 0.923. Unlike the Al/Si pair, higher concentrations of Ca/S do not show any spatial trending. These elements could derive from human activity, as both result from the disintegration of inorganic waste and S may also result from organic decay. They may likewise have been used in soil treatments such as gypsum (calcium sulfate), used in agricultural settings to loosen very compacted or clayey soils.

K-means cluster analysis, a multivariate test related to principal components analysis, was used to interpret whether there were statistically significant types of surface chemistry at the site, and whether there were any anomalous, spatially contiguous areas. With either five or six clusters, the variable means of the two main clusters indicate that they were distinguishing either the feldspar-rich sandy subsoil exposures or the thicker organic topsoil. These two clusters accounted for 202 of the 210 test locations. Three or four additional clusters formed around the remainder, two of which were comprised of two or three spatially contiguous test locations. These clusters were distinguished by relatively high levels of Ca, K, P and S, and also accounted for most of the locations where Cu was detected. A last cluster was formed by non-contiguous and non-proximal locations.

Based on these results, I selected one excavation unit within each of the two areas of anomalous but contiguous readings in order to ground truth the test results. These 2 x 2 m units were both excavated completely to glacial subsoil, with all features excavated separately, and all artifacts bagged according to strata and 5 cm level subdivisions. In addition, we collected column, deposit and feature sediment samples to assess the correlations, if any, between surface and subsurface geochemistry. One of the two test units (N472/E512) contained very little material culture within a very deep (approximately 1m) deposit of fairly homogenous sandy silt. No archaeological features were encountered. The thick silty deposit, downslope from the main site area, may have been the result of upslope erosion, or flood deposition from the nearby Crow Wing River. The second test unit (N494/E495) ultimately was found to be within the core of the 18th-century site area. In this unit two small pit features of unidentifiable function were documented, as well as a moderate quantity of artifacts of predominantly faunal bone with smaller amounts of lithic debris and a fragment of copper alloy sheet. The depth of the features and glacial subsoil were much shallower in this unit, approximately 35-50 cm below surface. Given that only one of the two units contained any subsurface features, excavation suggests a rather equivocal relationship between the surface geochemistry and the archaeological site. It is also problematic that clear features were documented in excavation units at which surface readings did not return anomalous geochemistry, including one hearth feature identified only 15 cm below surface.

Post-excavation Ex-situ Testing of Features and Fills

While the lack of correspondence between surface readings and the excavated subsurface context is disappointing, there are a few other lines of inquiry to be followed to better assess the utility of pXRF in field contexts. These include 1) a better understanding of the site/feature depths for which pXRF may be considered reliable (for similar inquiry with artifacts, see Gianoncelli and Kourousias 2007), and 2) the correspondence between in-situ and ex-situ test results, for a variety of degrees of sample processing (Custo et al 2005). As these are questions which were raised late in our field excavations, our sample collection was unfortunately inconsistent, but what we do have has been helpful. In order to try to understand the relationship between surface and subsurface in the ground-truthed units, column samples were taken from the corner baulk closest to where a surface reading had been taken, beginning below the root mat and at every 10 cm interval below (eight total from N472/E512, 6 total from N494/E495). Samples were approximately four ounces of material. In addition to samples taken from the two pit features, hearth features documented in two adjacent excavation units (10m to the east, and south) were sampled for comparison. In retrospect, surface ex-situ samples should have also been taken at all the in-situ test locations.

These samples were processed by drying, sieving to remove stones, and grinding to a particle size of 120 micron or smaller. This thoroughly homogenizes the sample, and greatly increases the ability of the pXRF analyzer to accurately characterize the sediment. After testing these processed samples using the same settings, the results were compared between the surface in-situ reading and the subsurface column samples (Figures 1 and 2). Although a better comparison would have all the samples processed alike, it appears that only in the uppermost sample of the column is there any hint of the elevated readings from the surface. Several other elements were read at much higher levels than they were at the surface. These results are based on poorly compared samples, but do suggest that further more consistent testing is warranted. The role of moisture in the readings should also be tested, by drying but not homogenizing the ex-situ samples. This could be done in the field, but would add some extra time to the survey.

Finally, I compared the processed, ex-situ feature samples to one another and to the surface in-situ readings closest to the feature area (Figure 3). The difference between the pit features and the hearth features, with identical testing procedure, is quite dramatic. Of note, the hearth features were the only samples in which Mg was detected in significant quantity. An interesting comparison which was unfortunately not undertaken

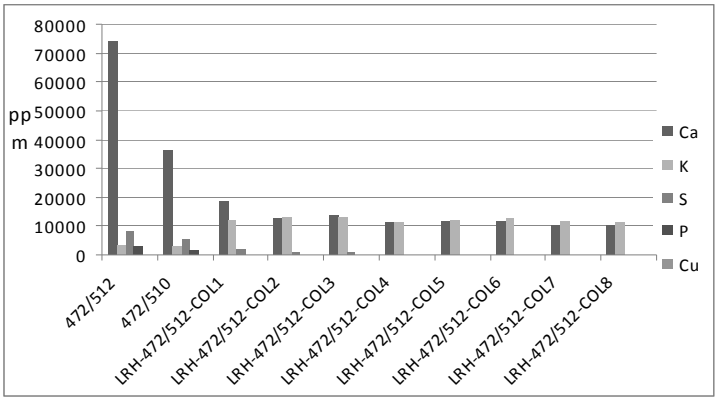


Figure 1: surface vs column sample readings for five elements, N472/E512.

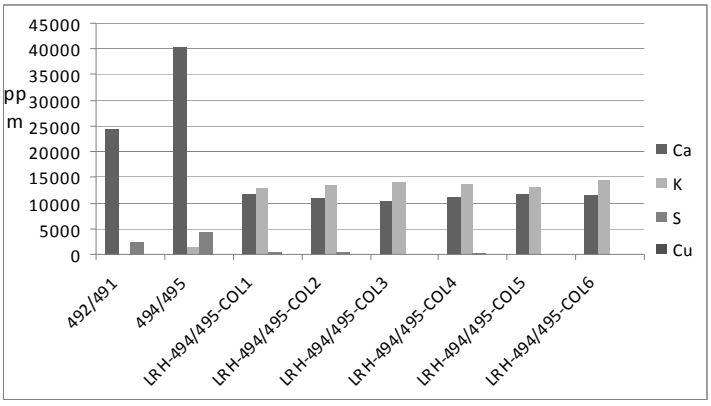


Figure 2: surface vs column sample readings for four elements, N494/E495.

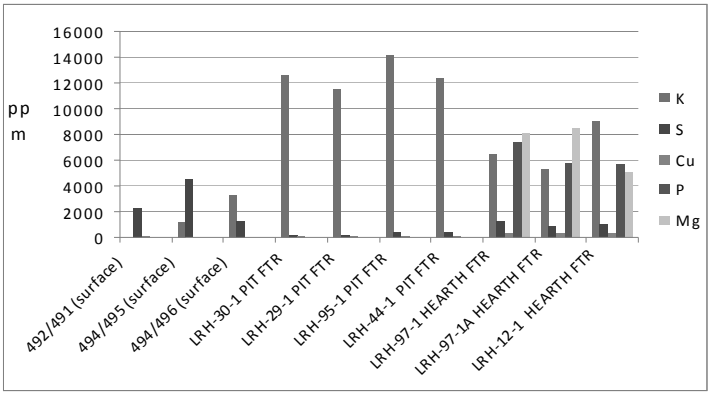


Figure 3: surface vs feature sample readings for five elements (Ca omitted due to extremely high levels in hearth features).

in this study would be between in-situ and ex-situ testing of features. However they were to be tested, I see potential in the use of the pXRF in quickly and inexpensively testing features and activity areas of floors.

Conclusion

Although in-situ field prospection using pXRF was not particularly successful in this case, the results do indicate some potential for use, subject to further testing. First, I think that the Niton Xl3t has distinguished between feature types quite clearly, and this may extend to its ability to distinguish floor or yard residues in archaeological contexts. Second, if sample homogeneity increases the analyzer's sensitivity or accuracy, it may prove useful to bring the test stand and processing tools to use in the field, despite the added time. Further experiments should be done to establish correlations between in-situ and ex-situ samples before settling on a testing method (see Custo et al 2005 for example). Finally, more experiments should be done to assess the effects of feature depth and soil moisture on the detection capabilities of the unit. It may be the case that in fairly shallow sites in very dry climates, the pXRF analyzer could in fact be used for archaeological prospection.

References

Birk, Douglas A. (1992). *A Preliminary Archaeological Study of the Little Round Hill Site, Old Wadena Park, Wadena County, Minnesota*. Institute for Minnesota Archaeology, Reports of Investigation, Number 214, submitted to the Wadena County Commissioners.

Custo, Graciela, Susana Boeykens, L. Dawidowski, L. Fox, D. Gómez, F. Luna, and Cristina Vázquez (2005). Soil Characterization by Energy Dispersive X-Ray Fluorescence: Sampling Strategy for *in situ* Analysis. *Analytical Sciences* 21:751-756.

Gianoncelli, A., and G. Kourousias (2007). Limitations of portable XRF implementations in evaluating depth information: an archaeometric perspective. *Applied Physics A* 89:857-863.

Oonk, S., C.P. Slomp, and D.J. Huisman (2009). Geochemistry as an Aid in Archaeological Prospection and Site Interpretation: Current Issues and Research Directions. *Archaeological Prospection* 16:35-51.

Wilson, Clare A., Donald A. Davidson, and Malcolm S. Cresser (2008). Multi-element soil analysis: an assessment of its potential as an aid to archaeological interpretation. *Journal of Archaeological Science* 35:412-424.

Using Portable Energy Dispersive X-Ray Fluorescence (EDXRF) Spectrometry in the Study of Ceramic Technology at Vinca-Belo Brdo, Serbia

John M. Matsunaga
Department of Anthropology
University of California, Berkeley

This brief article presents the results of a geochemical analysis of an assemblage of non-vessel ceramic objects from the Late Neolithic settlement of Vinca-Belo Brdo using portable

energy dispersive X-ray fluorescence (EDXRF) spectrometry. This analysis is part of a larger research project whose goal is to study ceramic technology, production, and social organization at Vinca-Belo Brdo. Portable EDXRF analysis is used in this research project to characterize the overall geochemical variability of the ceramic objects in the assemblage and to help with the identification of potential sources of raw clay material. In this article, emphasis will be given to a discussion of the methodological considerations of using a portable EDXRF spectrometer, and an assessment of its usefulness in achieving the goals of the research project.

Background

Located directly on the right bank of the Danube River 10 km SE of Serbia's capital city of Belgrade, Vinca-Belo Brdo is a multi-component tell settlement whose main occupation dates to the Late Neolithic and Early Eneolithic (ca. 5300-4200 cal B.C.). Vinca-Belo Brdo stands at approximately 9-10 meters tall on a low loess terrace with the entire height of the tell being comprised of cultural materials. Due to its long occupational history during the Neolithic (approximately 1000 years) and the abundance of materials found at the site, the stratigraphic sequence at Vinca has been used for understanding the sequence and dating of settlements throughout the Vinca Culture.

While clay and ceramics have been recognized as important materials within the Vinca Culture (Stevanovic 1997), very few detailed analyses of ceramic technology have been published and these have focused exclusively on ceramic vessels (e.g., Kaiser 1984, 1989, 1990; Svoboda et al. 2004/2005). The present research project, only part of which is discussed in this article, attempts to contribute to the existing knowledge of Vinca Culture ceramic technology through the study of non-vessel ceramic objects.

The EDXRF analysis presented here focuses on the characterization of ceramic materials from Vinca in an attempt to identify patterns of geochemical variability (or lack of it) and the potential sources of raw material that were used. Geochemical variability (if present) may indicate that people at Vinca used different sources of raw materials and/or used different clay recipes (by adding tempers or removing inclusions). One goal of this research is to determine if different clays or clay recipes were used at Vinca and if so to come to an understanding of their significance.

Methodology

The geochemical analysis was conducted on 785 ceramic objects from the 1998-2006 excavations at Vinca-Belo Brdo. These objects were recovered from an 800 square meter excavation area that includes at least four and possibly up to seven houses and a number of pit and oven features. The entire non-vessel ceramic assemblage from these excavations as well as a small sample of ceramic vessel sherds was analyzed. The non-vessel ceramic assemblage consists of altars, amulets, balls, beads, cones, weights, spindle whorls, and figurines. In addition to this, six samples (representing six different stratigraphic layers) of experimentally fired raw clay material from a local clay source (the Ciglana brick factory) were analyzed. Based on a previous survey of local clay sources conducted by archaeologists and geologists from the University of Belgrade, Ciglana (located within 1 km of Vinca) was identified as one of a few potential sources for the raw material used in the manufacture of ceramics at Vinca (Svoboda et al. 2004/2005).

Since destructive analysis and the exportation of the materials from Vinca was not permitted, the use of a portable EDXRF spectrometer presented itself as an ideal solution for obtaining geochemical data given these restrictions. All of the analysis was conducted at the University of Belgrade and on site at Vinca-Belo Brdo using a portable Niton XLt-793W spectrometer. This particular Niton unit uses an X-ray tube energy source (as opposed to a radioactive source) making it much easier to get through customs when transporting it internationally (see Morgenstein and Redmount 2005 for a discussion of this). The Niton XLt-793W is configured to detect seventeen elements (Sb, Sn, Cd, Ag, Sr, Rb, Pb, Se, As, Hg, Zn, Cu, Ni, Co, Fe, Mn, Cr) and produces measurements in parts per million (ppm).

In regards to the operating procedure, each time the unit was turned on it was allowed to sit idle and warm up for 20 minutes. This warm up time is essential as variable and inaccurate measurements can be produced from readings taken before the unit has had sufficient time to warm up properly. A standard was used prior to the analysis to verify that the unit was working properly, but was not used on a regular basis as the unit performs self calibration.

For each reading, an object with a clean and dry surface was laid flat against the 1 cm x 2 cm exposure window covering it completely. This was done to ensure consistent and accurate measurements.

Each object was analyzed in bulk sample mode for 240 seconds. The run time for each reading was determined based on independent run-time experiments conducted at the University of California, Berkeley (by Dr. Maurice Morgenstein) and at the University of Massachusetts, Boston (by Katherine Hayes and John Steinberg) using the Niton XLt-793W unit. Both of these experiments demonstrated that after 240 seconds, detection limits did not improve and fluctuation in measurements leveled off (see Morgenstein and Redmount 2005:1614).

Results and Interpretations

All of the geochemical data collected was analyzed using a 5 group K-means cluster analysis in JMP Version 8. This was done using all seventeen elements and again for only three of the elements (Sr, Rb, Fe). Sr, Rb, and Fe were singled out based on the results of powder X-ray diffraction (XRD) analysis of fifty of the objects from the ceramic assemblage (both vessel

and non-vessel) as well as all six of the raw material samples from the Ciglana source. Permission was given to perform this analysis on a small sample of the material and only after the EDXRF analysis had produced promising results. The XRD analysis showed that mineralogically, there was a strong match between the ceramic objects from Vinca and the raw clay material from the Ciglana source (Figure 1). Both are comprised of chlorite (clinochlore) clay minerals and include quartz, muscovite, and calcite. Given the mineralogy of both the raw material from Ciglana and the ceramics from Vinca, the use of Sr, Rb, and Fe appeared to be a better way of characterizing all of the samples (than using all of the elements available) and identifying variability (or lack of it) in the ceramic objects from Vinca. Specifically, strontium was useful in providing information about carbonate (calcite) content, rubidium about muscovite (since rubidium can serve as a proxy for potassium), and iron about the chlorite (clinochlore) clay mineralogy.

Based on the K-means cluster analysis using only Sr, Rb, and Fe, three main chemical groups can be identified (referred to here as Cluster 1 [n=486], Cluster 3 [n=278], and Cluster 4 [n=25]) (Figure 2 and Table 1). Of the six samples from the Ciglana source, all are similar geochemically to the ceramic material from Vinca, with three samples identified as belonging to Cluster 1, and three identified as belonging to Cluster 3. When looking at the cluster means for Sr, Rb, and Fe the differences between the different clusters becomes clear (see Table 1). The mean strontium count for objects that fall into Cluster 3 is higher than that for Cluster 1, while Cluster 1 has a higher mean Fe count. From what is known from the XRD data, this likely indicates that what distinguishes the two groups is primarily in relation to calcite, with those in Cluster 3 having a higher calcite content. The significance of the higher Fe count for Cluster 1 is still not completely understood. Cluster 4 is distinguished from the other two clusters by having a higher overall mean Rb count, especially in relation to Sr. This may

Table 1. K-means cluster analysis summary, means, and standard deviations.

