



SAS Bulletin

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Amazing Maize

Just as the new mega-volume *Histories of Maize* (Academic Press, 2006) makes its way onto our bookshelves, part of it may already have to be re-written...

Last month at the annual meeting of the American Society of Plant Biologists, John Jones, Mary Pohl, and Kevin Pope announced mounting evidence for maize farming some 7,000 years ago in the tropical lowlands along the Mexican Gulf Coast. New data now suggest that initial domestication of maize took place as early as 10,000 years ago.

Using genetic and microbotanical analyses of pollen, phytoliths, and starch grains from San Andrés, Tabasco, Jones and his colleagues are reconstructing the early history of maize agriculture in Mesoamerica. And other interdisciplinary teams of "maize scientists," which include geneticists, chemists, plant biologists, and archaeologists, are using this kind of information

to track the evolution and dispersal of maize varieties and their domestication across the globe.

In this issue of the *SAS Bulletin*, Michael Diehl reviews *Histories of Maize*, edited by John Staller, Robert Tykot, and Bruce Benz. With nearly 700 pages of text and over 300 illustrations arranged into 48 chapters, this was no easy task! As Diehl remarks, the book is "a high-quality, ambitious, detailed, broad, and often very technical treatment of the genesis, origins, history, evolution, archaeological occurrence, and social and dietary importance of maize."

As the book makes clear, maize has a rich genetic history that has resulted in thousands of varieties adapted to different environments. Preservation of these varieties and local ecological knowledge of their genetic and adaptive histories are supremely important as farmers around the world cope with changes in soil, climate, and water availability and struggle to maintain a food supply for growing populations.

So grab a bag of your favorite popcorn and enjoy this issue of the *Bulletin*—but appreciate that what you're eating has a long and highly complex history, some of which can be traced back to the jungles and swamps of southern Mexico.

E. Christian Wells, Editor



The ancient Maya Maize God (from Temple 22 at Copán, Honduras, ca. AD 680-750), a metaphor for birth, life, and resurrection. Like the maize plant itself, the Maize God was decapitated every year during the harvest, only to be reborn at the start of the next growing season (photo by Justin Kerr).

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Employment Opportunities

Pending budgetary approval, the **University of North Carolina at Greensboro** Department of Anthropology seeks qualified candidates to fill a tenure-track position (rank open) in Archaeology to begin August 1, 2009. We seek candidates who have demonstrated excellence in teaching and have an active, theoretically engaged record of scholarship. Individuals appointed at the rank of Associate or Full Professor will be expected to have a funded research program. Geographic area is open; the successful candidate should complement existing departmental theoretical interests. The department and college encourage multi-disciplinary scholarship among the faculty. Applicants must have the ability to design and teach research methods including applications of existing and emerging technologies. We are particularly interested in one or more of the following research foci: continuity and change in the face of contact, the development of complex systems, and/or the origins and maintenance of inequality. Candidates must be committed to high quality undergraduate education and show a willingness to include undergraduate students in their research activities. PhD is required at the time of application. Applicants should send a statement of research interests, a curriculum vita, and three letters of reference to Dr. Arthur D. Murphy, Head, Department of Anthropology, 426 Graham Building, The University of North Carolina at Greensboro, Greensboro, NC 27412-5001. Reviews will begin September 1, 2008 and will continue until the position is filled. Additional information can be found at www.uncg.edu/ant.

The Department of Sociology and Anthropology at **Washington and Lee University** invites applications for the position of Staff Archaeologist/Instructor. The staff archaeologist co-teaches a field methods course with the faculty archaeologist and is responsible for processing and cataloging artifacts, training/supervising student interns and staff, writing site reports/manuscripts, and managing the archaeology budget, equipment, website, and laboratory. The staff archaeologist may also participate in wider campus and community life through involvement with various courses, committees, or organizations. He/she receives support for professional development and participation in academic conferences. This position provides the rare opportunity to combine the work of a staff archaeologist with some teaching responsibilities, and to participate in crafting the W&L archaeology program's new collaboration with Monticello and involvement with its Digital Archaeological Archive of Comparative Slavery (www.daacs.org). For this position, a master's degree in Anthropology or closely related field and archaeological field/laboratory experience are required. Familiarity with historical archaeology, relational databases, and quantitative methods are desired. This is a full-time position with benefits. Washington and Lee is a highly selective, nationally ranked, liberal arts university in Lexington, Virginia (www.wlu.edu). Please send a cover letter and curriculum vitae to Alison Bell, Department of Sociology and Anthropology, Washington and Lee University, Lexington VA 24450. Review of applications will begin immediately; applications received

by September 15, 2008 will be given full consideration. Please contact Alison Bell at bella@wlu.edu or (540)458-8638 with any questions. Fax (540)458-8498. Washington and Lee University is an Equal Opportunity Employer; women and minorities are encouraged to apply.

Postdoctoral Fellow in Quaternary Environments and Geoarchaeology, **University of Cambridge**. The Leverhulme Centre for Human Evolutionary Studies is seeking to appoint a postdoctoral fellow in Quaternary Environments & Geoarchaeology from October 2008. The prime criteria for the appointment will be excellence in research in Quaternary environments and/or geoarchaeology, with particular emphasis on a record of field work and laboratory investigations. If interested in this position, application details are available at www.human-evol.cam.ac.uk. Closing Date: 30 September 2008.

Northwestern University, Department of Anthropology announces a tenure track Assistant Professor position in the archaeology of complex societies, starting Fall 2009. Geographical area and methodological focus are open. Research on either prehistoric or historic periods will be considered. Preference will be given to candidates whose research complements existing faculty specializations. Candidates should have a strong commitment to active field research, graduate teaching and mentoring, and a four-field approach in anthropology. Review of applications will begin on October 29, 2008. Send letter of application, vita, and names of three referees to: Dr. Timothy Earle, Archaeology Search Committee Chair, Department of Anthropology, Northwestern University, 1810 Hinman Ave, Evanston, IL, 60201-1310. AA/EOE. Women and minorities are encouraged to apply.

The Department of Anthropology at the **University of British Columbia** invites applications for a full-time, tenure-track position in bioarchaeology. The position will be at the rank of Assistant Professor, commencing 1 July 2009. A Ph.D in anthropology as well as a strong record of research and demonstrated excellence in teaching are required. We welcome applicants whose primary expertise is in the domains of bioarchaeology and bioanthropology and whose research intersects both the natural and social sciences in understanding past human societies. More specifically, we seek candidates with research expertise in one or more of the following: archaeo-chemistry, human osteology, zooarchaeology, ancient demography, disease and diet. The successful candidate will be expected to maintain an active program of research, service and undergraduate and graduate teaching. They will also take a lead role in developing and using the Laboratory of Archaeology's newly expanded facilities in the renovated Museum of Anthropology. For more information on the Department of Anthropology, please visit www.anth.ubc.ca. The position is subject to final budgetary approval. Salary will be commensurate with qualifications and experience. Applications and inquiries should be addressed to: Dr. John Barker, Department of Anthropology, University of British Columbia, AnSo 2104, 6303 NW Marine Drive, Vancouver,

BC V6T 1Z1. Applications must include: a letter of application; vita; evidence of teaching effectiveness; and three confidential letters of reference sent under separate cover. Review of applications will begin on 1 November 2008 and continue until the position is filled. The University of British Columbia hires on the basis of merit and is committed to employment equity. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents of Canada will be given priority.

Vanderbilt University announces a tenure-track position in anthropology, with preference given to advanced assistant professors. We seek a Mayanist archaeologist to join a dynamic group of Mesoamericanists in the department, including two archaeologists, an epigrapher, two ethnologists, and a linguist, in addition to other faculty working in South America. The successful candidate will be a specialist in Maya archaeology with an established, ongoing field project involving undergraduate and graduate students. A proven record of published research and excellence in teaching are essential qualifications. Applicants should send a letter of application, a list of references, and a CV to Chair, Search Committee, Department of Anthropology, Box 6050-B, Vanderbilt University, Nashville TN 37235. Preferential deadline for receipt of applications is 3 Nov. 2008.

Ohio State University at Marion invites applications for a tenure-track assistant professor position in Anthropology starting September 2009. The successful candidate must be qualified to teach introductory physical anthropology, archaeology, and cultural anthropology, as well as specialized upper-level courses. Teaching and scholarly interests in present and/or past human impacts on the environment are required (for example, cultural ecology, environmental anthropology, climate change, resource use and environmental impacts in archaeological settings), along with a demonstrated ability to produce research publishable in peer-reviewed journals and a strong commitment to undergraduate education. Ph.D. and teaching experience required. Marion campus faculty are members of their respective Columbus campus departments. To assure full consideration, send letter of application, curriculum vitae, and three letters of recommendation by November 15, 2008, to Anthropology Search, Office of Human Resources, OSU-Marion, Marion, OH 43302.

The **Ohio State University** seeks an archaeologist for a tenure-track position at the Assistant Professor of Anthropology beginning academic year, 2009-2010, pending budgetary approval. Geographic region and specialization open, but preference given to applicants working in the Eastern Woodlands of North America. Teaching and research interests should be compatible with the department's focus on evolutionary anthropology, human ecological adaptations, and quantitative approaches in anthropology. Ph.D. required. Evidence of productivity and excellence in research and teaching required. Deadline for applications is December 1, 2008. Send letter of application, CV, and names and contact information of three references to Douglas Crews, Anthropology Search Committee

Chair, Department of Anthropology, 244 Lord Hall, 124 West 17th Street, The Ohio State University, Columbus, OH 43210-1364.

At the Department of Materials Science and Engineering of **Delft University of Technology**, a research position is available for an experimental scientist with a strong interest to further develop the research field of Archaeometallurgy in the Netherlands. The Department of Materials Science and Engineering at Delft University of Technology is an internationally leading metallurgical institute, specializing in the structure and the behavior of materials from the nanometer-scale to the macroscopic scale, aiming at materials in their applications in society. For the research on Materials in Art and Archaeology the department participates in the Centre of Art and Archaeological Sciences (CAAS), a joint initiative of the universities of Delft and Leiden for interdisciplinary technical research on cultural-heritage material. Within the Department of Materials Science and Engineering, the research in the framework of CAAS is being performed in the groups Microstructure Control in Metals (MCM) and Structure and Change in Materials (S&C). S&C mainly concentrates on the study of art objects (for instance paintings) and MCM focuses on archaeometallurgy, the analysis of archaeological metal objects. The main objective is to perform detailed analyses of the interior of the objects, revealing details like underpaintings and composition, which provide information about the history, context and production of the artifacts. The experimental scientist that will work on this project will expand and strengthen the promising field of Archaeometallurgy in the Netherlands by intensifying the application of physical and materials research in archaeology. The emphasis in this project will be on the application of non-destructive neutron techniques, but another important aim is to propose and initiate new research in this field. The Faculty 3mE in Delft can eventually offer a tenure-track position as assistant professor for a researcher that is successful in this respect, in order to ensure a stable contribution to this field. Fruitful and continuous interaction with the Faculty of Archaeology at Leiden University will be the key to success for this position. The postdoctoral researcher will explore, apply and extend the possibilities of neutron techniques in materials research on art and archaeological objects. The main scientific aims are: (i) Analysis of early bronze objects from museums in the Netherlands and Belgium by means of the recently developed Neutron Resonance Capture Analysis (NRCA) at IRMM in Geel (Belgium). The detailed composition analysis will generate essential data concerning the origin of the material, and thus provide valuable information on early Dutch and neighbouring societies. A recent publication in this field can be found in *Archaeometry* 46 (2004) 635-646. (ii) Investigating possible expansions of the application of neutron techniques, like performing NRCA at other neutron sources, specifically the ISIS source at the Rutherford Appleton Laboratory near Oxford, UK, and thermal-neutron activation analysis at RID in Delft. The candidate must hold a Ph.D., preferably in the field of experimental physics or materials science. Please note that candidates with another relevant background will also be considered. The candidate has a strong interest to use her/his

expertise to strengthen the research on archaeological objects. A talent for interdisciplinary research is essential, as well as an affinity with technical cultural-heritage studies and an organizational talent to connect the fields. The postdoctoral researcher is strongly innovative in her/his thinking, and is capable of working independently and taking new initiatives. The candidate is strongly interested in expanding the work that is started in this project by initiating new research; a Statement of Interest is therefore to be included in the application. This position offers a unique opportunity to become the leading scientist in the Netherlands in the application of physical techniques on archaeological objects. This relatively new field has the potential to open up new possibilities in archaeological research, and offers possibilities that go far beyond the research that is offered in this two-year project. The incumbent will write a high-quality, innovative research proposal in archaeometallurgy in his or her own field of expertise and submit this to the Innovational Research Incentive Scheme (IRIS, Vernieuwingsimpuls) of The Netherlands Organization for Scientific Research (NWO). This is a highly competitive personal grant program for postdoctoral researchers. Further information on this scheme can be found at the English website of NWO (www.nwo.nl). In accordance with our faculty's human resource policy, a tenure-track position as assistant professor will be offered upon the award of an IRIS proposal to be carried out at TU Delft. The application for the current position should therefore include a statement of interest, in which the candidate briefly unfolds his research plans. For more information: Dr.ir. Jilt Sietsma, tel. + 31 15 2782284, J.Sietsma@tudelft.nl Dr. Joris Dik, tel. +31 15 2789571, J.Dik@tudelft.nl <http://www.mse.tudelft.nl>.

Awards, Fellowships, and Training

Research Awards for Graduate Students in Archaeology, Laboratory for Archaeological Chemistry, University of Wisconsin-Madison. The Laboratory for Archaeological Chemistry at the University of Wisconsin-Madison maintains an annual program of research award grants to graduate students in archaeology programs around the world. The lab staff strongly believes that major discoveries in archaeology in future years will come from laboratory investigations. In that light, the training of graduate students in analytical methods and their application is essential. This award is intended to further those goals. The awards are offered to support and encourage the application of chemical analyses in solving archaeological problems. The Laboratory for Archaeological Chemistry has been involved in the study of questions of archaeological interest for many years. The primary focus of research in the laboratory is on the characterization of prehistoric bone, soils, and pottery. A variety of other materials including stone, dyes, organic residues, metals and glass are also investigated in the laboratory. Instrumentation in the lab includes a (1) Inductively Coupled Plasma δ Atomic

Emission Spectrometer for the rapid elemental characterization of a variety of materials with a resolution in parts per million, and (2) Finnigan Element Inductively Coupled Plasma High-Resolution Mass Spectrometer for isotopic and elemental characterization of many materials, often at the parts per billion level. This instrument incorporates laser ablation as a sample introduction technique appropriate for many solids and for small or fragile samples. In addition the lab has access to a variety of other instrumentation and equipment on campus that is often used in our research. Application: Applications for the award should contain (1) a three-page letter from the applicant containing the specifics of the research and the analyses involved, (2) a curriculum vitae of the applicant, (3) a tentative table of contents for the dissertation, and (4) a letter of recommendation from the major advisor. The letter of application should contain detailed information on the research project, the kinds of analyses involved, the number of samples and analyses required, availability of samples with letter(s) of permission if appropriate, and a discussion of the importance of the analysis to the proposed research. This letter should also provide a timetable for research and completion of project. Discussions with the lab staff are recommended prior to application to ensure that the project meets award criteria and employs services available in the Laboratory for Archaeological Chemistry. There is no form for applications. Criteria for Award: The award will be made by the staff of the Laboratory for Archaeological Chemistry and major criteria for selection will be the significance of the research question, feasibility of the project, and impact on the student and the field. Deadline: 1 January for awards beginning in 1 September of the same year. Award: One award will be made each year consisting of analytical services involving elemental or isotopic measurements available with Laboratory for Archaeological Chemistry instrumentation. The lab encourages students to participate in analyses, where possible, in order to learn and understand the methods employed. Announcement: The award will be announced on 15 March each year. Awards should be appropriately acknowledged in any dissemination of results of the analyses and copies of resulting publications should be provided to the Laboratory for our files. Contact: Questions and Applications should be addressed to T. Douglas Price or James H. Burton, Laboratory for Archaeological Chemistry, University of Wisconsin-Madison, 1180 Observatory Drive, Madison WI 53706 USA. Phone: 608-262-2575 (tdp), 608-262-0367 (jhb), 608-265-4216 (fax). Email: tdprice@facstaff.wisc.edu or jhburton@facstaff.wisc.edu. For further information on the Laboratory for Archaeological Chemistry, please see our web site at www.wisc.edu/larch/aclab/larch.htm.