Cluster Summary

Step	Criterion
15	0

Cluster	Count	Max Dist
1	486	4.93072976
2	1	0
3	278	4.04798901
4	25	4.48962562
5	1	0

Cluster Means

Cluster	Sr	Rb	Fe
1	161.806255	111.046091	354.997836
2	665.55	10.76	56.12
3	212.757374	97.687554	285.762422
4	158.7732	187.778	316.598
5	174.47	31.8	759.72

Cluster Standard Deviations

Cluster	Sr	Rb	Fe
1	26.439938	10.1234757	42.4674503
2	0	0	0
3	37.6566674	13.1691433	47.771172
4	23.9311892	32.2253669	48.2542064
5	0	0	0

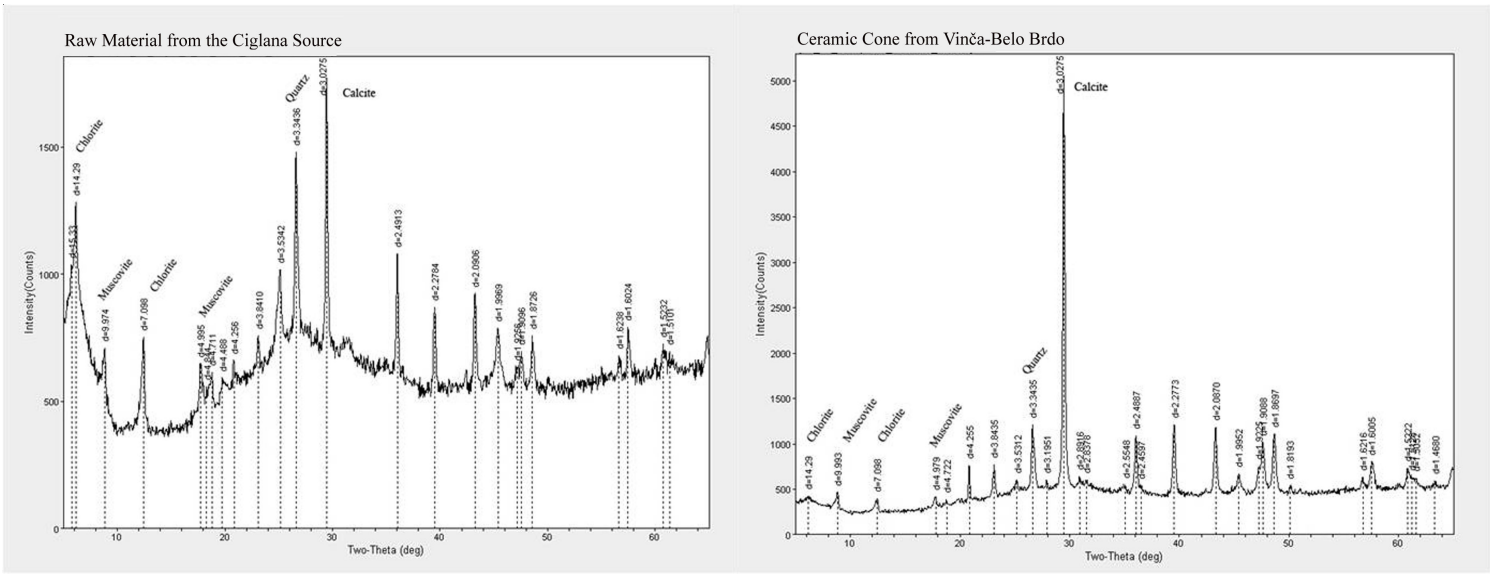


Figure 1. X-ray diffractograms of raw material from Ciglana (left) and ceramic material from Vinca (right).

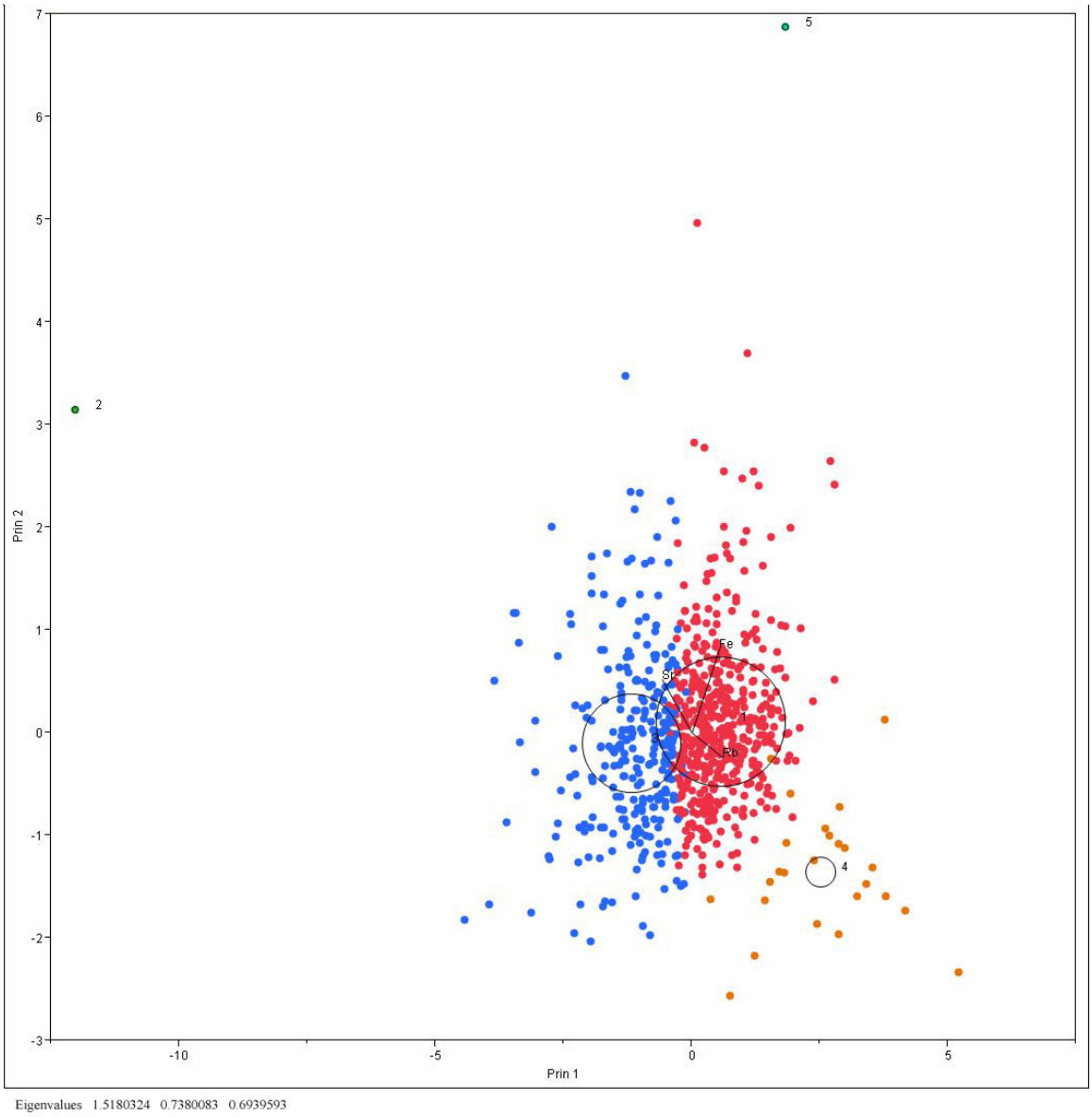


Figure 2. Principal components biplot showing the results of the K-means cluster analysis.

indicate that those objects in Cluster 4 may have higher muscovite content in comparison to the other two groups.

The principal components biplot which shows the results of the K-means cluster analysis (Figure 2) indicates that no clear separation among the ceramic material exists. While some variation is apparent (especially in regards to Cluster 4), most of the material is very similar geochemically and mineralogically (this is also evident in the XRD analysis, where there is little variation among those objects sampled).

Overall, the majority of the ceramic material from Vinca appears to be relatively homogeneous in terms of its geochemistry and mineralogy. While displaying some degree of variability, most of the range of variability found within the Vinca ceramic material matches that found within the Ciglana source and therefore can be interpreted as resulting from the variation in the raw material. Thus, almost all of the Vinca ceramics analyzed can be interpreted as being made from the same raw material, and at least in terms of raw material, no distinctions were made between the different object types. While the identity of Ciglana as the source of the material for Vinca ceramics is open to debate, this analysis has shown that most of the ceramic material from Vinca (with the exception of the Cluster 4 material whose geochemistry is still not clearly understood) is a close match with the raw material from the Ciglana source.

Conclusions

While detailed experiments assessing the performance of the portable Niton EDXRF spectrometer or how it compares

to tabletop units were not conducted as a part of this study, the portable unit used did produce meaningful results that made sense given what was known of the ceramic and raw material based on XRD analysis.

The results produced useful insights that helped to characterize the variability within the ceramic materials from Vinca and possibly connect this material to a local clay source. This is not to suggest that portable EDXRF spectrometers should or can replace tabletop units, especially given the limited number of elements that can be measured using portable units. But when your options are limited or if the materials you wish to analyze cannot be moved or transported, then the use of a portable EDXRF spectrometer can provide you with an excellent alternative for collecting geochemical data.

Acknowledgments

I wish to thank Dr. Nenad Tasic and the City Museum of Belgrade for granting me permission to analyze the material from Vinca. Financial support was provided by the Stahl Endowment Fund and the Archaeological Research Facility at the University of California, Berkeley. Special thanks go to Dr. Maury Morgenstein, who lent me the portable EDXRF spectrometer that was used in this analysis. I would also like to thank Predrag Dakic, who assisted with the analysis, Kristina Penezic, who helped me locate most of the archaeological materials that I analyzed, Rick Knurr, who provided invaluable assistance with the X-ray diffraction analysis, and Kat Hayes for editorial advice.

References

Kaiser, T. (1984). *Vinca Ceramics: Economic and Technological Aspects of Late Neolithic Pottery Production in Southeast Europe*. Ph.D. dissertation, University of California, Berkeley. University Microfilms, Ann Arbor.

Kaiser, T. (1990). Ceramic Technology. In *Selevac: A Neolithic Village in Yugoslavia*, edited by R. Tringham and D. Krstic, pp. 255-287. The Institute of Archaeology, University of California, Los Angeles.

Kaiser, T. and Lucius, W. (1989). Thermal Expansion Measurement and the Estimation of Prehistoric Pottery Firing Techniques. In *Pottery Technology: Ideas and Approaches*, edited by G. Bronitsky, pp. 83-92. Westview Press, Boulder.

Morgenstein, M. and Redmount, C. (2005). Using Portable Energy Dispersive X-Ray Fluorescence (EDXRF) Analysis for On-Site Study of Ceramic Sherds at El Hibeh, Egypt. *Journal of Archaeological Science* 32:1613-1623.

Stevanovic, M. (1997). The Age of Clay: The Social Dynamics of House Destruction. *Journal of Anthropological Archaeology* 16:334-395.

Svoboda, V., Vukovic, J., Knezevic, S., Izvonar, D., and Kicevic, D. (2004/2005). Experimental Archaeology – Traditional Production of Ceramic, Presentation of the Phase I. *Diana* 10:123-131.

A Preliminary Study of Carbon and Oxygen Isotopes in Human Tooth Enamel from Prehistoric and Modern Florida

Kathryn O'Donnell
Department of Anthropology
Florida State University

This study employs stable isotopic analyses of human tooth enamel to investigate changes in human diet throughout Florida prehistory to modern times. Deciduous and adult teeth were analyzed from four different time periods in Florida, consisting of three sites: Calico Hill, Bird Island (DI52) and Grant Mound (8BR56), as well as modern teeth from Miami. This study demonstrated varied dietary practices in prehistoric Florida populations as well as disparate delta ^{18}O values in the modern population sample.

Background

Delta ^{18}O analyses of meteoric and drinking waters and $^{13}C/^{12}C$ ratios can be used as tools for analyzing human paleodiet and migration (Al-Shorman 2004; Prowse et al. 2008; Seal et al. 1995; Triantaphyllau et al. 2008; Wiedemann-Bidlack et al. 2008; Wright and Schwarcz 1998). Researchers can infer paleodiets because stable isotopic compositions of food and fluids ingested by animals have a strong influence on the isotopic compositions of the tissues they synthesize. Thus, the composition of tissues, such as tooth enamel, allows one to trace certain diets with specific isotopic signatures (Lajha and Michener 1994). The formation of tooth enamel occurs during early to late childhood. Unlike bone, enamel does not undergo remodeling but grows by accretion with little reworking (Lajha and Michener 1994). Therefore, the isotopic composition of enamel only reflects one's dietary intake during childhood (during the period of tooth formation). Differential tooth development can reflect various dietary stages of children and young adults. Isotopic signatures of deciduous teeth compared to adult teeth, for instance, can reflect *in utero* versus postbirth and breastfeeding versus postweaning (Dupras and Tocheri 2007).

Materials and Methods

Twelve teeth were sampled for delta ^{13}C and delta ^{18}O analyses. Nine teeth (three per site) were analyzed from Florida prehistoric sites: Calico Hill, Bird Island (DI52) and Grant Mound (8BR56). The remaining three teeth were sampled from a modern population in Miami.

Calico Hill (DI52) is a large sand dune (app. 2 km long) that dates circa 1800 to 450 B.P and is located near the western bank of the Wacissa River in Jefferson County, Florida (Morse 1974; Smith 2002). The teeth sampled were from three different individuals, including three adult M3s, two mandibular and one maxillary.

Bird Island is a small island in the Gulf of Mexico. Samples from Bird Island were radiocarbon dated to the Late Archaic period (an uncorrected date of 4,570 ± 110 B.P.) (Stojanowski

and Doran 1998). The teeth sampled were two deciduous M3s and one adult M3, all from different individuals.

Grant Mound (8BR56) consists of a 4 km long shell midden reaching up to 2.5 m in height. It is located near Lake Okeechobee in the Indian River Lagoon region in Brevard County, Florida (Sears 1958). There are two sets of dates for the Grant Mound, possibly indicating two different occupations: the Beta-118371 date of 1215 ± 65 B.P. and the Beta-131314 date of 1430 ± 60 B.P. The teeth sampled were two adult M3s and one adult M1, all from different individuals.

Modern teeth from Miami residents were also sampled. Three teeth were examined from elderly and juvenile individuals who were born or died in the 1990s. Two deciduous teeth (one incisor and one supernumerary premolar) and one adult incisor were analyzed.

Approximately 1 g of enamel powder was removed from each sample using a dental drill. Bulk samples were crushed using a solvent washed mortar and pestle. Enamel samples were treated using the Wang and Deng (2005) procedure. To isolate the hydroxyapatite crystals, the powder was treated with 1M of acetic acid overnight to remove the carbonate, cleaned with distilled water and freeze-dried. The powder was reacted with 100% H_3PO_4 for two nights to produce CO_2 from the structural CO_3^{2-} in the apatite (Wang and Deng 2005:325). CO_2 produced from the samples was analyzed using a Gas Bench II Autocarbonate device connected to a Finnigan MAT Delta Plus XP stable isotope ratio mass spectrometer at the National High Magnetic Field Laboratory in Tallahassee, Florida.

Results and Interpretation

Human diet is reflected in the delta ^{13}C values of tooth enamel through photosynthesis carbon pathways (C_3 or C_4) of plants consumed by humans. C_3 plants (such as cacao or trees and grasses in temperate climates) have lower delta ^{13}C values (-18‰ to -34‰) while C_4 plants (such as maize or trees and grasses in subtropic climates) have higher delta ^{13}C values (e" -17‰). delta ^{13}C values d" -13‰ would indicate a diet of pure C_3 plants while a delta ^{13}C value > -3‰ would indicate a pure diet of C_4 plants (Al-Shorman 2004; Cerling et al. 1997; Wang and Deng 2005). Results from this study show a trend of increasing extremity in C_3 plant use from 3000 B.P. until today (Table 1).

Overall there appears to be no difference between adult and deciduous enamel delta ^{13}C values. Therefore, breast milk consumption seems to have had no effect on the stable carbon isotope ratio at Bird Island or in the modern Florida samples. Results also suggest that a trend for a higher consumption of C_3 plants occurred in Florida's more recent past. This pattern indicates that despite an abundance of C_3 plants, the Archaic cultures of Florida (those of Bird Island and Grant Mound) were also dependent on maize (a C_4 plant), a crop that became a widespread component of economic systems throughout North America between 1440 and 1050 B.C. (3500-3000 years B.P.) (Gibbon and Arnes 1998). Differential resource use may explain the varying delta ^{13}C values of Calico Hill and these previous Floridians. It is possible that the occupants of Calico Hill had access to a wider spectrum of resources, granting them the option of more eclectic diets (such as pure C_3 and pure C_4 diets). The modern Floridians in this study appear to consume a greater amount of C_3 plants and this may indicate a cultural preference for certain foods.

Table 1. Results demonstrating delta ^{13}C and delta^{18}O values as well as the Estimated % of C_4 dietary intake based on the assumptions: end-member enamel-delta^{13}C pure C_3 diet = -13‰ and end-member enamel-delta^{13}C for pure C_4 = +1‰.

Identifier 1	$\delta^{13}C$(PDB)	$\delta^{18}O$(PDB)	Estimated %C_4
Bird Island (DIS2)-1	-5.5	-3.3	54
Bird Island (DIS2)-2	-7.4	-2.7	40
Bird Island (DIS2)-3	-6.1	-3.2	49
Grant Mound (8BR56)-1	-5.5	-3	54
Grant Mound (8BR56)-2	-4.1	-2.7	63
Grant Mound (8BR56)-3	-6.7	-2.6	45
Calico Hills-1	-1.4	-1.2	83
Calico Hills-2	-15.4	-2.8	0
Calico Hills-3	-7.6	-1.6	39
Modern-1	-10.3	-5.1	20
Modern-2	-8.8	-3.5	30
Modern-3	-11.2	-5.8	13

The ratio of ^{18}O and ^{16}O in body tissue reflect the origin of water imbibed and oxygen obtained from food consumption. Ultimately, these oxygen ratios depend on delta ^{18}O of local water precipitation. This precipitation varies with latitude, due to Rayleigh distillation, in the global rainfall cycle (Kendall and Coplen 2001; Wiedemann-Bidlack 2008; Wright and Schwarcz 2008).

Body water itself is enriched in delta ^{18}O relative to drinking water because metabolic water contains atmospheric oxygen and because of the expiration of H2160 (Bryant and Froelich 1995; Wright and Schwarcz 2008). Body water contributes to human breast milk development resulting in breast milk being heavier in delta ^{18}O than water imbibed by the mother. Infants drinking breast milk usually have a heavier enrichment of delta ^{18}O than individuals who don't consume breast milk (Wright and Schwarcz 2008). Therefore, in theory, delta ^{18}O can serve as an indicator for breastfeeding.

Despite the effects of breast milk on isotopic signatures, the sampled deciduous teeth did not show a higher delta ^{18}O value than any of the adults from the same population. These results suggest that delta ^{18}O values were unaffected by the consumption of breast milk. All three prehistoric Florida sites had delta ^{18}O values consistent with surface water isotopic concentrations in their regions. They exhibited a range of -1.2‰ to -3.3‰ that fall within Florida's isotopic concentrations

for water. Analyses of the modern teeth, however, exhibited disparate delta ^{18}O values. The deciduous supernumerary premolar was within the range of variation for Florida while the adult incisor and the deciduous incisor did not show delta ^{18}O values naturally found within the state of Florida (especially for Miami). These values are more often found in states adjacent to Florida such as Georgia and the Carolinas. It is possible that these two individuals, during their early development, lived outside of Florida. It is also possible that these individuals resided in Miami but were continually consuming products (such as produce and meats) as well as bottled water from this more northern region, imprinting their enamel with another isotopic signature.

Conclusions

Results from this preliminary study recorded differential $^{13}C/^{12}C$ ratios between some sites, inferring varied dietary practices. delta ^{18}O analyses of the three prehistoric sites appeared to be consistent with surface water isotopic concentrations within their regions. Analyses of the modern teeth exhibited disparate delta ^{18}O concentrations possibly indicating prior residence or consumption of bottled water, produce or meat from a more northern region of the United States. Also, breast milk consumption seemed to have no effect on the isotopic signatures of either delta ^{18}O or delta ^{13}C values in the samples under study. These results demonstrate promising lines of work for further research using isotopes to explain population diet from Florida prehistory to modern times.

Acknowledgements

I would like to thank Yang Wang for all of her assistance and guidance and for the opportunity to conduct this research. I would also like to thank Glen Doran for providing the samples and site information used in this study. All work was carried out in the geochemistry department at the National High Magnetic Field Laboratory in Tallahassee, Florida.

References

Al-Shorman A (2004). Stable Carbon Isotope Analysis of Human Tooth Enamel from the Bronze Age Cemetery of Ya'amoun in Northern Jordan. *Journal of Archaeological Science* 31:1693-1698.

Byrant JD, Froelich PN, Showers WJ and Genna BJ (1996). Biologic and Climatic Signals in the Oxygen Isotopic Composition of Eocene-Oligocene Equid Enamel Phosphate. *Palaeogeography, Palaeoclimatology, Palaeoecology* 126:75-89.

Cerling TE, Harris JM, MacFadden BJ, Leakey MG, Quade J, Eisenmann V and Ehleringer R (1997). Global Vegetation Change through the Miocene/Pliocene Boundary. *Nature* 389:153-158.

Dupras TL and Tocheri MW (2007). Reconstructing Infant Weaning Histories at Roman Period Kellis, Egypt Using Stable Isotope Analysis of Dentition. *American Journal of Physical Anthropology* 134:63-74.

Gibbon GE and Ames KM (1998). *Archaeology of Prehistoric Native America*. Taylor and Francis.

Kendall C and Coplen TB (2001). Distribution of Oxygen-18 and Deuterium in River Waters across the United States. *Hydrological Processes* 15:1363-1393.

Lajha K and Michener H (1994). *Stable Isotopes in Ecology and Environmental Science*. Wiley-Blackwell.

Morse D, Dailey RC and Bunn J (1974). Prehistoric Multiple Myeloma. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 50(4):447-459.

Prowse TL, Saunders SR, Schwarcz HP, Garnsey P, Macchiarelli R and Bondioli L (2008). Isotopic and Dental Evidence for Infant and Young Child Feeding Practices in an Imperial Roman Skeletal Sample. *American Journal of Physical Anthropology* 137:294-308.

Seal J, Armstrong R and Schrire C (1995). Beyond Lifetime Averages: Tracing Life Histories through Isotopic Analysis of Different Calcified Tissues from Archaeological Human Skeletons. *Antiquity* 69:290-300.

Sears WH (1958). The Grant Site—Br-56. *Florida Anthropologist* 11(4):114-119.

Smith RK (2002). Analysis of Skeletal Material from Calico Hill, Florida: A Question of Paleopathology vs. Taphonomy. *The Florida Anthropologist* 55(2):59-63.

Stojanowski C and Doran GH (1998). Osteology of the Late Archaic Bird Island Site (8DI52), Dixie County, Florida. *The Florida Anthropologist* 51(3):139-146.

Triantaphyllou S, Richards MP, Zerner C and Voutsaki S (2008). Isotopic Dietary Reconstruction of Humans from Middle Bronze Age Lerna, Argolid, Greece. *Journal of Archaeological Science* 35:3028-3034.

Wang Y and Deng T (2005). A 25 M.Y. Isotopic Record of Paleodiet and Environmental Change from Fossil Mammals and Paleosols from the NE Margin of the Tibetan Plateau. *Earth and Planetary Science Letters* 236(1-2):322-338.

Wiedemann-Bidlack FB, Colman AS and Fogel ML (2008). Phosphate Oxygen Isotope Analysis on Microsamples of Bioapatite: Removal of Organic Contamination and Minimization of Sample Size. *Rapid Communications Mass Spectrometry* 22:1807-1816.

Wright LE and Schwarcz HP (1998). Stable Carbon and Oxygen Isotopes in Human Tooth Enamel: Identifying Breastfeeding and Weaning in Prehistory. *American Journal of Physical Anthropology* 106:1-18.

Archaeometallurgy

Thomas R. Fenn, Guest Associate Editor

The column in this issue includes the following categories of information on archaeometallurgy: 1) New Books; 2) Ph.D. Theses; 3) Previous Meetings; and 4) Forthcoming Meetings.

New Books

Metallurgy and Civilisation: Eurasia and Beyond. Proceedings of the BUMA VI Conference, edited by Jianjun

Mei and Thilo Rehren, Archtype Publications, August 2009, 208pp., 150+ illus., ISBN: 9781904982494, £47.50 / $95.00 (paperback). The papers presented here (proceedings of the BUMA VI conference in Beijing) provide a good overview of the breadth and depth of current archaeometallurgical research related to Asia and beyond. Many of the issues raised in this book, such as the beginnings of bronze metallurgy in China, the early history of lost-wax casting in Asia, the development of early steel-making technology in Europe and Asia, and the role of the steppe influence in metalworking in Eastern Zhou China, will continue to attract substantial research interest. The important role which casting technologies have played in large parts of Asia is immediately evident, as is the importance of studying technical aspects not in isolation, but as parts of complex and multi-dimensional cultural developments. It is evident that long-distance cultural connections and technological inspirations remained active over many millennia. The richness of past and present interactions, the ever-expanding archaeological knowledge, and an increasing cooperation across disciplinary and geographical boundaries in this volume are impressive.

The contents of the volume are divided into four sections. Papers in the first section, "Early Metallurgy across Eurasia", comprised "Ancient metallurgy in the Eurasian steppes and China: problems of interactions" (Evgenij Chernykh), "Early metallurgy in China: some challenging issues in current studies" (Jianjun Mei), "Metal trade in Bronze Age Central Eurasia" (Liangren Zhang), "Documentary and archaeological evidence for an antique copper-nickel alloy (baitong) production in southern China and its exportation to India" (François Widemann), "Metal trade between Europe and Asia in classical antiquity" (Alessandra Giumlia-Mair, Michel Jeandin and Ken'ichi Ota), and "The black bronzes of Asia" (Paul Craddock, Maickel van Bellegem, Philip Fletcher, Richard Blurton and Susan La Niece).

Papers in the second section, "Bronze Casting Technologies in Ancient China" included "Origins and evolution of the casting technology of Anyang bronze ritual vessels: an exploratory survey" (Yu Liu), "Three Western Zhou bronze foundry sites in the Zhouyuan area, Shaanxi province, China" (Wenli Zhou, Jianli Chen, Xingshan Lei, Tianjin Xu, Jianrong Chong and Zhankui Wang), "New research on lost-wax casting in ancient China" (Weirong Zhou, Yawei Dong, Quanwen Wan and Changsui Wang), "Incipient metallurgy in Yunnan: new data for old debates" (Tzehuey Chiou-Peng), "A study of the surface craft of weapons from the Ba-Shu region of ancient China" (Zhihui Yao and Shuyun Sun), and "Production of signature artifacts for the nomad market in the state of Qin during the late Warring States period in China (4th–3rd century BCE)" (Katheryn M. Linduff).

Papers in the third section, "Ancient Iron and Steel Technologies in Asia" comprised "An early iron-using centre in the ancient Jin state region (8th–3rd century BC)"(Rubin Han and Hongmei Duan), "From western Asia to the Tianshan Mountains: on the early iron artefacts found in Xinjiang" (Wu Guo), "South Indian Iron Age iron and high carbon steel: with reference to Kadebakele and comparative insights from Melsiruvalur" (Sharada Srinivasan, Carla M. Sinopoli, Kathleen D. Morrison, Rangaiah Gopal and Srinivasa Ranganathan), "Survival of traditional Indian ironworking" (Vibha Tripathi and Prabhakar Upadhyay), "Fine structures: mechanical properties and origin of iron of an ancient steel sword excavated from an old mound in Japan" (Masahiro Kitada), "Specialisation in iron- and steel-making in the early Middle East and Central Asia: myths, assumptions and a reassessment of early manuscript evidence" (Brian Gilmour).

Papers in the last section, "Ancient Metallurgical and Manufacturing Processes" included "The early history of lost-wax casting" (Christopher J. Davey), "A natural draught furnace for bronze casting" (Bastian Asmus), "The liquation process utilised in silver production from copper ore: the transfer to and development in Japan" (Eiji Izawa), "A technical study of silver samples from Xi'an, Shaanxi province, China, dating from the Warring States period to the Tang dynasty" (Junchang Yang, Paul Jett, Lynn Brostoff and Michelle Taube), and "Scientific analysis of lead-silver smelting slag from two sites in China" (Pengfei Xie and Thilo Rehren).

Ph.D. Theses

Changing technologies and transformations of value in the Middle Volga and northeastern Caucasus, circa 3000—1500 BCE, by *David Laurn Peterson* (The University of Chicago, Illinois, 2007, 585 p.). Abstract (Summary): In this dissertation I investigate the role of metal making as a technical and value system over the course of the Bronze Age in the Middle Volga region of the western Eurasian steppes, and the Early to Middle Bronze Age (early to middle 3rd millennium BC) at Velikent, Dagestan. The chief geographic focus is Samara, Russia, from where I examined nearly 100 metal objects from previously excavated kurgan cemeteries, in order to identify similarities, differences, and changes in the activities through which people created and transformed value in metalwork. I also explore how metalwork was used to objectify social distinctions and social values through adornment, and in mortuary rites and alliances. A survey of traces of mines in northeastern Samara provided a rare opportunity to characterize the scale and organization of the small, dispersed metal production that characteristic of the area in the Late Bronze Age. EPMA-WDS was utilized for compositional analysis. The results show the importance of recycling in Middle Volga metalworking, especially in the Middle Bronze Age II period. Variations in the metal pool for different cemeteries of the period are supported by statistically verified differences in work patterns as identified by metallography. Metal making itself may have been an important source of communal authority, which positioned participants for direct engagement with outside groups and the formation of new networks. Examined in light of the appearance of specialized communities of metal producers in the neighboring South Urals at this time, the argument is made that the new commodity role of copper and bronze may have been a source of tensions, encouraging metalworkers in Samara to form new networks for the

acquisition of bronze (which could not be replenished through local metalworking practices alone) with Volga-Kama forest dwellers to the north. Tin bronze entered a long-standing tradition of arsenic bronze production at Velikent, where it took on added importance in bodily adornment, along with the systematic production and uses of copper and alloys in the northeastern Caucasus.

The Chalcolithic and early Bronze Age metallurgy of Tepe Hissar, northeast Iran: A challenge to the 'Levantine Paradigm', by *Christopher Peter Thornton* (University of Pennsylvania, 2009, 501 p.). Abstract (Summary): In this dissertation, the scientific analyses of the metallurgical remains from Tepe Hissar—a 4th and 3rd millennium site in Northeastern Iran—are presented and juxtaposed with a new understanding of the 2000-year archaeological sequence at the site. It is argued that two types of contemporaneous metallurgical production occurred within this 'middle range' community: traditional practices (so-called "cottage industry") and standardized practices (e.g., workshop production). While traditional models for the development of *metallurgy* in Southwest Asia (the "Levantine Paradigm") would see these two types of production as representing entirely different stages in social development, at Tepe Hissar they are carried out at the same time and less than 100m from each other. Furthermore, the sophistication of metallurgical production at this site, particularly among the more 'traditional' practitioners, is truly staggering, and forces us to reconsider what independent craftspeople in small-scale societies understood about the chemical and material properties of the objects they made and used. In addition to challenging the "Levantine Paradigm," this dissertation set out to test theoretical discussions of "craft specialization" by applying various models to the data compiled herein. Although difficult in this situation to speak confidently about the craftspeople themselves, given the lack of suitable burial information and the secondary contexts of most of the metallurgical remains, it seems evident that using the concept of specialized craftspeople (e.g., "independent" vs. "attached" specialists) to compare the traditional vs. standardized practices at Tepe Hissar is not suitable. Instead it is argued that the spatial context of production directed technological practice, and not the level of specialization held by the artisans themselves. That is, distinct areas of the site (called "workshops") were designated for specialized (and standardized) production, while other areas (called "houses") were used for non-specialized, traditional craft production—a distinction not necessarily requiring different craftspeople. While this critique of "craft specialization" must await further analysis of the crafts from this site and others, the metallurgical remains from Tepe Hissar present an interesting study of craft production in ancient societies that should resonate with our understanding of craft production in traditional societies today.

Previous Meetings

The *2nd Latin-American Symposium on Physical and Chemical Methods in Archaeology, Art and Cultural Heritage Conservation* (LASMAC 2009) was carried out with the *Archaeological and Arts Issues in Materials Science Symposium* as part of the *International Material Research Congress 2009* in Cancun, Quintana Roo, Mexico from August 16 to 20, 2009. A number of papers of a variety of topics were presented within these symposia, including a handful on topics relating to metals and minerals. Presented papers included "Fingerprinting Lapis-Lazuli from Chile and Afghanistan Using an Integrated Analytical Approach" (Thomas Calligaro), "Microstructural Study of Gilded Copper Artifacts from the Chichén-Itza Cenote" (Jesús Arenas Alatorre), "Micro-Sr-XRF Studies for Archaeological Gold Identification – The Case of Carpathian Gold and of Dacian Bracelets" (Bogdan Constantinescu), "Infrared Reflection Spectrometry Analysis as a Non-Destructive Method of Characterizing of Minerals and Stone Materials in Archaeometric and Geoarchaeological Application" (Mikhail Ostroumov), "Metallographic Evidences of Bronze Casting Working Conditions at Moscow-Volga Region During Early Iron Age" (Irina Saprykina). A selection of posters also covered "Comparison between Pre-Columbian Alloys from the Royal Tombs of Sipán and from the Museum of Sicán Analyzed with a Portable Equipment Using EDXRF" (Angel Guillermo Bustamante Dominguez), "Implementation of Techniques for the Study of Vitreous and Metallic Materials from the Archaeological Site "Guardia Del Monte", San Miguel Del Monte, Buenos Aires Province" (Maria Ines Casadas), "The Manufacturing Techniques of the Turquoise Mosaics from the Great Temple of Tenochtitlan, México" (Emiliano Ricardo Melgar Tísoc), "EDXRF Measurements of Brazilian Old Coins" (Marcia de Almeida Rizzutto), and "Warrior's Belt from the Middle Volga Burial Ground X A.D. - Technology and Extraction" (Irina Saprykina). The proceedings of the symposia are typically published within the MRS *Archaeological and Arts Issues in Materials Science Symposium* series, so look for that to come out in about a year. A copy of the program can be found at: http://www.mrs-mexico.org.mx/webimrc09/documentos/s3-program.pdf.

The *Seventh International Conference on The Beginnings of the Use of Metals and Alloys, BUMA-VII*, was held from September 13-18, 2009 at the National Institute of Advanced Studies, Bangalore, India. Papers and posters were presented within session along the following themes: Metallurgy and Interaction across Eurasia, Ancient Iron and Steel Technology, History and Production of Copper-based Alloys, Precious Metals, Metallurgical Processes, Metalware Production, and Metal Workshops. Paper titles and authors included "Could Kumaun, Uttarakhand also be the source of the Harappan Copper?" (D.P. Agrawal), "Mineral resources and alloys on 2000 BC Pyrgos/Mavroraki metallurgical site" (Maria Rosaria Belgiorno), "The Bronze Age to Iron Age transition in Southeast Asia" (Anna Bennett and Ian Glover), "New avenues for studying the Iron Age copper industry in the southern Levant" (Erez Ben-Yosef, Thomas E. Levy and Mohammad Najjar), "Geomagnetic archaeointensity as a tool for dating slag deposits: examples from the southern Levant" (Erez Ben-Yosef, Lisa Tauxe, Thomas E. Levy, Hagai Ron and Amotz Agnon), "Early use of iron in Aksum. Trade and

technology transfer networks across the Ethiopian highland" (Constantin Canavas), "The reconstruction of a 7th c. AD blacksmith workshop in Central Italy" (Marco Cavalieri, Alessandra Giumlia-Mair, and Alan J.A. Mair), "The iron objects and iron smelting technologies of South China during the Han Dynasty" (Jianli Chen), "New Research on Regional Bronze Industries during the Shang Dynasty: the Hanzhong Case" (Kunlong Chen, Congcang Zhao, Jianjun Mei and Thilo Rehren), and "Metals and alloys in the past: archaeometallurgical perspectives on interaction between southern Africa and the Indian Ocean rim" (Shadreck Chirikure).