Conference News and Announcements

Society of Glass Technology announces a one-day symposium: History and Heritage, will be held on September 10, 2008 in Cambridge, UK. For details, see <http://www.societyofglasstechnology.org.uk>

www.cambridge2008.sgthome.co.uk/pages/Programme.htm. Presentations include: Wonders of Glass: Our Heritage from Earliest Times and into the Future (Malcolm Ingram); Marinha Grande glass – a contribution to its history (Filipa Lopes and António Pires de Matos); Effect of the Industrial Revolution on how glassmakers see their art (Ian Hankey); Aspects of Conservation of Glass (Kenneth Watt); Alteration of a façon de Venise glass: The role of humidity and organic pollutants (Sarah Fearn); Historic Mirrors in Architecture (Sandy Davison); How to Save these Fabulous Shards? (Hilde Wouters); The Archaeological Window Glass Collection of the Dunes Abbey in Koksijde, Belgium; Research at the Stained Glass Museum at (Ely Rosie Mills); Victorian Stained Glass - an Introduction for Window Spotters (Ruth Cooke); and Glassmaking defects - the Building Conservator's Friends (David Martlew).

The Institute of Technologies Applied to Cultural Heritage of the CNR (Rome) organizes the course on **High Formation in digital integrated technologies applied to cultural heritage: from data acquisition to the communication through virtual reality systems**. The course is from 15-26 September, 2008, Area della Ricerca di Roma 1, Via Salaria km.29,300, Montelibretti.. The course, addressed to archaeologists, architects, art historians, operators in the field of Cultural Heritage, proposes to introduce participants in methodologies knowledge and advanced digital technologies for documentation, communication and valorization of Cultural Heritage: from data acquisition to the processing and integration in virtual reality environments. It will follow a multidisciplinary approach that will include topographical survey sessions on the field, through the use of integrated technologies, subsequent phases of data processing in the laboratory until the realization of a virtual reality application. The Course will be in Italian language, (if there will be many foreign applications we will be consider to plan an English session). Further details: <http://www.vhlab.itabc.cnr.it/Education.htm>.

Fluvial Deposits and Environmental History: 39th Annual Binghamton Geomorphology, will be held from Friday-Sunday, October 10-11, 2008 on the campus of the University of Texas in Austin. Symposium organizers are Paul Hudson, Karl Butzer, and Timothy Beach. Fluvial deposits are widely recognized as a means to interpret environmental history across a range of temporal and spatial scales. Because fluvial deposits are linked to a variety of drainage basin processes, fluvial deposits represent critical archives for understanding how landscapes respond to environmental change, such as climatic, anthropogenic, or others. Geomorphologists analyze fluvial deposits using various sedimentologic and pedogenic approaches to characterize the extent and timing of environmental change, such as flooding, drought, or episodes of accelerated erosion and sedimentation. In many instances fluvial deposits include a human signal, providing insight into anthropogenic impacts on watershed processes spanning from headwaters to the lower reaches of large alluvial valleys. Because humans have occupied river valleys for millennia, alluvial and archaeological stratigraphy can elucidate complex

human-environment relationships stored within floodplain deposits. The goal of the 2008 Binghamton Geomorphology Symposium is to bring together a diverse range of scholars that work with fluvial deposits to advance our understanding of geomorphology and environmental history in several key areas, particularly in paleohydrology, geoarchaeology, and in understanding fluvial adjustment to climate change. The symposium is being held in the Thompson Conference Center on the University of Texas at Austin campus from October 10 - October 11, 2008. A pre-symposium field trip is scheduled for October 9, 2008, and will traverse a "source to sink" route from the Texas Hill Country to the Gulf of Mexico. For more information, see: <https://webpace.utexas.edu/hudsonpf/inghamton.html>.

The **9th International Conference on Ancient DNA and Associated Biomolecules** will be held in Pompeii, Italy, 19-22 October 2008. Main Topics: Preservation, isolation and analysis of ancient DNA and other ancient biomolecules; Methods of extraction and purification of ancient biomolecules from ancient materials; PCR and sequencing of ancient DNA; Prevention and causes of sample contamination; Authenticity of putative ancient DNA; Hereditary and infectious diseases in past populations; Population genetics, DNA profiling, sexing, methods and application; Identification of species; Forensic applications; Evolution; Human migrations; Domestication; New and emerging technologies. For more information, see <http://www.ancientdna9.it>, or contact the Organizing Secretariat, info@ancientdna9.it.

Geoarchaeology 2009: "Landscape to Laboratory and Back Again" will be held 15-17 April, 2009, Sheffield, UK. The meeting is hosted jointly by the Departments of Archaeology and Geography, and we encourage interdisciplinary presentations across the spectrum of geoarchaeological work. Papers are invited on any topic, but especially: Developing geoarchaeological theory; Landscape and place; Linking across or between scales; Integration of multiscale datasets; Interpretations of dynamic human-landscape interactions; The interface between academic and applied approaches; Novel techniques; GIS and remote sensing/survey; Integration of different/complementary approaches. Details will be posted on the meeting website at: <http://www.shef.ac.uk/scidr/geoarchaeology2009>. To receive further details please contact us at: geoarch@shef.ac.uk.

The **6th European Congress on Regional Geoscientific Cartography and Information Systems (EUREGEO)** will be held June 9 - 12, 2009 in Munich, Germany. It continues the dialogue of European Regions started in 1994 between Bavaria, Catalonia and Emilia-Romagna. As in the past it serves as a platform for experts from geological surveys, universities, research institutes and from private enterprises – forming a bridge between scientific research and practical application! With the subheading "Earth and Men" the discussion about the system Earth and mankind living on and from Earth shall be stimulated. The conference shall provide a firm support for the planning of land use and the definition of

regulations for it. In oral presentations, poster sessions and workshops a wide variety of topics reaching from natural resources and geo-hazards to the application of maps and methods and popularisation of Geosciences will be discussed. In 1992 the Geological Surveys of Emilia-Romagna (Italy), Catalonia (Spain) and Bavaria (Germany) informally started an innovative collaboration in the fields of Earth Sciences and Information Systems. This close working partnership led to the organisation of several editions of the “European Congress on Regional Geoscientific Cartography and Information Systems” in Bologna (1994), Barcelona (1997), Munich (2000), Bologna (2003) and Barcelona (2006). These congresses entailed effective co-operation across Europe between the Regional Geological Surveys, brought together numerous participants from many European countries, and even from Northern Africa and Asia, and produced important innovations and solutions regarding geo-environmental topics and information systems. Spontaneous cooperation between European regions has demonstrated that this could be a very effective way to bridge the gap between different traditions and methodologies and to begin sharing territorial and geo-environmental information at European level. To support this objective, the European Soil Bureau Network of the European Commission and EuroGeoSurveys have been invited to become members of the Scientific Committee. The sixth edition of the Congress will be held in Munich (June 2009). Deadlines: September 30, 2008 Submittal of short abstracts; November 2008 Second circular, information about accepted contributions; January 31, 2009 Submittal of extended abstracts; March 2009 Third circular, short programme; April 15, 2009 Deadline for registration at reduced fee; Contact Bavarian Environment Agency, Bürgermeister-Ulrich-Str. 160, D-86179 Augsburg, Tel. +49 821 9071 4674, Fax +49 821 9071 4519, Website: <http://www.lfu.bayern.de/veranstaltungen/euregeo2009>.

The **11th International Paleolimnology Symposium** will be held from the 23rd to the 26th of June 2009, in Guadalajara, Jalisco, Mexico. Guadalajara is an ideal location for this meeting as it lies in a region of major volcanic and tectonic complexity which has given origin to several of the main lacustrine basins in Mexico. The organizing committee is now calling for the proposal of special sessions. The deadline for submitting a special session proposal will be the 1st of October 2008. The number of special sessions will be limited by the availability of space during the meeting; therefore we suggest sending your proposal as early as possible. For submission, please send an e-mail to maga@geofisica.unam.mx with a brief description (one paragraph or so) of the theme of the session you intend to organize, including name(s) and contact details of the convener(s). If two or more special sessions are proposed on very similar subjects you might be asked to combine the sessions. We are also pleased to announce that the symposium's web page is now active at: <http://www.geofisica.unam.mx/paleolimnologia>. The major aim of IPA is promotion and advancement of the science of paleolimnology and its applications. The International Paleolimnology Symposium constitutes an important activity of the association, as it provides a forum for the presentation and discussion of research in every

area of paleolimnology. There have been ten previous meetings, the first one (1967) in Hungary and the last one (2003) in Duluth, Minnesota (USA). Seven of these meetings have been held in Europe, one in Australia, one in Canada and one in the USA. The 11th Symposium will be held in Mexico and thus constitutes an effort to promote paleolimnology over an even broader geographic area.