Other papers covered "Surface and Bulk Investigations on Bronze Roman Nummi" (Enrico Ciliberto, Maria Luisa Carrara, Salvatore Garraffo and Angelo Nicolosi), "Phosphate Corrosion Crust in XVIII sec. Bronze Medals" (Enrico Ciliberto and Francesca DiStefano), "Scientific Analysis of Some Bronze Artifacts unearthed from Fenshuiling Cemetery, Shanxi Province" (Jianfeng Cui and Binghua Han), "Egyptian Old Kingdom metal workshop practice" (Christopher J. Davey), "Technical Investigations of Iron objects found during excavations at Vidharbha Region of Maharashtra, India" (P.P. Deshpande), "The application of Rietveld refining methods and AFM on hydrothermal reactivity of polymetallic Ore Sources based on Archaeometallurgical founds in Meymand Cave Dwelling Village, Kerman, Central Iran" (S. Mohammadamin Emami), "Multiphase microstructures on late imperial Chinese brass coins" (M.J. Furtado), "New Observations on the Pactolus Alluvila Gold Grains of Sardis, Turkey" (A.E. Geçkinli), "The making and heat-treating of crucible steel: early manuscript evidence" (Brian Gilmour), "Hunnic gold in the Csongrád County, Hungary" (A. Giumlia-Mair and B. Kürti), "Ceramic Shell Casting of Copper-Based Artifacts During the Early 4th Millennium BC in Israel, New Discoveries" (Yuval Goren, Dana Ashkenazi and Shai Glipter), "Origin of iron metallurgy in Northern Eurasia" (S. Grigoriev), "Metallographic Study of 28 Metallic Artifacts Unearthed from Two Sarcophagus Tombs at Beipiao, Liaoning Province" (Rubin Han), "Chalcolithic copper artefacts from the northern Indian Subcontinent: New lead isotope data and possible relations to Mesopotamia" (A. Hauptmann, S. Klein and P. Yule), "The Composition of Indus Copper Alloys: Initial Results of XRF Analysis from Harappa" (Brett C Hoffman), "A New Discovery: Manganese as Flux Agent from the Song Dynasty Iron-Smelting Sites in the Xingye County, Guangxi, China" (Quansheng Huang and Yanxiang Li), "The relation between Mediterranean area and north west China before 221 BC – evidence from the technical and archaeological study of tinned objects excavated from Ma jia yuan site, Gansu province" (Wei Huang, Xiaohong Wu, Jianli Chen and Wang Hui), "Matte prills in slag from smelting of oxidized copper ore in ancient Japan" (Eiji Izawa), "Caste, Community and Rituals in Wootz Making Centres of Telangana -A Cultural Continuity in Wootz making Tradition" (S. Jaikishan), "Metal Antiquities and their Conservation" (V. Jeyaraj), "Iron Extraction Technology in Ancient India (With reference to their therapeutic Importance)" (C.B. Jha, Sudhaldev Mahapatra, Ramesh Gupta, and Dr. Rekha Chaturvedi), "Study on Ancient Bronze alloys from Nanling county" (Ying Jia, Pingsheng Liu and Yunlan Huang), "Late Bronze Age and Early Iron Age Gold Mining in the Eastern Rhodopes (Bulgaria)" (Albrecht Jockenhövel and Hristo Popov), "Bronze age and writing system of Sarasvati hieroglyphs evidenced by two 'rosetta stones' Decoding Indus script" (S. Kalyanaraman), "Protective Scale Development and Evaluation over Delhi Iron Pillar" (U. Kamachi Mudali and Baldev Raj), "Manufacturing and Characterization of South Indian Bronzes" (U. Kamachi Mudali and Baldev Raj), "Archaeometallurgical survey in Sikar District, Rajasthan" (J. S. Kharakwal), "Bidri ware: investigation of the nature of the black patina" (Susan la Niece, Nigel Meeks and Chris Jones), and "Behavior Chains and the Chaîne Opératoire for Ethnoarchaeology in India – A Case Study from the Hereditary Bronze Casters of Swamimalai" (Thomas E. Levy).

Other papers included "The regional characteristics of and interactions between the early bronze metallurgies of the Northwest and Central Plain" (Shuicheng Li), "Standardisation and Labour Organisation in the Qin bronze weapons for the Terracotta Warriors, China" (Xiuzhen Janice Li, Marcos Martinon-Torres, Andrew Bevan, Thilo Rehren), "An analysis of the technology of metallic artifacts unearthed from Jiandchuan Haimenkou site of Yunnan in 2008" (Xiaocen Li, Yali Yun and Rubin Han), "What's Mine is Yours: The Transmission of Metallurgical Technology in Eastern Eurasia and East Asia" (Katheryn M. Linduff), "Casting Technology and Production of Bronzes in Late Shang Dynasty: A Multiple Craft Perspective (Yu Liu and ZhanweiYue), "Studies of Early Bronze Metallurgy in the Yili Region, Xinjiang, China" (Jianjun MEI, Yong LING, Enguo LU), "Lock-in Thermography – An innovative and possible technique for non invasive classification of ancient coins" (M. Menaka, B. Venkatraman and Baldev Raj), "The application of Rietveld refining methods and AFM on hydrothermal reactivity of polymetallic Ore Sources based on Archaeometallurgical founds in Meymand Cave Dwelling Village, Kerman, Central Iran" (S. Mohammadamin Emami), "Forging technique for Korean high tin bronzeware "ban-bangjja" and its microstructure" (Takekazu Nagae, Han, Min-Su, Lee Eun Seok, Lee Sang-Yong, Haruhisa Mifune, Yasuji Shimizu and Shinya Shoda), "Mass and Heat Balance of Pig Iron Making by Tatara" (Kazuhiro Nagata), "Variations of the chemical composition of Japanese early modern silver coin " Ichibu-gin" (Tetsuya Nakanishi), "Banahalli- An Iron Age Wootz Steel Production centre" (B.Narasimhaiah, B.Raghunatha Rao, B.Sasisekaran, S.Sriram), "The microstructure - property relationship of the ancient bronzes in China" (Chunxu Pan, Lingmin Liao and Yali Hu), "Archaeological Evidence of Metallurgical Axctivities in Rajasthan" (Lalit Pandey), "Copper and Its Alloys in Ancient India" (Nidhi Pandey), "Archaeo-metallurgical Studies of Iron Artifacts from Gujarat, Western India" (Ambika Patel), "South India's Traditional Knowledge in Shaping High Tin Bronze" (R.M. Pillai, S.G.K. Pillai and A.D. Damodaran), and "Religious Traditions of Ferrous Paleometallurgists of Japan" (B. Prakash).

Lastly, papers also covered "Cultural Transmissions in Archaeometallurgical Landscapes: The Case from Southeast

Asia" (T. O. Pryce), "Khao Sam Kaeo - an Archaeometallurgical Crossroads for Trans-Asiatic Technological Traditions" (T .O Pryce , M. Murillo-Barosso , M. Martinón-Torres and B. Bellina), "Microstructural Evolution during Forge Welding of Delhi Iron Pillar"(Baldev Raj, T.Jayakumar, Anish Kumar, K.V.Rajkumar, A.Joseph, B.Venkatraman and C.Babu Rao), "Adichanallur: A Prehistoric Mining Site" (B.Sasisekaran, S.Badrinarayanan, D.Venkata Rao), "Chemical, Metallographical and Petrographic Study of Chalcolithic Copper Finds from Pequin Cave" (Irina Segal and Yuval Goren), "A technological study of a complex of bronzes from the protohistorical pile-dwelling site of Celano Paludi in Abruzzo, Italy" (Anna Maria Bietti Sestieri, Giorgio Cerichelli, Vincenzo D'ercole, Claudio Giardino, Maria Laura Mascelloni), "The Forging of Israel: Archaeometallurgical evidence of Early Iron Age metal production in the Land of the Bible" (Sariel Shalev), "The Character of Bronze Adoption Process in Northeast Asia" (SHODA Shin'ya), "Comparative Study of Bronze Adoption Processes in Northeast Asia and Northwest Europe: Daggers in stone and bronze" (SHODA Shin'ya and Catherine Frieman), "The Re-comparison of Zinc Smelting Techniques Used in Ancient India and China" (Liu Siran and Jianli Chen), "Archaeometallurgical and ethnoarchaeological insights on bronze casting traditions in Tanjavur district, southern India" (Sharada Srinivasan), "Unleaded and high-tin bronzes: further insights from Indian and Southeast Asian finds" (Sharada Srinivasan, Ian Glover and S. Ranganathan), "Casting in Transition: from piece-mold to lost-wax in early Chinese Buddha sculptures" (Donna Strahan), "A preliminary study of solders and soldering methods of ancient Chinese bronzes (9th - 3 rd centuries B.C.)" (Shuyun Sun and Jianjun Mei), "Metallurgical Innovations and Pattern of Adaptation of Iron in the Cultures of Ganga Plains in the 1st Millennium BCE" (Vibha Tripathi), "Procurement and use of tin in ancient India " (Prabhakar Upadhyay), "Improvements in Indian Ancient Iron Making Technology at the National Metallurgical Laboratory, Jamshedpur, India" (A. K. Vaish, S. D. Singh and M. M. Humane), "Khmer bronze craft and craftsmen during the Angkor period (12th-13th centuries): archaeometallurgical study of bronze artefacts from the Phnom Penh National Museum" (Brice Vincent), "A study on Bronze Drums of the Kmuic in Laos to Those of the Same Type in Its Neighbouring Nations" (Danfang Wei and Fubin Wan), "Damascene steel and Bin-tie: a relative steel technology between South Asia and China" (Wei Qian), "Indian steel in Medieval European swords" (Alan Williams), "Scientific Examination of Diverse Metal Objects of the Bronze Age from the Hejiashan Site, Western Yunnan" (Yali Yun), and "The origin of lost-wax techniques & the characteristics of lost-wax castings" (Weirong Zhou). More information and downloads of the program and abstracts can be found at the following website, http://materials.iisc.ernet.in/buma2009.

"*Eastern Mediterranean Metallurgy and Metalwork in the Second Millennium BC*" an International Conference in honour of James D. Muhly, was held at the University of Cyprus, Nicosia, on the 10th-11th October, 2009. The conference began early Saturday morning, October 10, with opening welcomes by University of Cyprus officials Demetrios Michaelides (Director Archaeological Research Unit) and Constantinos Christophides (Vice Rector of Academic Affairs), which were followed by Vassos Karageorghis, Director of the A. G. Leventis Foundation and legend of Cypriot archaeology, and Robert Maddin, Professor Emeritus, University of Pennsylvania, "Reminiscing" of Working with Jim Muhly. Paper presentations followed and comprised "Late Bronze Age copper production in Cyprus from a geologist's perspective" (George Constantinou), "Metallurgical production and exchange on Bronze Age Cyprus" (A. Bernard Knapp), "Pyrgos/Mavrorachi in Cyprus metallurgy" (Maria Rosaria Belgiorno and Daniela Ferro), "Tinker, tailor, farmer, miner: metals in the Late Bronze Age economy at Kalavasos" (Alison South), "Standing on ceremony? Copper metallurgy at Maroni-Vournes" (Gerald Cadogan, Roger Doonan, and David Sewell), "Broken Symbols: Aspects of metallurgy at Alassa" (Sophocles Hadjisavvas), "From regional gateway to Cypriot kingdom: Copper deposits and copper routes in the chora of Paphos" (Maria Iacovou), "The role of the Apliki mine region in the post 1500 BC copper production and trade networks in Cyprus and in the wider Mediterranean" (Nöel H. Gale and Zofia A. Stos-Gale), "Reconstructing" the Enkomi tombs (British Excavations): An instructive exercise" (Despo Pilides), "Metallurgy and metalwork in Enkomi: the early phases" (Vasiliki Kassianidou), "Niello versus Kuwanna, the examination of the Enkomi cup" (Alessandra Giumlia-Mair), "Profusion of Cypriot copper abroad and dearth of bronzes at home: reflections on a paradox in Late Bronze Age Cyprus" (Georgios Papasavvas), "Cypriot copper and the transformation of Minoan metals production in the Late Bronze Age" (Philip P. Betancourt), "Bronzesmithing in the harbour-town of Knossos at Poros-Katsambas" (Nota Demopoulou Rethemiotaki). The remaining papers given Sunday included "The oxhide ingots in Central Mediterranean" (Fulvia Lo Schiavo), "On the ceasing of the local copper production in the Aegean 2nd millennium BC" (Ioannis Bassiakos and Thomas Tselios), "Cyprus beyond the East Mediterranean in the second millennium: developments and perspectives" (Anthony Harding), "Late Bronze Age Alalakh and Cyprus: A relationship of metals?" (Aslihan K. Yener), "The evidence for metallurgical workshops of the 2nd millennium in Ugarit and the Levant" (Ella Dardaillon), "The merchants of Ugarit: Oligarchs of the LBA trade in metals?" (Carol Bell), "QANTIR-PIRAMESSE — Bronze workshops of industrial dimensions" (Edgar Pusch), "The metallurgy of bronze production at Qantir – Pi-Ramesse" (Thilo Rehren and Edgar Pusch), "The emergence of tin-bronze metallurgy across the Asian Old World – a question of sources and societal impact" (Vincent C. Pigott), and "Just a few rusty bits: the innovation of iron in the Eastern Mediterranean in the 2nd and 1st millennia BC" (Xander Veldhuijzen). The conference link: http://www.ucy.ac.cy/data/archreun/Conferences/EasternMediterranneanMetallurgy/Eastern_Mediterrannean%20Metallurgy_and_Metalwork.pdf.

Forthcoming Meetings

A workshop course will be offered by Alessandro Pacini on Ancient Etruscan Gold-working Techniques. This course

will be offered from November 2-5, 2009 in Montepulciano, Italy. More details can be found at: www.aliseda.it/alessandro/corsidisco.htm.

ArchaeoMetallurgy Conference: In Celebration of Gerry McDonnell at Bradford University will be held at the University of Bradford, November 10-12, 2009. Dr Gerry McDonnell is leaving the University of Bradford's Division of Archaeological Science. The overall aim of this conference is to therefore celebrate the research carried out by Gerry McDonnell during his time at Bradford, and to wish him well for his future research. The conference has been combined with the Historical Metallurgy Society's 2009 Research in Progress Meeting, and offers a varied program covering slag, ferrous and non-ferrous metals, spanning multiple time periods and research from across the world. For more information and to see the provisional program, visit the website www.archaeomaterials.me.uk/conf/archmet09.html or email eleanor.blakelock@ironsmelting.net. Papers listed in the provisional program from the first day of the conference include "One Man's Waste is Another Man's Obsession- A Theoretical View of the Role of Slag within Archaeometallurgical Research" (Allan Daoust), "Colour Change in Copper Alloys through Alloying" (Lien Fang), "Iron Age Grey Slags" (Jane Cowgill), "Nidderdale Iron Project" (Jim Brophy), "A study of wear in Roman and Early Medieval knives" (Ed Kendal), "Early Medieval iron technology, changes with the coming of urban settlements" (Eleanor Blakelock), "Aspects of the introduction of water power to iron smelting, 13th-15th centuries, Shropshire, England" (Tim Young), "The Asante Ewer and the casting technology of large Medieval Bronze Jugs" (Susan La Niece), "Tudor arrowheads: battlefield finds under the microscope" (Rachel Cubitt & David Starley), "The impact of the medieval and early modern iron industry on the woodlands of Rievaulx and Bilsdale, North Yorkshire, UK" (Jane Wheeler), "Kiln hunting! In search of the definitive earthwork evidence for chop-wood/white coal production" (Janis Heward), and "The other side of the melt; Bradford's fire-brick industry" (Derek Barker). The second day of the conference includes "Metals, envaluation and materiality" (Tim Taylor), "Accessing skills of the first European metalworkers: metallographic analysis of copper implements from Plocnik, a Vinca culture site in south Serbia" (Miljana Radivojevic), "Identification of raised vessel manufacturing workshops in Late Minoan Crete" (Christina Clarke-Nilsen), "From Bronze to Copper: The Effect of Recycling on Copper Alloys in prehistory" (Giovanna Fregni), "Found the furnace!" (Xander Veldhuijzen), "Geophysical prospecting on iron slags in Hamadab/ Northern Sudan" (Burkart Ullrich), "Forging, Texts, and Identity: Understanding iron and iron workers in EIA Greece" (Roger Doonan), "Iron and the Parisi" (Peter Halkon), "Iron Cart Tyres from Wetwang: a brief metallographic examination" (Janet Lang), "Smithies and ironworking in Denmark" (Arne Jouttijärvi), "Roman age ironmaking in Mid-Norway" (Arne Espelund), and "Ironworking in Roman Worcestershire and surrounding areas: can we compare data across commercially excavated sites?" (Christine Elgy). The final day of the conference included papers on "Silver for the Emperor" (Bastian Asmus), "How to part silver from copper. Understanding *Saigerprozess* through experimental liquation and drying" (Maxime L'Héritier), "Silver refining in Medieval times" (Marie-Pierre Guirado), "Slag? What slag? In search of evidence for medieval lead/silver smelting" (Peter Claughton), "Understanding Lithage Cakes" (Justine Bayley), "Interim results of the Stanley Grange Medieval Iron Project" (Patrice de Rijk), "Experimental ironmaking processes of the 1720s" (Peter King), "Steel blades made in Sheffield 1624-1924" (Joan Unwin), "Archaeometallurgy of copper coins rescued from a historical site in Rio de Janeiro" (Guillermo Solorzano), and "Chemical evidence for the origin of hammerscale" (Tim Young).