7th International Conference on Geomorphology (ANZIAG 2009): Ancient Landscapes—Modern Perspectives, will be held in Melbourne, Australia, July 2009. One session will be dedicated to Geoarchaeology. The International Association of Geomorphologists holds its International Conference every four years. The IAG International Conference series provides the major forum for the global community of geomorphologists and scientists in related disciplines. The Seventh IAG Conference on Geomorphology (ANZIAG) in Melbourne in July 2009 will be on the theme ‘Ancient Landscapes – Modern Perspectives’. For the first time in the history of the International Association of Geomorphologists the International Conference will be held in the Southern Hemisphere, on an ancient piece of Gondwanaland. The Conference will provide a venue for geomorphologists working in all branches of the discipline to present their own work, to hear the work of others, and to interact with colleagues from around the globe. In keeping with the location of the Conference, there will be a special session on Southern Hemisphere/Gondwana Geomorphology. Conference sessions will cover the major traditional themes in Geomorphology as well as new and developing fields such as Chronometrics and Cosmogenic Dating, Terrestrial Laser Scanning, and the Geomorphological Impact of Armed Conflict. Each of the working groups of the IAG will hold meetings at the Conference. The Conference is being hosted by the Australian and New Zealand Geomorphology Group Inc. (ANZGG) and will showcase the work of geomorphologists in both countries. Associated with the Conference will be field trips both before and after the main event in Melbourne. Field trips will enable visitors to experience the variety of geomorphological settings in Australia and New Zealand and will include some further afield to the Pacific Islands. For details, see <http://www.geomorphology2009.com>.

Royal Society Honors Oxford Scientist

Professor Robert Hedges, Deputy Director of the Laboratory of Archaeology and the History of Art at Oxford has been awarded a Royal Medal of the Royal Society for his contribution to the rapid development of accelerator mass spectrometry and radiocarbon dating techniques.

His research focuses on the recovery of information about human and animal diets, and ancient environments, from

archaeological sites. This work includes identifying surviving biological molecules and understanding how such molecules degrade over time. Professor Hedges' work with this exciting technology allows fellow archaeologists a rare insight into the lives of those found at archaeological sites.



Robert Hedges

From Professor Hedges' website, www.rlaha.ox.ac.uk/php/person?person=REMH: "My interests in stable isotopes are defined by the work of the group as a whole. That is to say in recovering palaeodietary and environmental information concerning humans and animals in an archaeological context. This work has close connections with radiocarbon dating (where carbon flux is an essential basis), with the diagenetic alteration of bone during burial, and with the identification of surviving biomolecules."

"Since collagen bulk carbon and nitrogen isotopic values give at best only two values with which to describe and quantify diet, I am concerned to expand the basis of information available. One approach being taken is at the individual amino acid level. Another is the study of other isotopes such as sulphur, hydrogen and oxygen, and also collaborative development work on calcium and boron."

"Advances in methodology are likely to come from the interaction between field data, experimental studies, including living populations and an appropriate level of metabolic modelling, and the research of the group aims to address these. A particular developing interest of mine is bone turnover rates and the recovery of time-dependent information."

Because of the large numbers of attendees (attracted solely by archaeometry, or possibly by the idea of spending a week in Siena in May?) the local organizers were required to switch venues at almost the last moment. We therefore convened at the beautiful and commodious San Niccolo complex, a former insane asylum.

ISA is an unusual conference in that there are no concurrent sessions, allowing all participants to hear the entire program. Posters are given unusual prominence, with two separate, 2.5 hour blocks of time devoted to poster viewing and discussion when no oral sessions are in progress. In addition to the standard sessions on Technology and Provenance of a) Ceramics, Glazes, Glass, b) Stone, Plaster, Pigments, c) Metals and Metallurgical Ceramics; Bioarchaeology; Archaeochronometry; Field Archaeology; Human-Environment Interactions; and Integrated Site Studies, two special theme sessions organized by I. MemmiTurbanti and her local committee were held: "Micro-Nano Diagnostics and Ancient Technology," and "Food Preparation and Consumption in Antiquity."

Highlights of the Oral Sessions

The ceramics and glass sessions included a paper by Muller, et al. (Greece) on "Thermal Properties of Ceramics and Cooking Methods in Antiquity: half-baked, or all souped-up?" as well as papers on color in Minoan faience, Roman terra sigillata in the Alps, Islamic luster techniques, analyses of Spanish tin glazes (J. Perea-Arantegui, et al., Spain), and the production of ancient antimonate opacified glass in Egyptian, Roman, medieval Limoges, and 18th c. A.D. Nevers objects (S. Lahlil et al., France).

In the stone, pigments and plasters sessions, A. Paradisi (Lucca, Italy) presented a paper describing testing the microstructural and mechanical properties of lime plaster specimens before and after treating with consolidants. Robert Tykot (Tampa, Florida) presented a paper on "Intra-site Obsidian Subsource patterns at Contraguda, Sardinia" using a non-destructive, portable XRF instrument made by Bruker. Tykot demonstrated the instrument at the poster sessions. Other stone sourcing papers featured PGAA (prompt gamma activation analysis) on jasper (Crandell et al., Romania).

The metals and metallurgical ceramics session featured a discussion of Early Bronze Age metallurgy in Britain by P.J. Bray (Oxford) by measuring levels of arsenic and antimony in copper. Other papers included analyses of iron smelting slags in Mali, tin smelting in S. Africa, and Arabic coins as a source for silver.

The special theme session on micro and nano diagnostic techniques included some conservation studies, e.g. a paper on abrasion of sponge cleaning of paintings using SEM, optical digital profilometry, and atomic force microscopy (C. Alberston and A. Shugar, Buffalo, New York) and another paper analyzing mineral films on Romanesque buildings in Sardinia using XRD and polarizing microscopy (S. Columbu et al., Italy).

The 37th International Symposium on Archaeometry

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The 37th International Symposium on Archaeometry was held in Siena, Italy, on May 12-16, 2008. This five-day conference drew a record crowd, both in terms of people and presentations: 81 oral papers and 486 posters.

Noreen Turross' paper (Harvard University, USA) on migration and seasonality of early human populations in the Americas using hydrogen and oxygen isotopes and the paper on DNA analysis of grape seeds and Medieval wine production (E. Cappellini, et al.) were highlights of the Bioarchaeology session. In the Food Preparation session, S. Mirabaud et al. (France) reported on identification of cow and goat milk residues in Neolithic pottery using nano-electrospray mass spectrometry.

New radiocarbon dates from Thera in the Aegean, reported by ISA Chairman Yannis Maniatis (Athens, Greece) in the Archaeochronometry session, refine the chronology of the settlement and confirm the older age of the volcanic eruption. J.G. Rejas et al. reported on 3D laser and hyperspectral remote sensing techniques used to survey the site of Segeda, Spain in the Field Archaeology session.

Highlights of the Poster Sessions

Three sets of student poster prizes were awarded this year. 1) Members of the ISA Standing Committee (S. Wisseman, L. Barba, and K. Biro) awarded two Martin Aitkin prizes (cash plus a year's subscription to the journal *Archaeometry*) for best student poster. They were: 1) K.W.C. Poon, I.R. Dadour, and A.J. McKinley, "In Situ Chemical Analysis of Tattooing Inks and Pigments in Ancient Mummified Remains," (Australia) and 2) N.C. McCreesh, A. Gize, and R. David, "From a Single Strand: Scientific Analyses of Human Hair" (United Kingdom).

The Society for Archaeological Sciences, represented by judges T. Rehren, R. Sternberg, R. Tykot, and A. Burke, awarded one prize (cash plus SAS membership) to L. Molofsky, D. Killick, J. Chesley, and J. Ruiz, "Prehistoric Trade of Tin in South Africa Revealed by Lead Isotopes" (USA), and two Honorable Mentions (SAS membership), to C. Rosania, M. Boulanger, M. Glascock, K. T. Biro, "Geochemical Analysis of Eastern European Obsidian" (USA and Hungary) and H. Schroeder, J. Evans, T. O'Connell, R.E.M. Hedges, "Restoring the Links: Isotopic Evidence for the Origins of Enslaved Africans from Barbados" (United Kingdom).