The *Early Scottish Metallurgy: HMS Archaeology Day Meeting*, Spring 2010, will be held in Edinburgh, Scotland, on Saturday, March 20, 2010. The meeting will be on the subject of early Scottish metallurgy (up to c. AD1000). Offers of papers (along with an abstract) should be sent to Fraser Hunter, National Museum of Scotland, Chamber Street, Edinburgh, EH1 1JK, UK. Email: fjh@nms.ac.uk.

The *International Conference on Historic Metals Conservation*, Interim Meeting of the ICOM-CC Metal WG, will be meeting from 11-15 October, 2010, in Charleston, South Carolina, USA. Original papers are invited for submission under the following themes: 1) Case Studies and Treatments, and 2) Research and Treatment Development. The first theme includes papers within the topic of Technical and Authentication Studies; Conservation of Large Artifacts; Conservation of Composite Artifacts; Mass Treatment; and, Conserving Artifacts on a Budget. The second theme includes papers within the topics of Advances in Metal Analysis and Corrosion Characterization; Progress in Conservation Treatments; New Approaches in Metals Protection; Monitoring Artifacts Before and After Conservation; and, Technology Transfer from the Industry. The deadline for abstracts submissions has passed, but details of the call for papers can be found at: http://www.icom-cc.org/54/document/call-for-papers-historic-metals-conservation/?id=485.

Archaeological Ceramics

Charles C. Kolb, Associate Editor

The column in this issue includes five topics: 1) News and Notices; 2) Reviews of Books on Archaeological Ceramics; 3) Previous Meetings; 4) Forthcoming Meetings; and 5) Exhibition.

News and Notices

Dating fired-clay ceramics: Moira A. Wilson, Margaret A. Carter, Christopher Hall, William D. Hoff, Ceren Ince, Shaun D. Savage, Bernard Mckay, and Ian M. Betts. (2009) "Dating fired-clay ceramics using long-term power law rehydroxylation kinetics." *Proceedings of the Royal Society A* 465(2108):2407-2415 (8 August 2009) Abstract: "Fired-clay materials such as

brick, tile and ceramic artefacts are found widely in archaeological deposits. The slow progressive chemical recombination of ceramics with environmental moisture (rehydroxylation) provides the basis for archaeological dating. Rehydroxylation rates are described by a $(time)^{1/4}$ power law. A ceramic sample may be dated by first heating it to determine its lifetime water mass gain, and then exposing it to water vapour to measure its mass gain rate and hence its individual rehydroxylation kinetic constant. The kinetic constant depends on temperature. Mean lifetime temperatures are estimated from historical meteorological data. Calculated ages of samples of established provenance from Roman to modern dates agree excellently with assigned (known) ages. This agreement shows that the power law holds precisely on millennial time scales. The power law exponent is accurately $^{1/4}$, consistent with the theory of fractional (anomalous) 'single-file' diffusion," http://rspa.royalsocietypublishing.org/content/465/2108/2407.abstract. Discussed in the following article: James Beresford, "Revolutionary new dating technique unveiled." *Minerva* 20(4):5-6 (July-August 2009).

Gliozzo, E., D'Arco, D., Memmi Turbanti, I., Galli, A., Martini, M., and Sibilia, E. (2009). Common ware production at Thamusida: Dating and characterisation of Roman and Islamic pottery. *Archaeological and Anthropological Sciences* 1(2):77-85. Abstract : Twenty-one samples of likely Roman, likely Islamic and unknown common ware from the archaeological site of Thamusida (Rabat, Morocco) were analysed in order to anchor selected types of pottery to a limited time span and, possibly, to a production area and technology. Analytical techniques were thermoluminescence, optical microscopy, scanning electron microscopy and X-ray fluorescence. The results arising from this research are definitely useful for the study of the site of Thamusida as well as for all researchers involved in archaeological and archaeometrical research in Morocco. Chronologies proposed on a typological base have been denied twice: a likely Islamic cup dates back to the second century A.D.; vice versa, a stewpot, framed into the Roman period, resulted to be an eighth century A.D. production. Moreover, the identification of an eighteenth century ceramic production is of outstanding importance, as it characterizes a completely unknown production.

Roxanna M. Brown's dissertation, *The Ming Gap and Shipwreck Ceramics in Southeast Asia*, has been posthumously published in her honor; an obituary appeared in *SAS Bulletin* 31(3):19-20 (Fall 2008). Eileen Deeley, the Director of the "Roxanna Project," reports that the Siam Society was entrusted by the late Roxanna Brown to publish her doctoral dissertation. A book launch took place on Tuesday, 8 September at the Siam Society at which Acharn Burin and Acharn Pariwat of the Bangkok University delivered a short presentation to honor Roxanna and her contribution in the field of ceramics, in particular her work for the Southeast Asia Ceramics Museum.

She was the author of *The Ceramics of Southeast Asia: Their Dating and Identification*, 2nd ed (Chicago: Art Media Resources, 2000) which is an expanded reprint of the 1988 second edition of her seminal book on Southeast Asian ceramics. In that volume she presented original research on four areas of major importance: 1) the identification of Guangdong ceramics as the missing link between the wares of China and those of both Vietnam and Kampuchea; 2) the unexpected discovery of burial sites in the hills of western Thailand, which contained examples of northern Thai wares rarely seen previously; 3) the discovery of Burmese glazed ceramics; and 4) new data from excavations at the Sawankalok kiln site. In this second edition, the author takes into account the developments in the last decade to bring her original study up to date, and also revises the text where necessary. A large number of new illustrations, both in color and black and white, were included together with drawings and maps. The outcome is virtually a new book, completely reset and reillustrated.

Roxanna Maude Brown, *The Ming Gap and Shipwreck Ceramics in Southeast Asia: Towards a Chronology of Thai Trade Ware*. Bangkok, Thailand: River Books, 212 pp., 73 plates (with 295 color illustrations), 50 tables, 8 drawings, bibliography, indices, 2009. ISBN 978 974 9863 77 0, 759 baht (prepublication in Thailand). It is to be published on 1 November 2009 and available through online booksellers below the advertized price of $50.00 U.S., €40.40, or £30.00. The author, the late Roxanna M. Brown, was the founding director of the Southeast Asian Ceramics Museum, Bangkok University and was one of the world's leading experts in Southeast Asia ceramics, having devoted over 35 years of her life to their study and preservation. Shipwrecks discovered throughout Southeast Asia and the precious cargoes they contain represent invaluable information for the study of international trade networks. However, these treasure troves of Thai, Vietnamese and Chinese ceramics have been unsystematically studied and rarely published. This book addresses this issue with the author tracing the developments and fluctuations of the international ceramic trade between China and Southeast Asia focusing specifically on the 14th-15th centuries, a period known in ceramic scholarship as the "Ming Gap," a term which arose to describe the ban placed on the export of Chinese ceramics by the Ming Dynasty. The author illustrates how as a result, Southeast Asian ceramics began to fill this void and for over a century became the dominant ceramic trade ware throughout the region. Analyzing over 120 shipwrecks, the author for the first time proposes a chronology of ceramic production placing Thai ceramics into five chronological periods and discussing issues such as the relationship between Sukhothai and Sawankhalok kilns, the discovery of exported Burmese celadon wares and the location of Vietnamese production sites for ceramic exports. River Books (396 Maharaj Road, Tatien, Bangkok 10200, Thailand) Telephone +66 2 622 1900, +66 2 224 6686, +66 2 222 1900; Fax +66 2 225 3861; Email contact http://www.riverbooksbk.com/books/catalog/contact_us.php. A review of this volume will be published in a forthcoming issue of the *SAS Bulletin*.

Ethnoarchaeology: Journal of Archaeological, Ethnographic, and Experimental Studies Volume 1, Number

1, April 2009 (semi-annual in April and October, 256 pages per volume) is published by Left Coast Press; Lisa Frink (University of Nevada, Las Vegas) and Kathryn Weedman Arthur (University of South Florida, St. Petersburg), are the editors. The first issue of this new journal includes an article on ceramic ethnoarchaeology, "Counting pots in Kalinga, Philippines: Short- and long-term change in household assemblages" by Margaret E. Beck (pp. 79-105) as well as contributions by Michael Brian Schiffer and James M. Skibo. The second issue for 2009 (in press) contains an article by A. Mayor, "Ceramic traditions and ethnicity in Mali: Between population dynamics and transmission of knowledge regularities." Ethnoarchaeology is a cross-cultural peer-reviewed journal that focuses on the present position, impact of, and future prospects of ethnoarchaeological and experimental studies approaches to anthropological research. The journal's primary goal is to provide an intellectual platform to showcase and appraise current research as well as foreground theoretical and methodological directions for the 21st century. *Ethnoarchaeology* welcomes submission of original manuscripts of no more than 30 double spaced pages that focus on management of the world's heritage resources. All manuscripts must be submitted electronically in MSWord or RTF format to ethnoarchaeology@unlv.edu. If an author is unable to submit an electronic version of their manuscript they should first contact the editors. Unless contacted, the editors will not consider manuscripts that have not been submitted electronically. For information regarding subscriptions or submissions to the journal, please visit: http://lcoastpress.com/journal.php?id=9.

EMAC'07: 9th European Meeting on Ancient Ceramics, 24-27 October 2007, Hungarian National Museum, Budapest, Hungary edited by Katalin Biró, Veronika Szilágyi, and Attila Kreiter, Budapest: Hungarian National Museum, 2009. 292 pp., ISBN 978-963-7061-67-7, €45.00 has just become available. The published proceedings of this meeting include 98 presentations. The volume may be obtained from Dr. Endre Tóth, Head Librarian, Library of the Hungarian National Museum, H-1088 Budapest, Múzeum körút 14-16. Email Dt. Tóth at teutanus@freemail.hu. A review of this volume will be published in a forthcoming issue of the *SAS Bulletin*.

Book Reviews

A Guide to Spanish Colonial Ceramics in Texas, Anne A. Fox and Kristi M. Ulrich with contributions by Barbara Meissner. Special Report 33, San Antonio: University of Texas at San Antonio, Center for Archaeological Research, 2009, x + 157 pp., 44 figures, spiral bound, no ISBN. The second hardcopy printing of this publication is now sold out, but the Center is making CDs available. The price is $15.00 (plus $1.22 state sales tax if applicable) and there is a charge of $2.00 shipping and handling. For more information, please visit their Web page at http://car.utsa.edu/Publications/pubsdirectory.html. See also the review note in *SAS Bulletin* 32(2):29 (2009). In four chapters, this new volume provides a south Texas perspective on Spanish Colonial ceramics for the period ca. 1680-1824. The usual authors' preface, a preface by the editor, Steve Tomka, and acknowledgments are provided. The authors acknowledge the assistance of Florence and Robert Lister, Kathleen Deegan, Jack Williams, and Timothy Perttula. The first three chapters provide background information and context. Chapter I, "Missions, Presidios, and Villas of Spanish Texas" (pp. 1-20) includes an historical overview and regional information for west, east, and central Texas, coastal Texas, San Antonio, and the presidios, The color map show locations for 38 missions, 10 presidios, and 2 settlements. Chapter 2, "Ceramic Manufacturing in Mexico and Supplying the Missions and Presidios of Texas" (pp. 21-26) documents production sites and issues in supplying the missions, and is illustrated by a color map showing 11 manufacturing sites. In Chapter 3, "Defining Variation in Manufacture, surface Treatments, and Vessel Forms in Spanish Colonial Ceramics" (pp. 27-35). Manufacturing techniques, paste types (further defined in Appendix A), surface treatments (glazed [lead or tin] and unglazed, as well as burnishing and slip decoration), vessel forms (4 storage vessels, cooking wares), and table service are considered. The latter include a variety of plates, bowls and cups, as well as other products including chamber pots, cosmetic jars, candle holders, and sugar molds.

Chapter 4, "Ceramics from Spanish Colonial Sites in Texas" (pp. 37-113) begins with Figure 4.1 illustrating the chronologies for 37 wares. The chapter is divided into 10 parts and covers all 37 wares: Unglazed Wares (n = 3 wares); Sandy Paste Lead-Glazed Wares (2); Fine Paste Lead-Glazed Wares (8); Mexican Tin Glazed Wares (4 covering the late 17th to early 18th centuries); Mexican Eighteenth Century (5); Mexican Late Eighteenth Century (1); Late Eighteenth to Early Nineteenth Centuries (10); and Nineteenth Century (2). In addition to these eight are Faience (the two types in Texas are *faience brune* and *faience blanche* in the form of bowls, plates, patters, cups, and ointment jars) and Chinese Porcelain (underglaze blue and overglaze red-orange and gold in the form of tea bowls, small plates, and saucers). Lastly, the volume includes 119 "References Cited" (pp. 115-123), Appendix A, "Glossary of Terms Used in Ceramic Analysis" (pp. 125-130) with 63 entries, and Appendix B, "Bibliography of Archaeological Research at Spanish Colonial Sites in Texas" (pp. 131-157). The latter very useful appendix was prepared by Barbara Meissner and is organized into three parts: Mission Sites (pp. 132-150, 37 sites with 173 references); Presidios (pp. 151-153, nine sites and 22 references); and Some Spanish Colonial settlements (pp. 153-157, 4 loci with 33 references).

Readers will find the ceramic descriptions and accompanying color illustrations valuable for research. Important resources that should also be consulted include: Cohen-Williams, A. and J. Williams (2004), *Reconstructing Maiolica Potters from Colonial Sites in Southern California*, http://www/colonial majolica.com and Deegan, K. (2007), *Historical Archaeology at the Florida Museum of Natural History: Digital Type Collection*, http://www.FMLH.UFL.edu/HISTARCH/ both of which also provide important descriptions and color images of Spanish Colonial

pottery. Two theses and one dissertation are also contributions: Longoria, L. D. (2007), *Chinese Export Porcelain in the Missions and Presidios of Eighteenth Century Spanish Texas*, M.A. thesis, University of Texas, San Antonio; May, R. V. (1975), *Mexican Majolica in Northern New Spain: A Model for Interpreting Ceramic Change*, M.A. thesis, San Diego State University; and Seifert, D. (1977), *Archaeological Majolicas of the Rural Teotihuacan Valley, Mexico*, Ph.D. dissertation, University of Iowa.

Thin-Section Petrography of Ceramic Materials, Sarah E. Peterson with contributions by Philip P. Betancourt, INSTAP Archaeological Excavation Manual 2, Philadelphia: INSTAP Academic Press, 2009, vii + 20 pp., 7 figures, bibliography, ISBN 978-1-931534-55-0 (paper), $9.95. Also available as a free download on the INSTAP Academic Press web site: http://www.instappress.com. This brief volume contains seven "chapters," commencing with a one-page "Introduction" with two figures in which the author reminds readers that thin sections may be "… used to examine a wide variety of materials including rocks, minerals, slags, concrete, mudbrick, and plaster as well as fired clays. The method can provide evidence for a number of important aspects of ceramic studies including the determination of provenance and the reconstruction of technology" (p. 1) and she discusses in general the preparation of the thin section. In second essay, "Goals for the Thin-Section Petrography of Ceramics" (p. 2), Peterson comments that ceramic petrography is an "indispensable" analytical technique and comments on four features that can be observed in thin section: 1) the nature and characteristics of non-plastic inclusions (mineralogical composition and the relative percentage, size, shape, distribution, and orientation of different particles); 2) textural and optical characteristics of the clay matrix (such as birefringence and color); 3) shape, quantity, and orientation of voids; and 4) relationship between the body of the ceramic material and the surface/decoration. The third chapter, "History of Thin-Section Petrography" (pp. 3-7) begins with a discussion of the method, tracing its beginnings to the Scottish scientist William Nichol in the late 18th century and his contribution to the creation of the first polarizing microscope in 1828. The importance of English scientists William Henry Fox Talbot and Henry Clifton Sorby, and German geologist Georg Richard Lepsius in the late 1800s are noted. Peterson next discusses the important contributions of Anna O. Shepard in the Pecos area of New Mexico and the lesser-known work of Wayne M. Felts (University of Cincinnati) at Troy in the late 1930s. The significance of Frederick R. Matson's article "Technological Ceramic Studies" (1942) she sees as a precursor to the concept of ceramic ecology which began with his work in Syria and Turkey in the early 1940s. David Peacock's work in England on local and Roman pottery helped establish the methodology there in the 1960s. The remainder of the essay focuses on research by David F. Williams, J. A. Riley, George Myers, Philip P. Betancourt, Ian Whitbread, R. E. Jones, Sarah J. Vaughn, Peter M. Day, and Christine Shriner.

In "Preparation of Thin Sections" (pp. 8-9), Peterson describes and illustrates (with two figures) the basic preparation and then focuses on "Examination and Analysis of Thin Sections" (pp. 9-14). She documents the characterization of the fabric, focusing of "Non-Plastic Inclusions" (mineral inclusions or rock fragments; organic inclusions such as plant materials, shell and bone; and grog (crushed fragments of previously fired ceramics); three illustrative figures are included. She also mentions three standard references: Bambauer, Taborsky and Trochim's *Optical determination of Rock-Forming Minerals* (1979); Deer, Howie, and Zussman's *An Introduction to Rock-Forming Minerals* (1996); and Nesse's *Introduction to Optical Mineralogy* (2004). Chandra L. Reedy's *Thin-section Petrography of Stone and Ceramic Cultural Materials* (2008) is also noted as are the works of Velde and Druck, *Archaeological Ceramic Materials* (1999), and Orton, Tyers, and Vince, *Pottery in Archaeology* (1993). She also comments that firing data, forming techniques, and geological sources are sometimes identifiable in the specimens. In "Clay Matrix" Peterson considers the characterization of fabrics and firing temperatures before turning to Voids/Pores and Surface Treatment." The final section, "Development of Aims and Sampling Strategy" (pp. 14-15) emphasizes that "… a successful petrographic project should be developed with the aim of addressing a focused and sound archaeological problem." The "Conclusion" (pp. 15-15) mentions other investigations that might be undertaken, such as XRD. The "Bibliography" (pp. 17-20) contains 61 entries.

For a neophyte who does not know about the subject, this volume provides a very basic introduction to thin-section petrography. The historical background is useful but in the post 1960s focuses on a limited geographical region and neglects important publications on the American Southwest and Mesoamerica, many of which are cited in Prudence Rice's seminal overview, *Pottery Analysis: A Sourcebook* (1987), which isn't cited. Peterson does not cover the analytical procedures involved in assessing the content of thin section slides. Reedy's *Thin-section Petrography of Stone and Ceramic Cultural Materials* (2008), is among the best and most recent treatment of the subject. Her comprehensive and illustrated manual (a CD-ROM that illustrates all the photomicrographs in her book) provides an appropriate overview of the minerals and textures seen in polarized light microscopy of cultural artefacts. The reader can learn the techniques used to identify and characterize such materials; to differentiate between them; to monitor the extent of their deterioration; to determine where they may have originated; and to interpret their fabrication, decoration, and use history. Also of note is Graham Mansfield Chandler's *Development of a Field Petrographic Analysis System and its Application to the Study of Socioeconomic Interaction Networks of the Early Harappan Northwestern Indus Valley of Pakistan* (2001). His book describes the creation of the portable petrography kit. As he notes, the creation of thin sections of sherds for petrographic analysis has relied on cumbersome equipment and export permits, and he has devised a system that would produce and analyze thin sections under difficult working conditions on an archaeological site. Lastly, the presentations at the recent EMAC meeting (reported later in this column) have useful

summaries on recent thin sections studies often coupled with other analytical procedures.

Previous Meetings

The EMAC'09 Conference (The 10th European Meeting on Ancient Ceramics), co-organized by The British Museum and the University College London Institute of Archaeology, was held 10-12 September 2009 at The British Museum, London England and was attended by approximately 125 persons. Details online at www.ucl.ac.uk/EMAC09. John Curtis (Keeper of Middle East Department at The British Museum) gave a welcoming talk. There were 43 oral presentations, four keynote speakers (Clive Orton, Venetia Porter, Ian Freestone, and Hector Neff), a public lecture by Gaye Blake Roberts (Curator, Wedgwood Museum), and a gallery talk in the Percival David Collection by Jessica Harrison-Hall (Curator of Chinese Ceramics and Vietnamese Art, British Museum). In addition, 55 poster presentations were listed in the preliminary program, 16 withdrew, and 8 new ones added. On Sunday, 13 September, there was an excursion to the Wedgwood Museum. The oral papers are listed in the order in which they were presented and the posters are listed alphabetically by senior author. I attended the meeting and have summarized key points in the final paragraphs of this report.

Thursday 10 September, Morning Session: Methodological Developments: Renson, Virginie, Coenaerts, Jan, Nys, Karin, Mattielli, Nadine, Vanhaecke, Frank, and Claeys, Philippe "Identifying potential sources of Late Bronze Age pottery from Cyprus using Lead Isotopic Analysis." Prudêncio, M. Isabel, Dias, M. Isabel, and Gouveia, M. Ângela "REE and other trace elements as chemical tracers for the establishment of archaeological ceramics provenance." Molera, Judit and Pradell, Trinitat "Technological implications of the microstructures present in ceramic glazes." Müller, Noémi, Kilikoglou, Vassilis, Day, Peter, and Venkinis, George "Thermal shock resistance of ancient cooking vessels: Myth and reality." Keynote Speaker Clive Orton, "Lessons from the Elephant's Child: Questioning ancient ceramics." Halliday, Kirsten "Using production step measures to assess changes in the control and standardization of Chimu and Chimu-Inka pottery and textiles." Budden, Sandy "Technological signatures of ceramics: A methodology to define and interpret skill and learning strategies." Ben-Shlomo, David, Karasik, Avshalom, and Smilansky, Uzy "Computerized documentation of painted decoration on pottery vessels employing 3D scanning."

Thursday 10 September, Afternoon Session: Building Materials: Kang, Baoqiang, Duan, Hongying, Ding, Yinzhong, Miao, Jianmin, and Lv, Guanglie "Technology research on a rare ceramic system in ancient China: Architectural glazed tile of Huangwa Kiln." Blain, Sophie, Bailiff, Ian, Guibert, Pierre, Sapin, Christian, Prigent, Daniel, Bayle, Maylis, and Bouvier, Armel "Luminescence dating of ceramic building materials: Application to the study of early medieval churches in north-western France and south-eastern England." Karatasios, Ioannis, Alexiou, Konstantinos, Müller, Noémi, Day, Peter, and Kilikoglou, Vassilis "The second life of ceramics: A new home in a lime environment." Thursday 10 September, Afternoon Session: Technology and Provenance: Pentedeka, Areti "Exchanging pottery in the Neolithic: The case of Thessaly (Greece.)" Spataro, Michela and Fletcher, Alexandra "Heartland and periphery: Petrographic and chemical analyses of Halaf fine ware production." Hunt, Alice "Assyrian Palace Ware: Definition, *chaîne opératoire* and archaeological implications." Braekmans, Dennis, Neyt, Bert, Degryse, Patrick, and Poblome, Jeroen "Ceramic workshop differentiation during the Classical and Hellenistic period on the territory of ancient Sagalassos (SW Turkey): An archaeometric approach." Hommel, Peter, Day, Peter, Jordan, Peter, Müller, Noémi, Heron, Carl, Steels, Val, Bazaliskii, Vladimir, and Vetrov, Viktor "Early hunter-gatherer pottery in eastern Siberia: Towards an integrated analytical approach."

Friday 11 September, Morning Session: Islamic Ceramics: Tite, Michael "Technological choices in the production of Italian maiolica ceramics." Waksman, Yona "Ceramics production in Medieval Beirut: Between "Frankish ware" and Islamic traditions." Pradell, Trinitat, Molera, Judit, Gutierrez, Carolina, Climent-Font, Aurelio, Smith, Andrew, and Tite, Michael "The technology and optical properties of silver rich Islamic lustres." Keynote Speaker: Venetia Porter "The tiles of Damascus." Alavi, Mehdi, Fabbri, Bruno, Gualtieri, Sabrina, and Kelder, Erich, Schoonman, Joop, and Tavakoli, Ashgar "Chemical investigation of blue ceramic glazes of some mosques in Isfahan, Iran." Pérez-Arantegui, Josefina, Marzo, Paz, and Laborda, Francisco "Lead glazes in Islamic pottery from the Iberian Peninsula: Materials and technology used during the 11th-12th centuries."

Friday 11 September, Afternoon Session: From Craft to Science: Keynote Speaker: Ian Freestone with Martin, Lara, and Mazzoli, Claudio "Shades of white: Variability and experiment in mid-eighteenth century British porcelain production." Fabbri, Bruno and Gualtieri, Sabrina "Capodimonte porcelain: A unique manufacture." Maggetti, Marino, Rosen, Jean, Neururer, Christoph, and Serneels, Vincent "Paul-Louis Cyfflé's (1724-1804) *Terre de Lorraine*: A technological study." Métreau, Laetitia, Ben Amara, Ayed, and Rosen, Jean "Evidence of tin-glazed earthenware technique experimenting in Brittany." Emery, Laetitia, Ben Amara, Ayed, Bechtel, Françoise, and Camin, Philippe "The Manufacture "Royale" of Samadet (1732-1838): Characterisation of a faience production." Public Lecture, Gaye Blake Roberts (Curator, Wedgwood Museum) "Wedgwood: The Arts and Sciences United."

Saturday 12 September, Morning Session: Technology and Provenance: Buxeda i Garrigós, Jauma, Madrid i Fernandez, Marisol, Gualtieri, García Iñañez, Javier, Capelli, Claudio, and Beltran de Heredia Bercero, Julia "The discovery of the 13th century archaic majolica and lead glazed pottery production at Barcelona." Martinez Ferreras, Verónica, Tsantini, Evanthia, Gurt, Esparraguera, Josep, and Pidaev, Shakir "Archaeometrical study of the ceramic technology in Termez (Uzbekistan): Pottery

making in the ancient Bactriana province during and following the Hellenistic Period." Kolb, Charles C. "The ceramic ecology of Red-on-Buff ceramics from Northern Afghanistan: An enigma at Aq Kupruk." Tomber, Roberta, Cartwright, Caroline, and Gupta, Sunil "Rice temper: technological solutions and source identification in the Indian Ocean." Faber, Edward and Knight, David "Microanalysis of later prehistoric granodiorite tempered pottery from the East Midlands." Gherdán, Katalin, Biró, Katalin, Tóth, Mária, Szakmány, György, Virág, Zsuzsanna, Kiss, Viktória, and Tankó, Károly "Site synthesis: Pottery from Vörs, Máriaasszonysziget (SW Hungary)."

Saturday 12 September Afternoon Session: Technology and Provenance, Keynote Speaker: Hector Neff "Pots as signals: Explaining the enigma of long-distance ceramic exchange." Iñañez, Javier "*Romita Ware*: Between two worlds. Hybrid technology in Colonial Mexico?" Ting, Carmen, Graham, Elizabeth, and Martinón-Torres, Marcos "Moulding the 'Collapse': The technological characterization of the Terminal Classic Ahk'utu' moulded-carved vases from Altun Ha, Belize." Howie, Linda, Aimers, Jim, and Graham, Elizabeth "50 Left Feet: The manufacture and meaning of effigy censers from Lamanai, Belize." Iizuka, Fumie "Inferring provenance and firing temperatures of the Monagrillo Ware (ca. 4,500-3,200 B.P.), Panama's first pottery." Boileau, Marie-Claude, Kilikoglou, Vassilis, D'Agata, Anna Lucia, and Whitley, James "Similar yet different: Trace element discrimination of Early Iron Age fine ware productions in Central Crete." Kiriatzi, Evangelia, Georgakopoulou, Myrto, Penredeka, Areti, and Gauss, Walter "From fabrics to recipes to landscapes: Linking ancient and modern pottery production on the island of Aegina, Greece." Day, Peter, Relaki, Maria, Wilson, David, Kariotis, Stephanos, and Kouka, Ourania "Ceramic intruders in the Cyclades? Provenance and technology of a 'Kastri Group' deposit from Akrotiri, Thera."

A keynote speech by Prudence Rice and two papers listed in the preliminary program were not presented: Labbaf-Khaniki, Meysam "Sassanian pottery of northeastern Iran: Classification, comparison, and interpretation based on attributes of form." Mirti, Piero, Gilmini, Monica, Giannini, Rita, Lega, Anna Maria, and Manna, Gabriella "Technology of production of Ghaznavid glazed pottery from Afghanistan."

Posters: Authors and Title (alphabetical order): Albero, Daniel and Mateo, Eduardo "Pottery production and mineral resources management in Majorca (Balearic Islands, Spain) during Bronze and Iron Age (1700-123 BC): Provenance, technology and society." Amato, Francesca, Fabbri, Bruno, Gawronski, Jerzy, Gualtieri, Sabrina, and Jaspers, Nina "On the origin of compendiario majolica coming from excavations in Amsterdam." Ben-Schlomo, David, Uziel, Joe, and Maeir, Aren "Pottery production at Tell es-Safi/Gath: A *longue durée* perspective." Biró, Katalin, Visser, Sirk, Kardjilov, Nikolay, and Gherdán, Katalin "Inside the shard." Broughton, David, and Quinn, Patrick "Ceramic analysis and cultural interpretation of the Stacked Stone site, Cuyamaca Rancho State Park, Southern California." Burbidge, C. I., Rodrigues, A. L., Dias, M. I., Prudêncio, M. I., Cardoso, G., Figueirdo, M. O., Matos, M. A., and Pais, A. M. "Optimisation of preparation and measurement protocols for luminescence dating of small samples from a suite of porcelains and faiences." Cannavo, V., Cardarelli, A., Levi, S. T., Lugli, S., Marchetti Dor, S., and Vezzalini, G. "A Bronze Age pottery production in the Po Valley." Cootes, Kevin and Quinn, Patrick "Ceramic production, distribution and prehistoric society in the Peak District National Park." Damjanovic, Ljiljana, Holclajtner-Amtunovic, Ivanka, Pašti, Igor, and Bikic, Vesna "Physicochemical characterization of Byzantine ceramics found at excavation sites in Serbia: Ras, Reljina Gradina, Niš and Branièevo." Daszkiewicz, Malgorzata, Baranowski, Marcin, Bobryk, Ewa, and Schneider, Gerwulf "Provenance studies of black-coated pottery from Risan (Montenegro)." Dessene, Frédéric and Boileau, Marie-Claude "Late 5th to early 3rd mill. BC Transcaucasian Wares: A technological and petrographic perspective." Dias, M. Isabel, Pais, Alexandre, Rodrigues, A. Luisa, Marques, Rosa, and Prudêncio, M. Isabel "Chemical characterization of Portuguese faience from 16th-18th century: A preliminary neutron activation study." Dúz, K. "The real thing and the replica." Fabbri, Bruno, Gualtieri, Sabrina, and Acquaro, Enrico "Archaeometric investigation on Punic lamps from Ibiza Island (Spain)." Faber, Edward and Monteil, Gwladys "Reassessing the Oswald-Plicque Samian Ware Collection (University of Nottingham Museum)." Giomar Sánchez, Carmen "Mayapán: A ceramic petrographic analysis." Gluzman, Geraldine, Gonzalez, Luis, and Martinón-Torres, Marcos "Technical ceramics and metallurgical secrets: The Prehispanic workshop of Rincón Chico (NW Argentina)." Gómez, Anna, Cruells, Walter, and Molist, Miquel "Late Halaf pottery productions in Syria: Technological approach: Evidences from Tell Halula (Euphrates Valley)." Havancsák, Izabella, Bajóczi, Bernadett, Tóth, Mária, Kreiter, Attila, and Szöllösi, Szilvia "Archaeometric investigation of Celtic graphitic pottery from different archaeological sites in Hungary." Hein, Anno and Kilikoglou, Vassilis "Blowin' in the wind: Thermal efficiency of pyrotechnical ceramics." Hein, Irmgard, Tschegg, Cornelius, and Ntaflos, Theodoros "On the track of the Leopard." Holclajtner-Antunovic, Ivanka, Damjanovic, Ljiljana, Bajuk-Bogdanovic, Danica, and Andric, Velibor "Raman microscopy study of glazed Byzantine ceramics excavated in Serbia." Hurley, Noirin, Quinn, Patrick, Cumberpatch, Chris, and White, Harriet "The production and consumption of traditional tablewares in eighteenth century South Yorkshire: A macroscopic and petrographic approach."

Ikäheimo, Janne "'Trial by fire': Studying Roman cooking wares produced in the region of Rome." Ixer, Rob, Lunt, Sara, and Sillar, Bill "The temperament of the Inca state: On the source and significance of andesite tempered pottery from Cuzco." Jorge, Ana, Day, Peter, and Dias, M. I. "Ceramic landscapes in the Late Neolithic Mondego Plateau, Portugal." Karl, Stephan "Insights in manufacturing techniques of ancient pottery: Industrial X-ray computed tomography as a tool in the examination of cultural material in museums." Madrid i Fernández, Marisol and Buxeda i Garrigós, Jaume "Hispanic *terra sigillata* productions documented on the Catalan coast, some unexpected results and new issues." Martinez Ferreras,

Verónica, Capelli, Claudio, Cabella, Roberto, and Jezegou, Marie-Pierre "Archaeometrical study of Roman amphorae of Port Vendres 4 shipwreck: New data on wine trade from *Hispania Tarraconensis* (NE Spain) to *Gallia Narbonensis* (SW France)." Molera, Judit, Iñañez, Javier, Casas, Joan, Buxeda, Jaume, Speakman, Robert, and Pradell, Trinitat "Provenance of blue tin glaze and lustre pottery from Sant Bartomeu del Grau 17th-18th c. (Catalonia)." Molina Muñoz, Elena "Social dimensions on pottery: A methodological proposal to investigate the ceramic provenance." Neyet, Bert, Braekmans, Dennis, Segryse, Patrick, and Elsen, Jan "Provenance of regional ceramics in Pisidia (sw Turkey)." Nodari, Luca, Maritan, Lara, Secco, Michele, Russo, Umberto, Mazzoli, Claudio, and Pesavento Mattioli, Stefania "Alteration process in lagoon environments: The case study of the Roman pottery from Aquileia and Olbia (Italy)." Rohfritsch, Agnès, Castillo, Luis Jaime, and Chapoulie, Rémy "Archaeometric contribution to the understanding of ritual ceramic production in the Moche society (North coast of Peru, AD 150-850)." Saracino, Massimo, Maritan, Lara, and Mazzoli, Claudio "Ceramic technology between Final Bronze and Second Iron Age in the north-eastern Italy: The case of Oppeano (Verona)." Spataro, Michela, Meeks, Nigel, Bimson, Mavis, and Dawson, Aileen "Seventeenth-century England: Early attempts to make the 'Arcanum'." Szilágyi, Veronika, Biró, Katalin, Csengeri, Piroska, Szamány, György, Taubald, Heinrich,, Mijály, Judith, Koós, Judit, and Zöldföldi, Judit "Petro-mineralogical and geochemical characterization of Middle Neolithic Bükk Culture fine ware (Hungary)." Szilágyi, Veronika, Gál-Mlakár, Viktor, Rácz, Tibor, and Simonyi, Erika "First results on the archaeometric investigation of the Buda white ware (12th -15th century, North Hungary)." Trindade, Maria José, Dias, Maria Isabel, Prudêncio, Maria Isabel, Coroado, João, and Rocha, Fernando "Raw materials of Roman ceramics from Algarve (South Portugal): Firing tests and mineralogical assembly." Van Wersch, Line, Coquinot, Yvan, Mathis, François, and Bouquillon, Anne "Merovingian pottery in the Mosan Valley: Diffusion and consumption." Wagner, Ursula, Gebhard, Rupert, Häusler, Werner, and Shimada, Izumi "A study of black pottery by Mössbauer spectroscopy." Waksman, Yona, Capelli, Claudio, Pradell, Trinitat, and Molera, Judit "The ways of the lustre: Egypt, Tunisia, Spain." Wang, Kuan-Wen, Henshaw, Christina, and Rehren, Thilo "Early Islamic mixed alkali glazes in Central Asia." Wood, Nigel "Parallel developments in Chinese porcelain technology in the fourteenth century AD." Yin, Min "Scientific analysis of sherds from Wuzhou Kilns in China."