The Italian Association of Archaeometry, led by president Marco Martini, awarded three cash prizes: 1) E. Blakelock, M. Marinno-Torres, and T. Young, "Slag Inclusions and the Quest for Provenance: Analysis of Slag an Slag inclusions from Iron Smelting Experiments" (United Kingdom); 2) F. Amato, B. Fabbri, S. Gualtieri, J. Gawronski, N. Jaspers, "Looking for the Provenance of Some Samples of Compendiario Majolica found in Archaeological Excavation carried out in the Centre of Amsterdam," (Italy and The Netherlands); and 3) M. Mrozek Wysocka, "Provenance Study of Archaeological marbles from marina el Alamein—The Greco-Roman Town in Egypt" (Poland).

Proceedings and Future Meeting

The Standing Committee agreed that the cost of publishing a paper proceedings volume is prohibitive, so any publication

will be electronic. Details will be posted on the conference website: <http://www.unisi.it/eventi/isa2008/index.htm>. Complete paper and poster titles, authors, and affiliations, and more pictures, can be found in the same place.

The next International Symposium on Archaeometry will be held in Tampa, Florida second week of May, 2010. The local Chair will be Rob Tykot, University of South Florida.

A new ISA official website is in the works. Until that time, the old ISA homepage will be maintained at: <http://www.itarp.uiuc.edu/atam/conf/home.html>.

Some Photos

A great time was had by all. Below and on the following page are some photos courtesy of Robert Tykot and others.



The ISA Standing Committee (courtesy of R. Tykot)



Piazza del Campo, Siena (courtesy of R. Tykot)



ISA Chair Yannis Maniatis (right) and Isabella Memmi, Chair of the Siena Meeting (left) (courtesy of S. Wisseman)



Dining! (courtesy of R. Tykot)



Dancing! (courtesy of R. Tykot)

A Bioarchaeological Examination of Health and Diet in Mainland and Coastal Central California

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Prehistoric Central California foragers subsisted on a wide spectrum of resources that varied across space and time, and maintained some of the highest population numbers in North America in the absence of agriculture. The impact of human population on the availability of food resources in the region has been addressed primarily through the faunal record, which shows evidence of resource depression, marked by a reduction in the abundance of low-cost, large fauna relative to higher-cost, smaller fauna during the late Holocene (Broughton 1994a, 1994b). Archaeobotanical remains and food processing implements also show increased investment in high-cost vegetal resources, especially acorns and small seeds (Basgall 1987; Wohlgemuth 2004). Interpreted within the framework of late Holocene resource intensification, these models posit a decline in health through time linked to a reduction in foraging efficiency (Broughton 1994a, 1994b).

While extensive bioarchaeological research has been conducted in the Santa Barbara Channel and San Francisco Bay proper, little research has examined diet and health patterns on the coast and mainland interior of Central California. This study provides a test of the resource intensification model by examining the relationship between diet and health in three coastal (Tomales Bay, Drake's Bay) and three mainland late Holocene Central California sites (Middle Period, ca. 2160-740 BP; Late Period, ca. 940-230 BP). Skeletal health indicators include evidence of anemic response (cribra orbitalia, porotic hyperostosis) and infection (tibial periostoses). Diet is examined through the study of dental caries and stable carbon and nitrogen isotopes of bone collagen.

Methods

The sample includes 80 individuals from three coastal (n=49) and three mainland (n=31) sites (ca. 2150-200 BP) from collections curated at the Phoebe A. Hearst Museum of Anthropology at UC Berkeley. The coastal sample includes the Estero (CA-MRN-232) and Cauley (CA-MRN-242) sites from Drake's Bay and the McClure site (CA-MRN-266) from Tomales Bay. The interior San Francisco Bay sample includes the Orwood #2 (CA-CCO-141), Hotchkiss (CA-CCO-138), and Monument (CA-CCO-137) sites (Figure 1). Sex and age assessments followed Buikstra and Ubelaker (1994). All individuals were scored for presence of tibial periostoses, cribra orbitalia, and porotic hyperostosis. Skeletal elements that were at least 50 % complete were included in the analysis. Dental caries was scored as present or absent in premolars and molars only and included individuals that had at least 8 postcanine

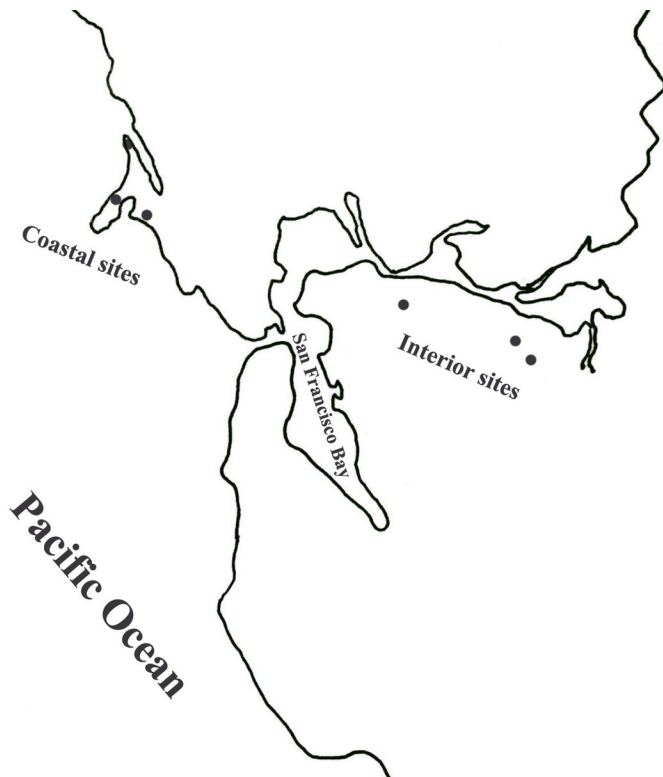


Figure 1. Map of Central California showing archaeological site locations.

teeth. Bone from 44 individuals was sampled for stable carbon and nitrogen isotope analysis of bone collagen. Chi-square tests were used to examine the relationship between health and dietary indicators. For comparisons of indicators with small sample sizes, Fisher's Exact was used in place of Chi-square. All analyses were conducted using SPSS 15.0 and statistical significance was determined at $\alpha = 0.05$.

Results

Table 1 presents the prevalence of each health indicator as well as the average isotope values for the total sample, and for each region and time period. In the total sample, 11 % show evidence of cribra orbitalia, 24 % show evidence of porotic hyperostosis, 15 % and 12 % have at least one tibia periosteal lesion of the left and right sides respectively, and 13 % of individuals are affected by dental caries.

Regional comparison of pathological indicators reveals that porotic hyperostosis ($p = 0.00$) and tibial periostoses (left, $p = 0.01$ and right, $p = 0.02$) are significantly more common in the coastal sample than in the interior sample (Figure 2). However, individuals from the interior are significantly more affected by dental caries than individuals from the coast ($p = 0.00$). For the Middle Period, there are no significant differences between the coastal and the interior samples; however, this may be due to small sample size. For the Late Period, tibial periostoses are significantly more common in the coastal sample compared to the interior sample (left, $p = 0.02$; right, $p = 0.01$). The stable

Table 1. Distribution of Health Indicators and Stable Isotope Values.