Two papers deserve special mention. The oral presentation by Renson, Coenaerts, Nys, Mattielli, Vanhaecke, and Claeys, "Identifying potential sources of Late Bronze Age pottery from Cyprus using Lead Isotopic Analysis," is a path-breaking paper by Belgian researchers who employ for the first time lead isotope composition analyses on ceramics. Lead isotopes were measured using MC-ICP-MS on 67 sherds and 69 clay samples from the Late Bronze Age site of Hala Sultan Tekke. The robust data they presented indicates that the isotopic composition does not change even when clays are mixed. Pradell, Molera, Gutierrez, Climent-Font, Smith, and Tite presented "The technology and optical properties of silver rich Islamic lustres." Three authors are from different institutions in Spain and two are from different institutions in the UK. The paper traces lustre production from 9th century CE Iraq to the end of the Fatimid lustre production in 12th century Egypt. Results of research on color and shine were presented. A variety of analyses were employed to assess the oxidation state of copper and silver in the lustre layers (determined by Extended X-Ray Absorption Fine Structure [EXAES] and X-Ray Absorption Near-edge Structure [XANES] spectroscopy, the size of nanoparticles (determined by micro-XRD), volume fraction of the metal nanoparticles and thickness of the lustre layer (determined by Rutherford Backscattering Spectroscopy = RBS).

The following information was complied from the paper and poster abstracts and from listening to the papers and visiting the poster presentations. Among the 43 oral presentations and 55 posters actually presented there were a variety of analytical tools employed; among the most used were Optical Mineralogy-Thin-section analysis (OM-TS) by 38 researchers (16 oral and 22 poster presenters) and SEM and variants (SEM-EDS, SEM EDS, and SEM-XRPD) by 29 investigators (19 oral and 19 posters). Among the 98 presentations the following were employed (number of instances in parentheses): EDS-XRF (3) and EXA-FS (1); ICP variants: ICP-AES (3), ICP-MS (4), ICP-OES (1), ICP-QMS (1), MC-ICP-MS (1); and LA-ICP-MS (3). XRD by 21 researchers plus variants: uXRD (1) and WDXRD (1); XRF by 7 presenters, plus variants: WDXRF (3), PXRF (1); and XRA (1), XRPD (5), and XRS (1). INAA was reported in 8 presentations, X-Radiography in 3, and CT and 3D imaging in 2. Other procedures employed FTIR (3 uses) PIXE (3), Raman Spectroscopy, Mossbauer Spectroscopy, Optical Electron Microscopy, and Gas Chromatography. Researchers performing replications studies used test bars for shrinkage measurements, firing variation determinations (temperatures and colors), and thermal shock and thermal conductivity analyses.

Investigators' ceramic subjects focused on European topics (40), Asian (17), African (1), Latin American (10), and North American (2); one presentation was on pottery from Egypt, Tunisia, and Spain. Specific research was reported on ceramics from Greece, Hungary, and Portugal. The presenters, representing 28 nationalities, formed a United Nations of ceramic researchers, and it was especially pleasing to see that international cooperation flourishes. Most presenters were from the United Kingdom (19), Spain (9), Portugal (5), Hungary (5), and U.S. (6). Multinational presentations were authored by symposiasts from: Argentina, Spain and the UK; Canada and the UK; France and the UK; France, Italy and Spain; France and Peru; Germany and the U.S.; Greece and the UK; Greece, Italy and UK; Hungary and Germany; Italy, Iran and the Netherlands; Poland and Germany; Spain, Italy and France; Spain, Italy and the U.S.; Spain and Uzbekistan; UK, Canada, Greece and Cyprus; UK and India; UK and Portugal; and UK and Russia. To my mind, EMAC09 was a great success. EMAC11, the 2011 meeting, will be held in Vienna, Austria.

The volume of papers from EMAC'07 has recently been published and will be reviewed in a subsequent *SAS Bulletin*.

Forthcoming Meetings

The Eastern States Archaeological Federation Annual Meeting will be held 5-9 November 2009 in Johnstown, Pennsylvania, USA. Among the 44 papers being presented is one on ceramics by Darla Spencer Hoffman (Cultural Resource Analysts, Inc.), "The Significance of Corncob-impressed Pottery in Southern Virginia."

Ceramic Ecology XXXIII: Current Research on Ceramics 2009 is the 23rd Annual Ceramic Ecology Symposium held at the American Anthropological Association Annual Meeting. It is scheduled for Saturday, 5 December 2009, 1:45-5:00 p.m. in the Grand Ballroom Salon III, Downtown Philadelphia Marriott, Philadelphia, Pennsylvania. As before, it is organized and chaired by Charles C. Kolb (National Endowment for the Humanities); the discussant is Christopher Pool (University of Kentucky).

Symposium Abstract: The papers in this international and interdisciplinary symposium, the 23rd in the annual series, reflect a number of approaches within the framework of Matson's concept of Ceramic Ecology, set forth in his volume, *Ceramics and Man* (1965). In this work Matson a ceramic engineer, archeometrician, ceramic ethnoarchaeologist, and ethnographer stated that "unless ceramic studies lead to a better understanding of the cultural context in which ceramic materials were made and used, they form a sterile record of limited worth." Ceramic Ecology as a methodological and theoretical approach has as its paramount goal a better understanding of the peoples who made and used pottery and seeks to redefine our comprehension about the significance of these materials in human societies. The concept of Ceramic Ecology is contextual, multi and interdisciplinary, and analytical. On the one hand, it seeks to evaluate data derived from the application of physiochemical methods and techniques borrowed from the physical sciences within an ecological and sociocultural frame of reference. It relates environmental parameters, raw materials, technological choices and abilities, and sociocultural variables to the manufacture, distribution, and use of pottery and other ceramic artifacts. On the other hand, interpretation of these data and explanations of the ceramic materials utilize methods and paradigms derived from the social sciences, humanities, and the arts. The concept of Ceramic Ecology forms an implicit or explicit basis of the investigations reported by archaeologists, ethnographers, and others in this symposium in which emphasis is placed upon the technological and socioeconomic aspects of ceramic materials regardless of chronology or geography. It also demonstrates the value of the cross fertilization which results when investigators ranging from art historians and professional potters to ethnoarchaeologists and archaeometricians come together in a forum devoted to a topical consideration: ceramics. These papers continue a symposium series initiated at the 1986 AAA meeting by students of ceramic materials who are members of the informal "Ceramic Studies Interest Group," an organization formed at the suggestion of Matson.

Charles C. Kolb (National Endowment for the Humanities) "Introduction to Ceramic Ecology XXIII: Current Research on Ceramics 2009."

James J. Sheehy (Pennsylvania State University and Juniata College) "Potters, People, and Land in Bihar, India: A Perspective from the 1961 Census of India." The 1961 Census of India provides a potentially useful data base for anthropologists and archaeologists interested in the relationships between craft production, population size, agricultural activities and the availability of land. The main 1961 Census of India compiled data from local levels to produce general tables and information at the state and national scale. Each Indian state also published a series of District Census Handbooks containing information at the level of the individual village. The handbooks detail the geographical size of individual villages as well as that of their cropped and irrigated fields. Population data is provided for the individual villages along with the total size of the workforce for activities such as: cultivators and agricultural laborers, household and non-household manufacturing workers, quarrying and construction labor force, as well as the personnel involved in trade and transport activities. An additional source of information includes the number of industrial/craft establishments in individual villages and the number of occupied houses and households. This exploratory study draws on the district census handbooks from two 1961 Census districts (Patna and Gaya districts) in the Indian state of Bihar. These two districts cover a combined geographical area of 17,802 km^2. The industrial tables for the two districts report some 3,655 establishments involved in the production of earthenware pottery. I employ this information to examine the interrelationship of potting establishments to other craft activities (for instance, handloom weaving), population size, village area, as well as, the extent of cropped and irrigated village fields.

Rahul C. Oka (University of Notre Dame), Chapurukha M. Kusimba (Field Museum of Natural History) Laure Dussubieux (Field Museum of Natural History), Vishwas Gogte (Deccan College Post-Graduate and Research Institute Pune, India), and Kuldeep Bhan (Maharaja Sayajirao University of Vadodara Baroda, India) "Producing and Exporting 'South Asian; Islamic Monochrome Glazed Wares: Import Substitution and Market Capture in the 16th and 17th centuries CE?" As one of the more ubiquitous trade ceramics in the Indian Ocean, Monochrome Glazed wares have usually been sourced to Southwest Asia and North Africa. However, recent discoveries in the state of Gujarat in Western India, suggest that the high demand for Middle Eastern soft-fired glazed wares in the Indian Ocean economy might have led to the emergence of competing production centers in South Asia. In this paper, we use provenience analysis using Laser Ablation-Inductively Coupled Plasma Mass-Spectrometry (LA-ICP-MS) on Monochrome Glazed Wares recovered from production sites in South Asia and Southwest Asia and those ceramics excavated from the trading ports of Mtwapa, Kenya and Chaul, India. Our analysis

suggests that by the late 16th and 17th centuries, the South Asian glazed wares dominated the ceramic assemblages of these ports. We argue that this process might be a result of strategic investment in ceramic production by an emerging class of entrepreneurial traders based in South and Southwest Asia. Taking advantage of the cheap skilled labor, and the commerce-friendly political conditions in South Asia, these groups intensified the mass production and dumping of these wares to corner regional and peripheral markets and to out-compete the more established industries of the Middle East and North Africa.

Tara L. Tetrault (Montgomery College, Takoma Park, MD) "Tracing Variation in Vessel Manufacture and Cultural Identity through Ceramics in Ghana, West Africa." Previous research among the coastal Akan pottery villages suggests that pottery production can be both matrilineal and gendered. Cultural continuity, in pottery production technique and vessel form suggests that people perpetuate traditions reinforcing their own cultural identity. This paper will explore details on vessel manufacture and use by expanding the current pottery database of ceramic type, assigned cultural identity, expressed cultural identity, ceramic function, and specific manufacturing techniques practiced in an attempt to create a broader and more useful Ghanaian pottery database that encompasses many villages. Hopefully this resource Identifying and comparing previous ethnographic research promotes one of the few tools we have to help interpret artifacts and is necessary to augment the lack of available archival data in this region. Ethnography and historical ethnographies provide evidence that even within cultural groups, there are distinct differences in how villages manufactured ceramics. This study attests to the continued value of integrating archaeology and ethnographies.

John W. Arthur (University of South Florida, St. Petersburg) "Pottery and Castes Groups: Historical Archaeology of the Gamo Highlands of Southern Ethiopia." For the last four years, the Southern Ethiopian Ethnoarchaeological Project has engaged in oral tradition, ethnoarchaeology, and preliminary archaeological testing to reveal the origin, location, and organization of historical settlements to address the development of the Gamo caste system in southern Ethiopia. This new research project is an extension of my previous two-year ethnoarchaeological study of Gamo pottery production, use, and discard. I found that household pottery assemblages do reflect current caste hierarchy through the use of space and frequency, types, and use of pots found in different caste households. The archaeological sites have revealed distinct signatures of specific castes, including evidence of hideworker caste and farmer caste households. This paper will discuss the pottery assemblages of the different sites and demonstrate the usefulness of applying ceramic ethnoarchaeology to the study of historic Gamo ceramic assemblages in association with other material culture to interpret caste association.

Jerolyn E. Morrison (University of Leicester) "Must Haves for the Minoan Kitchen, a Tripod Cooking Pot and a Cooking Dish." Modern industry has drastically changed the role of cooking in our lives. It has freed us from the hearth by developing high quality vitamin and mineral supplements as well as various types of packaged foods and dinning services. In fact, many people cook only because it brings them pleasure, connects them to a specific culture, or gives them a sense of dietary control. But cooking is much more. It is an activity that is uniquely human. It sustains life by physically altering food so that our small stomachs and delicate digestive system can absorb the nutrients to survive. Clearly, cooking is an essential component to daily-life and as such it has the potential to tell us how people lived in the past. For historical time periods, written documents helps us understand the role of cooking in society; however, deciphering the role of cooking in a prehistoric society is not as straight forward, especially when we have removed ourselves from the hearth. In the Aegean, the tripod cooking pot and the wok-shaped cooking dish are well-known Minoan cook-pots. While many agree that the morphology and the ceramic fabric of these vessels have chronological and regional significance, little investigation comparing the production and the design of these vessels have attempted to link them to specific types of cooking activities within a broader cultural context. By integrating ceramic analysis with ethnographic accounts and experimental methods, this paper will evaluate assumptions of how people could have cooked in the Bronze Age.

Michael Sugarman and Jill Bierly (both University of Massachusetts at Amherst) "Idalion: Ceramics and Identity at an Iron Age Border Town in Cyprus." The site of Idalion was established toward the end of the second millennium BC and became one of the largest production and administrative centers of Cyprus over the next thousand years. Historical evidence indicates that Idalion was annexed by the coastal kingdom of Kition, a Phoenician kingdom, in the fifth century BC. The American Expedition to Idalion undertook a multi-level program of regional survey, site survey, and excavation in the 1970s, with broad goals for investigating Idalion's long-term development within its environmental and cultural contexts. The project was never completed, in part as a result of the military activities on the island in 1974. More recent excavations at Idalion have brought to light a great deal of data about the history of the site, and it is important that the American Expedition's fieldwork be published now, as part of the regional archaeological research currently under way. As part of that publication project we are working with ceramics recovered through survey and excavation more than 30 years ago. Using these materials we are investigating the formation of Cypriot cultural identities and relationship between Cypriot Idalion, Phoenician Kition, and other "foreign" influences brought to the site by means of far-reaching trade networks.

James M. Skibo (Illinois State University), Mary E. Malainey (Brandon University), and Eric C. Drake (Hiawatha National Forest) "Stone Boiling, Fire-Cracked Rock, and Nut Oil: Exploring the Origins of Pottery Making in the Upper Great Lakes." Pottery appears quite late on the south shore of Lake Superior during what is called the Initial Woodland Period (A.D. 0-600). Throughout the prehistoric sequence, Native groups were mobile hunters and foragers and there is little evidence

for cultivation. Yet, by the turn of the first millennium A.D. there is evidence that pottery was regularly made and used. Using a combination of use-alteration traces (residue analysis), a performance-based approach, and an examination of well-dated sequences from Grand Island, I address the questions: Why did pottery arrive so late in this region, and why did people start making pottery at all?

Aleksandra Wierucka (University of Gdansk, Poland) "The Disappearing Art: The Ceramics of Quichua along the Napo River." The Quichua Indians of Ecuador are well known for their art in ceramics. It is the art that belongs especially to women of the Quichua families and it is handed down from generation to generation. Today, in the age of plastic and metal, Quichua women still teach their daughters how to make clay bowls and pots for everyday and ceremonial use. The special care is given to the process of making as well as the decorating with Quichua symbols. The majority of Quichua live in the Pastaza region of Ecuador, but some groups moved north about two generations ago. They live now along the Napo River. In this group of Quichua women do not practice the art of pottery. Two years of research were dedicated to finding out why the women left behind something that was very important for constituting them as women in the tribe. The findings were that the generation that now is more or less in their fifties still knows how to make pottery but did not hand this knowledge down to their daughters. Some houses still have the great bowls for cooking but do not use them anymore. In some families there are relatives still making ceramics but they do not live along the Napo River (although they did before). The research tries to give an answer to the question of the mystery of disappearing art.

Amy Hirshman (West Virginia University) "Petrographic Analysis of Paste Variability in Tarascan Fine Ware Ceramics: a Preliminary Assessment." On the surface, the ceramic sequence from the Lake Pátzcuaro Basin, Michoacán, Mexico, leading up to and including the Late Postclassic Tarascan state, is a relatively consistent sequence of commonly occurring shapes and colors. However, since the 1970's, both visual and low-power binocular inspection of the ceramics indicates great diversity among the pastes themselves; for example, thirteen distinguishable categories identified from survey and stratigraphic excavations at just two sites have been identified. This paste diversity consistently crosscuts morphological and surface treatment categories through time and across space. This paper, the first petrographic analysis of the sherds from the Lake Pátzcuaro Basin, assesses the paste composition of four related paste categories in comparison with results from an initial chemical appraisal of these same visual categories. This diversity is thought to point toward dispersed organization of ceramic production prior to and concurrent with the emergence of the Tarascan state.

Sandra L. López Varela (Universidad Autonoma del Estado de Morelos) "Institutional Imagining of Development: New Inquiry Field for Ethnoarchaeology." The different spaces of perception, characterizing the population of the State of Morelos, Mexico, converge in this presentation that propounds the centrality of ethnoarchaeology to analyze development policies promoting modernity. Until recently, ethnoarchaeology had been a silent component of the wide range of sciences approaching modernity. Ethnoarchaeology is a potential candidate to approach these issues as it explores human responses to social and ecological changes while embracing temporal and spatial dimensions. The essential contribution of ethnoarchaeology to the study of contemporary societies concentrates on learning how individuals materialize these responses by applying techniques and theories of its derivative field. Imperceptible to most institutions, civil organizations and society, the introduction of development policies to combat poverty is changing peoples' life ways without solving this deficiency. Lacking anthropological approaches, including social impact assessment studies, result in the transformation or abandonment of traditions and technologies, such as pottery making, as our program of investigation will discuss for Cuentepec.

Jim Weil (Science Museum of Minnesota) and Anayensy Herrera Villalobos. "Archaeological and Ethnohistorical Inferences Based on the Manufacture of Three Ceramic Pieces by Contemporary Artisans on Costa Rica's Nicoya Peninsula." The adjacent communities of San Vicente and Guaitil on Costa Rica's Nicoya Peninsula have a long tradition of ceramic production, perhaps continuous since pre-Columbian times. The archaeological site they occupy lies within the Greater Nicoya culture area (northwestern Costa Rica and southwestern Nicaragua) and dates back over a thousand years to the Sapoá Period, when Mesoamerican iconography and other ceramic design features became pronounced. The presence of clusters of communities where people were still speaking Mesoamerican languages when Spanish explorers arrived in the sixteenth century indicates that entire groups had migrated southward. After the rapid depopulation and social collapse brought about by Spanish colonization, the elegant ceremonial styles were abandoned. By the turn of the twentieth century, San Vicente and Guaitil were manufacturing pieces with little or no embellishment for household use. By mid-century the market for these forms was declining, given the shift in consumer preferences to industrially produced goods of metal, glass and plastic. Beginning in the 1960s, however, the rise of tourism created a new demand for decorative ceramics—i.e., ethnic arts and souvenirs—which involved a recovery or reinvention of pre-Columbian traditions. This paper reviews sequential details in the processes of manufacturing a "tinaja" (spherical water storage container), a "comal" (concave platter for toasting tortillas) and a replica of a pre-Columbian polychrome vessel. Based on comments by the artisans as well as direct observations, inferences are made about continuities and changes in raw materials, equipment, techniques, forms and styles of this ancient and persisting heritage.

Charles C. Kolb (National Endowment for the Humanities) "From the Field and Laboratory: Current Research in Ceramic Studies." Members of the informal "Ceramic Studies Interest Group" (CSIG) employ a variety of multifaceted approaches in the search for answers to the questions related to ceramic

materials: who, what, when, where, and why. Current field and laboratory ceramic research from both the Old and New Worlds — work that that includes the disciplines of archaeology, ethnoarchaeology, ethnography, archaeometry, and materials science. Some of these field and laboratory investigations are still in progress and have not yet reached a final "paper ready" stage and research "in progress" also invites input from colleagues. Other projects have been too recently completed for a "final report" and, for others, results are in press, or have been too recently published to be generally known. The content for this report comes from correspondence from the more than 200 members of the CSIG, but some current research is reported by members of the audience.

Book Reviews

Deborah L. Huntley, Associate Editor

Underwater Archaeology: The NAS Guide to Principles and Practice (2nd ed., with major revisions). Amanda Bowens (editor). Wiley-Blackwell Publishing, Oxford: 2008. 240 pp., 141 figures, 52 colour plates, glossary, bibliography, index. Price: $44.95 USD (paper). ISBN: 978-1-4051-7591-3.

Reviewed by Corioli Souter, Department of Maritime Archaeology, Western Australian Museum, Cliff St, Fremantle, 6160, Western Australia

The second edition of the NAS Handbook, as it is more commonly referred to, has been a long time in the making. It is the primary text for the Nautical Archaeology Society's (NAS) foreshore and underwater archaeology training courses. The first edition has been out of print for some time, perhaps too long for a course promoted internationally. In recent years the NAS has expanded globally and the training program has been run in Argentina, Australia, Austria, Belgium, Bermuda, Brazil, Canada, Egypt, Finland, France, Germany, Gibraltar, India, Ireland, Italy, Latvia, Mexico, Netherlands, Portugal, South Africa, Sri Lanka, Sweden, Switzerland, Turkey and the USA. Consequently, expectations for this new edition are high. The NAS training program was franchised to the Australasian Institute of Maritime Archaeology in 1998. Certain adjustments were made to the curriculum to account for environmental and legislative differences, but the course structure essentially remains the same. Any critique of this publication should examine how the book contributes to the NAS training program, given that it was designed to 'mirror' the courses, as well offer a review of the factual content and presentation.

With twenty chapters and three appendices, this textbook seeks to provide a comprehensive overview of the practice of maritime archeology, focusing on techniques applied in the field. It functions as a 'how to' manual for undertaking an archaeological project. It is important to note that in the United Kingdom, unlike Australia, members of the public trained through the NAS system can survey and in some cases, excavate maritime archaeological sites independently. With only a handful of sites afforded any legislative protection, preservation of underwater cultural heritage is contingent on the cooperation of the diving public. The NAS realized early on that public education and inclusion were the best mitigation and management strategies to ensure continued investigation of such a vast resource. The NAS training course as we told in the opening chapter was 'commissioned to help address a scarcity of information about how to undertake archaeological work underwater while maintaining acceptable standards' (p. 1). By rights, any trained archaeologist should be equipped with such skills whether working underwater or on land. However, it is important to understand the United Kingdom context in which this book was written before taking umbrage from the statement 'Anyone can call him/herself an archaeologist' (p. 2).

The early chapters are a combination of basic archaeological definitions (Chapters 2 and 4) and directions for project planning (Chapters 3 and 5). While these chapters are generally progressive in reiterating current archaeological opinion such as *in situ* preservation and non-destructive archaeological testing, the perhaps all too common description of an archaeologist as a 'detective' or 'forensic expert' is clichéd. Chapter 4, devoted to basic principles, just falls short of university archaeology introductory units when perhaps it would do better to at least equal it (many tertiary courses both in the United Kingdom and abroad refer to this text in undergraduate and/or postgraduate programs). More detailed in-text referencing and bibliography in this section would have proved helpful in this regard. I am not an advocate of generalized or oversimplified diagrams as seen in figure 4.2, a bar graph of the percentage rate of deterioration of material types in terrestrial contexts compared to underwater. After all, preservation of any material type is dependant on environment which either underwater or on land, has a multitude of variables. Not accounting for these makes any pictorial representation of the concept less credible. While this figure has been retained from the last edition, others that derive from archaeological or museology publications, for example, the typology graph of 13th-14th century pottery from the Museum of London (p. 45, 1st edition) or Isle of White Trust survey drawings of Roman artifacts (pp. 123-124, 1st edition) regretfully, have not.

Several new chapters addressing current issues and approaches in maritime archaeology have been included in this edition. An outcome of the recent emphasis in most underwater pursuits on occupational health and safety is, presumably, the devotion of a whole chapter to it (Chapter 6). General diving technique and safety, while important, may be considered as off-topic in a text such as this. Any diver taking part in underwater archaeological operations should be trained and competent. A welcome addition is Chapter 7, 'International and National Laws relating to Archaeology Underwater'. The first edition downplayed this important part of archaeology relegating the information to a small sub-section in the 'Project Planning' chapter wryly entitled 'Legislation: Playing by the

Rules'. This latest addition clearly addresses international conventions and contexts by outlining a number of important case studies. Similarly, recent approaches for *in situ* site conservation and management are described in Chapter 17. Again, references to a few more individual sites would have been useful. Chapters 9, 10 and 11 are also new, outlining the historical research process, photography and geophysics. The research process described is, however, geared for UK-based or British shipping researchers, which is still useful for those of us living at the edge of the Empire. The photography chapter while comprehensive, offers some outdated advice such 'the best set-up for use in archaeology is a Nikonos V' (p. 75). While the geophysical descriptions are an improvement, Chapter 10 is let down by some of the images; Figure 13.4, 'a time-slice from a 3-D Chirp sub-bottom profiling system' has been printed at low resolution and readers would benefit from further explanation.

Some chapters are remiss in important details or a bit outdated. Chapter 8 does not differ very much from the first edition despite a number of recent advances in recording techniques, the most notable being the advent of Geographical Information Systems (GIS). The text could have benefited from some real world examples of GIS applications in archaeology projects, as often these programs form the heart of any recording system. The Site Recorder program is given a plug (p. 127) but the application of GIS in archaeology needs to be better explained. Similarly, other information sources available today, such as satellite and aerial imagery are only given cursory attention. Chapter 11 develops concepts such as geographical coordinate systems which were only touched on in the first edition, mostly to prepare the reader for the increased use of GPS systems. In contrast, we have the retention of sextants as a means of position-fixing, although stated in text as outdated. Chapter 12 is just about the same as its first iteration, reflecting the fact that physical underwater search methods have also, essentially remained the same. The process of surveying, the primary skill set taught in the NAS program, is much easy to digest (Chapter 14) in this edition. Examples of how DSM information is recorded by divers on site, however, would be useful in this chapter given it is not fully explained in the earlier 'Archaeological Recording' section (Chapter 8). With the addition of colour plates, the 'practice' of underwater archaeology is clearly illustrated.

Despite this text being geared for a British audience, it is an excellent edition to the NAS training program. Considering the success of the program, information regarding how to get involved in maritime archaeology should be expanded and more international examples of underwater archaeology considered. I would expect the text will be picked up by most institutions and non-academic groups involved in the teaching and general practice of maritime archaeology.

Ancient Health: Skeletal Indicators of Agricultural and Economic Intensification. Mark Nathan Cohen and Gillian M. M. Crane-Kramer (editors). University Press of Florida: Gainesville: 2007. xx + 416 pp., 80 figures, 130 tables, 1 appendix, index. Price: $75 USD (cloth). ISBN: 978-0-8130-3082-1.

Reviewed by Robin M. Cordero, Office of Contract Archeology, Maxwell Museum of Anthropology, 1 University of New Mexico, Albuquerque NM 87131, USA

I began reading *Ancient Health* with earnest and great eagerness. How else can one approach the twentieth anniversary update to one of the seminal works in bioarchaeology and paleopathology, Cohen and Armelagos's 1984 volume, *Paleopathology at the Origins of Agriculture*? Although several criticisms were levied against the original volume, which Cohen summarizes in the first chapter, *Paleopathology at the Origins of Agriculture* still stands as one of the most influential books in bioarchaeology and paleopathology. *Ancient Health* also marks the first publication in the University Press of Florida's new series, Bioarchaeological Interpretations of the Human Past: Local, Regional, and Global Perspectives.

In *Ancient Health*, a Cohen and Crane-Kramer address one of the primary critiques of the 1984 volume, that it did not emphasize a more global perspective. To this end, the editors have included 21 papers reflecting a diverse global perspective, including five papers that update works published in the 1984 volume. Five regions are represented in this volume: North America emphasizing the eastern U.S., Andes, Europe, Middle East and Asia. Accommodating this global perspective is an expanded focus that includes "any sequence of technological, social and political change, or economic intensification" (p. 9).

The number of contributions to this volume precludes reviewing each individually, but several are worth noting. Cook's updating of her Cahokia work (Chapter 1) is an excellent start to this volume. Cook presents new data and revises some of her earlier interpretations based not only on these new data, but also on a revised understanding of the etiologies of various pathologies. Specifically, her discussion on interpreting periosteal lesions is a must read for practitioners and students alike. Doran (Chapter 3) presents a unique way of looking at past changes in health on a continental scale. Although limited by sampling biases with few sites representing entire regions and time periods, this type of study has tremendous potential for examining changes in health associated with major climate shifts or other macro-scale phenomenon. Márquez Morfín and Storey (Chapter 6) present an interesting approach to comparing samples with uneven age distributions in their summary of Mesoamerican health. Alfonso and others (Chapter 8) provide the reader with a clear understanding of the impact that the transition from a hunter-gatherer to agriculturalist lifestyle had on dental health in Northern Chile. Their discussion of life expectancy also is a welcome addition to this volume. Littleton's discussion of skeletal remains from Bahrain (Chapter 12) offers one of the clearest examples of declining health with the agricultural intensification. Moreover, Littleton's attribution of declining health to increased severity of infections, including

malaria, during the Hellenistic Period is intriguing. Douglas and Pietrusewsky offer a comparison of dispersed and aggregated populations during periods of slow increases in agricultural intensification in Northeastern Thailand (Chapter 21). This contribution highlights the importance of assessing changes in population distribution and settlement patterns that often occur with agricultural intensification. In combination with Domett and Tayles analysis of a roughly contemporaneous data set also from Northeastern Thailand (Chapter 20), the reader is afforded the opportunity to observe how the transition to a more intensified form of agriculture affected the health of two adjacent populations.

The research presented in *Ancient Health* offers a unique global perspective to the study of health in past populations. By encompassing a wide range of researchers and regions, Cohen and Crane-Kramer offer a significant update to *Paleopathology at the Origins of Agriculture*. However, this serves as a mixed bag. One of this reviewer's main criticisms of *Ancient Health* is the results summary sections are sometimes redundant with presentation of both tables and a text summary that recites the same data presented in the tables. This redundancy results in some chapters being quite cumbersome and reading like a laundry list of pathologies with their respective frequencies. Also, many contributors attempted to summarize all pathological data from their respective regions resulting in what often appeared to be a "kitchen sink" approach to reporting. This reviewer found that the most effective contributions were those that selected a few health indicators and comprehensively assessed them. Second, Cook eloquently discusses why researchers should be cautious about interpreting periosteal reactions as infections or diseases. However, many of the contributors contradict this important caveat and continued to interpret periosteal reactions as infections or diseases. Third, frequencies of pathologies are often presented sans sample size, leaving the reader to ponder if the differences between samples are a result of sample size/bias or do they represent actual differences between populations.

This reviewer's final criticism is that while Cohen and Crane-Kramer succeeded in incorporating a more global emphasis in this volume, many of the interpretations and models for interpreting changes in health had not changed. As noted by Cook, one of the major issues with *Paleopathology at the Origins of Agriculture*, even though it was a seminal piece of scholarly work, was that it is not regularly referenced within the archaeological community by non-bioarchaeologists. This may be a result of the emphasis by bioarchaeologists on understanding the etiologies of the pathologies rather than modeling the behavioral/environmental factors that contribute to the changes in prevalence of pathologies. With some notable exceptions, the use of "agricultural intensification" or "economic intensification" was often inferred as a temporal distinction. However, this assumption is not entirely founded since, for example, some populations may be undergoing expansions of extensive agricultural systems as opposed to intensified agricultural production. Also, there is no clear distinction in this volume between the effects of increased agricultural production and other cultural phenomenon, such as population aggregation and increased social stratification, that may co-occur.

Overall, *Ancient Health* offers the reader a wealth of data summarized from many sources not typically accessible in the general literature. Cohen and Crane-Kramer's incorporation of research from multiple regions of the globe is a resounding success and introduces the reader to many less well known areas. The comprehensive summaries and associated bibliographies offered by each of the researchers is a boon to most bioarchaeology scholars. In this reviewers opinion, *Ancient Health* would be a good reference volume for both introductory and advanced researchers in bioarchaeology, although the lack of adequate modeling may limit its use to archaeologists.

Upcoming Conferences

Rachel S. Popelka-Filcoff, Associate Editor

2009

2-6 December. American Anthropological Association Annual Meeting; Philadelphia, Pennsylvania, USA. General information: http://aaanet.org/meetings.

2-6 December. Ceramic Ecology XXIII (as part of the American Anthropological Association meetings); Philadelphia, Pennsylvania, USA. General information: http://www.aaanet.org/meetings; contact: Charlie Kolb, ckolb@neh.gov.

14-18 December. International Paleolimnology Symposium; Guadalajara, Mexico. General information: http://www.geofisica.unam.mx/paleolimnologia.

14-18 December. American Geophysical Union Fall Meeting; San Francisco, California, USA. General information: www.agu.org/meetings.

2010

6-9 January. Society for Historic Archaeology Conference on Historical and Underwater Archaeology; Amelia Island Plantation, Jacksonville, Florida, USA. General information: http://www.sha.org.

6-9 January. 111th Joint AIA/APA Annual Meeting, Anaheim, California, USA. General information: http://www.archaeological.org/webinfo.php?page=10096.

21-25 March. 239th ACS National Meeting & Exposition, San Francisco, California, USA. General information: http://acs.org.

6-9 April. Annual Conference on Computer Applications and Quantitative Methods in Archaeology: "Fusion of Cultures;" Granada, Spain. General information: http://www.caa2010.org.

Department of Anthropology
University of South Florida
4202 E. Fowler Ave., SOC 107
Tampa FL 33620-8100 USA

Non Profit Org.
U.S. POSTAGE PAID
Tampa, FL
Permit No. 257

ADDRESS SERVICE REQUESTED

Please send subscription address changes to SAS Administration

SAS Bulletin

Newsletter of the Society for Archaeological Sciences

Published quarterly by the Society for Archaeological Sciences
Distributed to subscribers: $20/yr regular membership; $15.00 student & retired; $30.00 institutional; $300 lifetime. Individuals add $110.00/yr for *Journal of Archaeological Science*; $40/year for *Archaeometry*. ISSN 0899-8922.