Sample	Total	Coastal	Interior	Middle Period	Late Period
Cribra orbitalia	7/62 (11%)	4/38 (10.5%)	3/24 (12.5%)	3/31 (10%)	4/31 (13%)
Porotic hyperostosis	15/63 (24%)	14/36 (39%)	1/27 (4%)	12/30 (40%)	3/33 (9%)
Periostoses (left tibia)	10/65 (15%)	10/40 (25%)	0/25 (0%)	6/29 (21%)	4/36 (11%)
Periostoses (right tibia)	8/67 (12%)	8/41 (19.5%)	0/26 (0%)	4/30 (13%)	4/37 (11%)
Dental caries	7/52 (13%)	0/29 (0%)	7/23 (30%)	0/22 (0%)	7/30 (23%)
$\delta^{13}\text{C}$	-15.24	-13.07	-19.43	-13.26	-17.6
$\delta^{15}\text{N}$	14.31	16.13	10.79	15.83	12.49

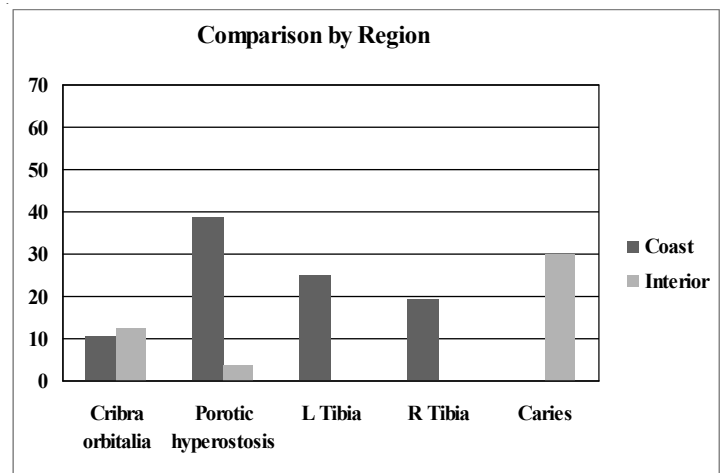


Figure 2. Comparison of pathological indicators by region.

isotope results show significant differences between the coastal and interior samples ($p < 0.05$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$). Small sample size did not permit regional comparisons by time period; however, examination of the data suggest that regardless of time period, coastal samples show heavy consumption of high trophic level marine resources (e.g., marine fish, marine mammals), and interior samples show heavy consumption of terrestrial and freshwater resources (e.g., deer, freshwater fish, acorns, seeds).

Middle Period skeletons show a significantly higher prevalence of porotic hyperostosis than skeletons from the Late Period ($p = 0.00$). However, individuals from the Late Period show a significantly higher prevalence of dental caries than those from the Middle Period (Figure 3). When compared by region, there are no significant differences in the prevalence of porotic hyperostosis or dental caries between the Middle and Late Period, although this is likely influenced by the small size of the Middle Period interior sample.

Table 2 provides information on the presence/absence of a lesion and the associated $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values. Upon first glance the comparison of diet and health seems to suggest that individuals with lesions have markedly different carbon and nitrogen isotope signatures than those without lesions. When studied more closely, however, it is clear that this relationship is influenced by the marked regional differences in diet and health. As expected, the stable isotope data reveal that individuals from the coast were heavily reliant on marine foods

Table 2. Comparison of Lesion State with $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values.

Indicator	Lesion state	Cribra orbitalia	<i>p</i>	Porotic hyperostosis	<i>p</i>
$\delta^{13}\text{C}$	Absent	-14.85	0.78	-15.91	0.08
	Present	-14.17		-13.86	
$\delta^{15}\text{N}$	Absent	14.49	0.98	13.57	0.09
	Present	14.45		15.40	
	Present	-10.52		-10.26	

Indicator	Lesion state	Periostoses (left tibia)	<i>p</i>	Periostoses (right tibia)	<i>p</i>	Dental caries	<i>p</i>
$\delta^{13}\text{C}$	Absent	-16.07	0.00	-15.95	0.00	-15.16	0.01
	Present	-12.55		-12.46		-20.39	
$\delta^{15}\text{N}$	Absent	13.63	0.00	13.67	0.00	14.31	0.00
	Present	16.66		17.02		10.94	
	Present	-9.83		-9.68		-14.83	

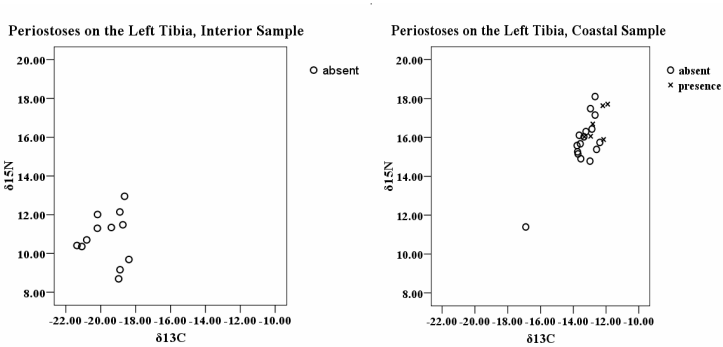


Figure 4. Comparison of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values by presence/absence of tibial periostoses (left) in the coastal and interior samples (right).

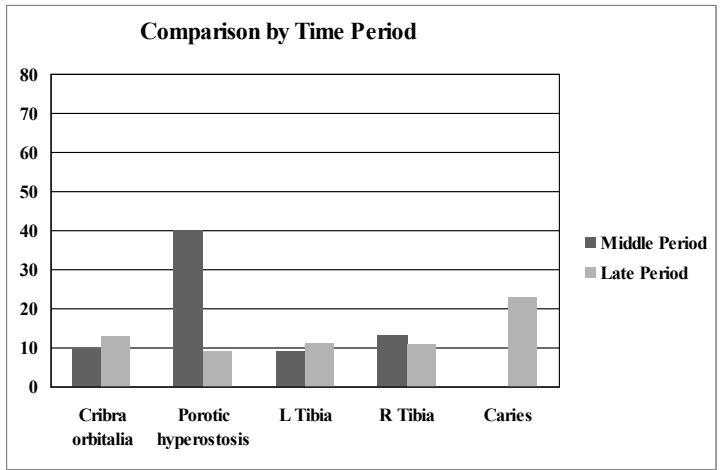


Figure 3. Comparison of pathological indicators by period.

whereas the interior samples had a more terrestrially-based diet. As discussed above, pathological indicators vary significantly by region, with a higher prevalence of porotic hyperostosis in the coastal sample and a higher prevalence of dental caries in the interior sample. Thus, the dietary difference between individuals with and without the lesion is a regional pattern, i.e, individuals who live on the coast have a higher incidence of porotic hyperostosis and a heavily marine diet compared with those from the interior, who have a lower incidence of porotic hyperostosis and a more terrestrial diet. This is clearly illustrated in Figure 4 which depicts the relationship between presence and absence of periostoses on the left tibia and diet separately in the coastal and interior samples.

Summary and Conclusions

The data from this study indicate significant regional differences in diet and health in prehistoric Central California. As expected, individuals from the coast show a heavily marine diet that is consistent with consumption of high trophic level marine resources, such as marine fish and marine mammals. Despite the abundance of shell recovered from shell middens at many coastal sites, the isotope values suggest that shellfish

were not a major contributor to the overall diet. The interior sites show a diet heavily focused on terrestrial and/or freshwater animal protein and C3 plants (e.g., deer, freshwater fish, acorns, seeds). These results conform to expectations of dental disease, in which dental caries rates are higher among interior groups that consumed greater amounts of carbohydrates than among coastal groups that consumed marine resources.

Comparisons of skeletal indicators suggest significant regional differences in both the prevalence of porotic hyperostosis and tibial lesions. Parasitic infestation and bacterial infection are likely sources of anemic response in the coastal sample (see Walker 1986), since individuals were clearly eating sufficient amounts of dietary protein (based on $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values). This finding is also tentatively supported by the higher prevalence of tibial periostoses in the coastal sample, which may be linked to higher rates of infection. Alternatively, tibial periostoses may be linked to accidental trauma incurred due to the more rugged terrain along the coast compared with the interior.

Small sample size limits the strength of our interpretation for temporal change in the region. Thus, the data do not provide clear support for a temporal decline in health (with the exception of the increase in dental caries in the interior).

However, the decline in porotic hyperostosis between the Middle and Late Period may provide some support for a change in health status. More data are needed to address long term changes in diet and health in the region, and to further test predictions of resource intensification models.

Acknowledgements

We thank Dr. Tim D. White, Natasha Johnson, and the staff of the Phoebe A. Hearst Museum of Anthropology for their assistance with the UC Berkeley collections. This study was funded by a NSF Doctoral Dissertation Improvement Grant (# 0424292) and by a Strategic Performance Grant, College of Behavioral and Social Sciences, California State University, Chico.

References

- Basgall, M. E. (1987). Resource Intensification Among Hunter-Gatherers: Acorn Economies in Prehistoric California. *Research in Economic Anthropology* 9:21-52.
- Broughton, J. M. (1994a). Declines in Mammalian Foraging Efficiency During the Late Holocene, San Francisco Bay, California. *Journal of Anthropological Archaeology* 13(4):371-401.
- Broughton, J. M. (1994b). Late Holocene Resource Intensification in the Sacramento Valley, California: The Vertebrate Evidence. *Journal of Archaeological Science* 21(4):501-514.
- Buikstra, J. E. and D. H. Ubelaker (editors) (1994). *Standards for Data Collection from Human Skeletal Remains: Proceedings of a Seminar at the Field Museum of Natural History*. Arkansas Archeological Survey Research Series No. 44, Fayetteville, Arkansas.
- Walker, P. L. (1986). Porotic Hyperostosis in a Marine-Dependent California Indian Population. *American Journal of Physical Anthropology* 69(3):345-354.
- Wohlgemuth, E. (2004). *The Course of Plant Food Intensification in Native Central California*. Ph.D. dissertation, University of California, Davis. University Microfilms, Ann Arbor, Michigan.



Figure 1: Location of Gazole (25.7 °N, 89.2 °E) in West Bengal, India.

Characterization of a Pala-Sena, High-Tin Bronze Bowl from Bengal, India

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The peoples of Bengal, India have a tradition of making bronzes with different compositions of tin (Sn) in copper (Cu). Analyses of bronze objects excavated by archaeologists have demonstrated a shift in bronze making technology, from low-tin bronzes to high-tin bronzes and super high-tin bronzes at different archaeological sites. One such site is Gajole (25.7 °N, 89.2 °E), which is located in the District of Maldah in West Bengal, India (Figure 1). A large number of archaeological materials were recovered during the 1995 exploration of the villages around the Police Station in Gajole by the Directorate of Archaeology, Government of West Bengal (Maity et al. 1996). One of those materials was a broken fragment of a bowl made of copper alloy that was later identified as high-tin bronze (Figure 2). On the basis of this bronze sample, a new investigation was conducted to learn about technological aspects of the metal production process. The objective of the

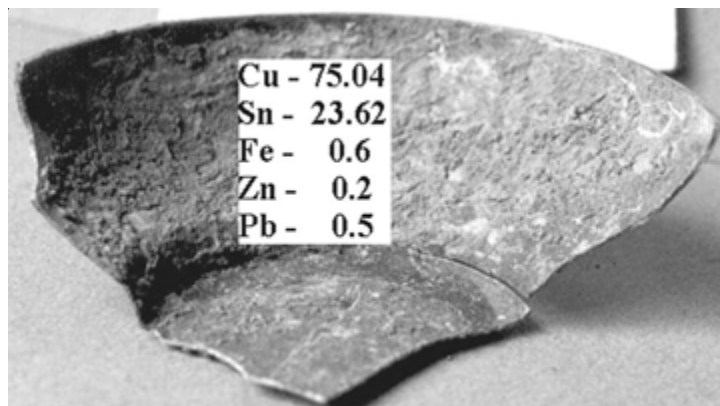


Figure 2. The high-tin bronze bowl from Gazole in West Bengal. The chemical composition (inset) of the bronze has been analyzed as a high-tin (>20 % Sn) copper alloy, commonly known as *kansa* in Bengal, Bell metal in the Western World, and β -bronze in metallurgical parlance.

present study was to investigate the macrostructure, microstructure, X-ray diffraction pattern, and texture of the bronze metal. Additionally, a preliminary study of the mechanical property by hardness measurement was also conducted.

Chemical Analysis

The metallurgical characterization started with the chemical analysis by wet method of the sample. The sample was found to contain mainly 75.04 wt.% copper, 23.62 wt.% tin with few impurities, such as 0.6 wt.% iron, 0.2 wt.% zinc, 0.5 wt.%

lead. From this composition it is easily inferred that the metallic sample is basically a copper-tin alloy known as high-tin bronze.

Macrostructure

The bronze sample was prepared for structure examination with FeCl_3 + dil. HCl as etching solution and was examined using an OXFORD – JEOL JSM-6360 scanning electron microscope. The macrostructure (Figure 3) of the bronze sample has been developed over the transverse cross-section. The thickness of the bronze sample as received is 1.1 mm. The structure suggests that the deformation occurred in a preferred direction, as observed from the longish second phase precipitates. The size of precipitates of the second phase varies in width from 4-50 μm while the length is from 25-250 μm . The heavy metal forming deformation at hot working temperature, known as hot forging, has been identified by the alignment of intermittent second phases (later identified as β -phase) in the form of lines. The longish shape of the precipitates clearly gave rise to flow lines due to forging, commonly known as fibrous structure (Dieter 1966). With heavy forging over spatial areas during thickness reduction, in transverse and radial directions, the non-uniform deformation expected from manual hammer forging led to little micro-cracking of the bowl in some areas, marked by arrows in Figure 3. This was a processing handicap of forging high-tin bronze, which is hard and brittle and cannot be cold worked at room temperature. But the ancient Bengalese metal workers, without having modern metallurgical knowledge, overcame the handicap and succeeded in making bowls of this complex shape by only hot forging, without any deep drawing (which is normally done in making metallic cups at room temperature).

Microstructure at the Transverse Section

The microstructure of the same transverse section of the specimen in higher magnification revealed numerous elongated grains of the second phase, known as β -phase, aligned along

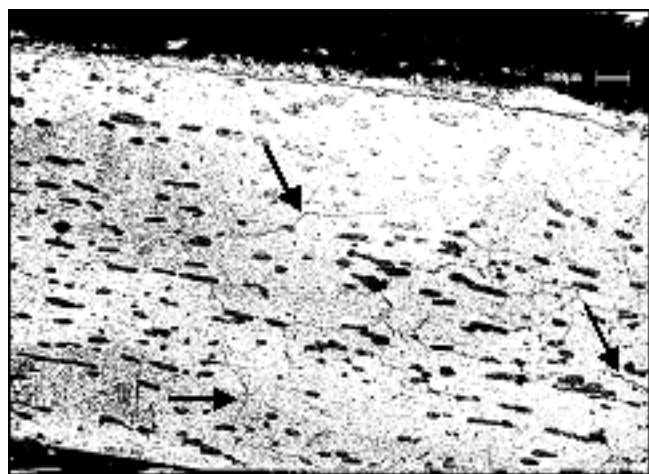


Figure 3. Macrostructure of the bowl at transverse section. Some forging cracks of the item, marked by arrows, are visible.

a preferred direction (Figure 4). The matrix in the β -phase surrounds β -phase, as with the macrostructure. Both phases are solid solutions of tin in copper. Forging fibers normally follow the contour of the forged product (Rollason 1975). This phenomenon of bi-axial deformation also occurs in this case. Parts of some of the grains of the second phase are oriented or pointed almost perpendicular to the earlier preferred orientation. The perpendicular orientation of the second phase in some areas implies working characteristics of the heterogeneous alloy in two directions, radial as well as transverse. The rounded corners and globular nature of the second phase, β -phase, in some cases are also seen in the microstructure. It is due to the repeated forging at red hot condition, when the recrystallization and annealing of the metal also occurred, that the softening process rounded the phases as well as eliminated major cracking.

Microstructure over the Surface

The microstructure (Figure 5) over the surface area of the bowl produces slip bands (strain bands), (Rollason 1975) caused by heavy deformation of forging. Slip occurs on some favorable planes and the results of the slip movement form a series of steps on a polished surface that appears under the microscope as slip bands. The slip bands enclosed within β -grains (second phase) are also found to be oriented in different directions, confirming the movement of the grain flow in more than one direction as already suggested.

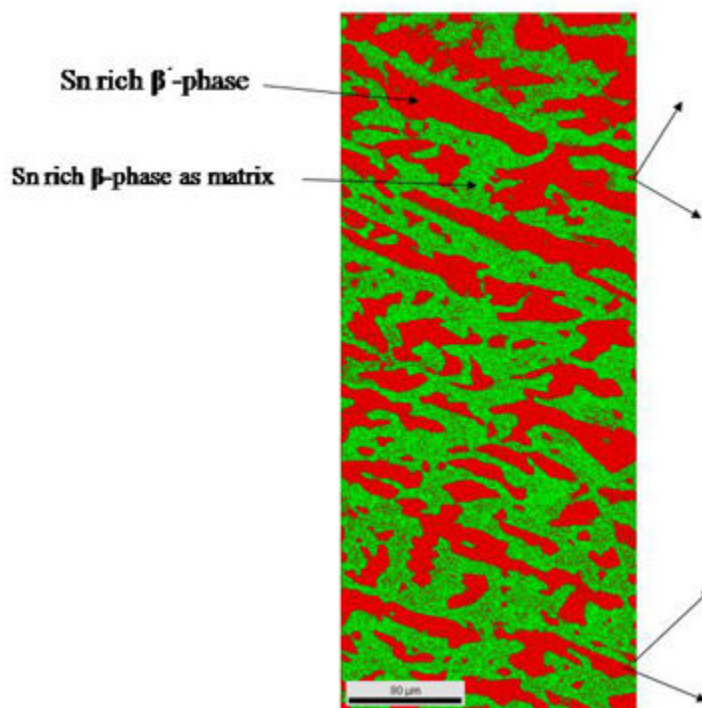


Figure 4. The microstructure indicates predominantly β -phase of lighter color and β -phase of darker color as second phase. The β -phase orients itself more or less in the preferred direction of the forging operation.

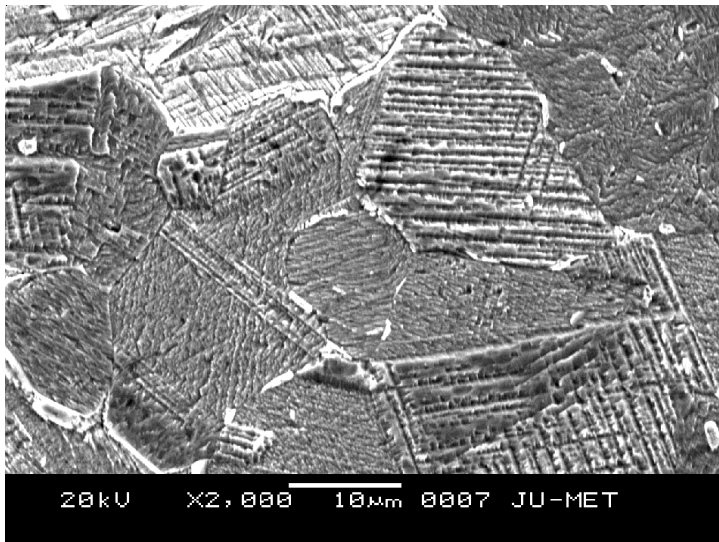


Figure 5. The deformation slip bands of β -phase can be seen within the grains. Similarly, fine slip bands in the β' -region also surround the β -phase.

Distribution of Tin in the Matrix and the Second Phase

During ingot making of the high-tin bronze stock from which the bowl was manufactured, the phase of lower tin content formed first (Haasen 1997). The β' -phase, which formed initially, shows its chemical composition of tin as 15.77 wt. % (Table 1), lower than the β -phase, which contains 34.22 wt. % tin. The matrix β -phase should be richer in tin and the percentages of tin analyzed by EDX satisfactorily confirm the general metallurgical observation.

Further Analysis of the Distribution of Tin

A large grain of β - phase was selected (Figure 6) for EDX analysis from the center of the grain to another grain up to a small length of the latter. The results identify the presence of Cu, Sn, and Fe (Table 2). The EDX results show a continuous increase of Sn percentage from the core (center) of the grain towards its surface and, thereafter, in the inter-dendritic region

Table 1. Elemental Compositions of Phases.

Element	Composition, Wt %	
	β -phase	β' - phase
Cu	65.33	82.61
Sn	34.22	15.77
Fe	0.35	0.39
O	1.98	1.22
Zn	0.41	nil

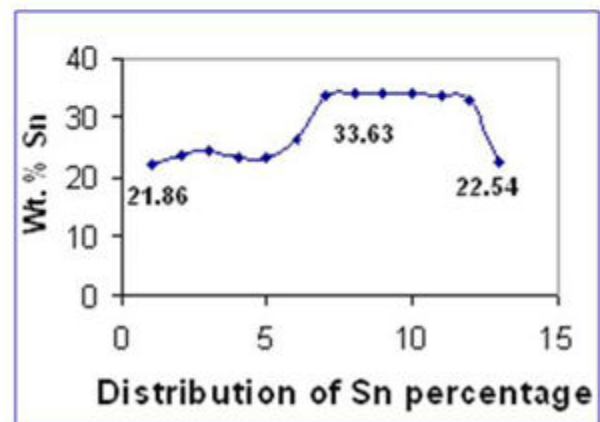
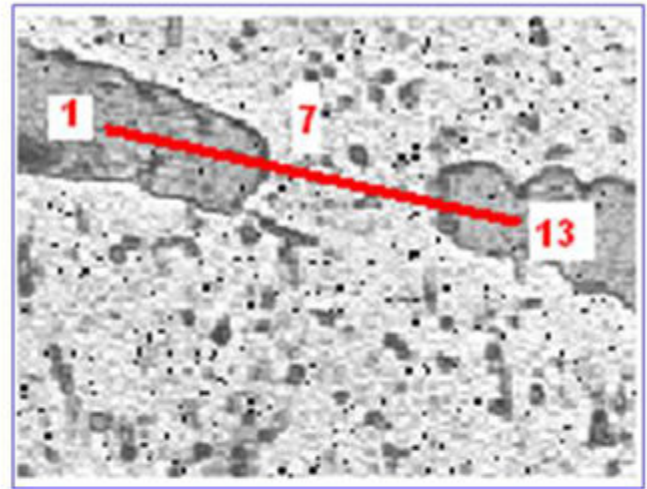


Figure 6. The contents and distribution of Sn in the given microstructure obtained from SEM-EDX analysis shows a lower proportion of Sn in β' -phase and a higher proportion of Sn in β -phase, as expected in normal heterogeneous material.

Table 2. Chemical Composition at Points 1-13.

Point	Cu	Sn	Fe
1	78.14	21.86	
2	76.25	23.75	
3	75.71	24.29	
4	76.88	23.12	
5	76.83	23.17	
6	72.50	26.22	1.29
7	65.44	33.63	0.93
8	65.35	34.06	0.58
9	65.51	34.00	0.49
10	65.24	34.00	0.76
11	65.71	33.59	0.70
12	66.28	32.88	0.84
13	76.65	22.54	0.81

of the metal the percentage of tin jumps as it should happen during solidification.

After casting, the ingot was subjected to repeat mechanical working in red-hot conditions during forging, when diffusion of the elements occurred. The diffusion averaged the elemental composition, within and outside the grains, removing heavy coring. The variation of tin within the grain ranges only from 21.86 wt. % to 22.54 wt.% and outside the grain it varies from 33.63 wt. % to 34.00 wt.%. Due to insufficient time, the hot working could not homogenize the metal completely in the form of either β or β' -phase.

X-ray Diffraction Analysis

The X-ray diffraction pattern was obtained using a PHILIPS PW 1700 diffractometer with Cu-K α radiation. The X-ray diffractogram (Figure 7, Table 3) of the bronze sample shows the presence of the following phases: pure tin, β -phase and β' -phase of copper-tin systems as compared by Sn (JCPDS files 5-0390, 4-0673, 18-1380), β -phase (JCPDS file 6-0621), β' -phase (JCPDS file 17-0865), respectively.

Neutron Diffraction Pattern

The high-tin bronze sample was subjected to further examination by the neutron diffraction technique (Figure 8). From the neutron diffraction pattern, the reflections can be indexed to β Bronze (Pmmn space group, JCPDS 06-0621) and β' (Cu_{5.6}Sn, JCPDS 17-0865) (P4/n space group). From this pattern, it appears that there are two possible phases in this sample.

The cell parameters in β Bronze are 4.578802, 5.377717, 4.252579 (all in Å units). The cell parameters in β' (Cu_{5.6}Sn) are 3.727009, 3.727009, 3.677952 (all in Å units). The upper and lower tick marks in the diffractogram indicate the positions of the allowed reflections. The upper and lower ticks are for β Bronze and β' (Cu_{5.6}Sn), respectively.

Texture Analysis

To further investigate the problem of the preferred orientation of the forged bronze sample, X-ray pole-figures were examined by an Xpert Pro PANalytical machine (Figure 9). The contours of the pole-figure {100} do not provide much information. The contours of the pole-figure {111}, {110}, and {113} are discontinuous and the orientations of the forging texture are very difficult to identify due to larger grain sizes (25-250 μ m). The deformation texture due to thermo-mechanical treatment may affect the orientations of {110} <112> and {113} <211>.

Differential Thermal Analysis (DTA) and Thermogravimetric Analysis (TGA)

The high-tin bronze sample was studied with DTA and TGA analysis up to 900 °C in a nitrogen atmosphere for the

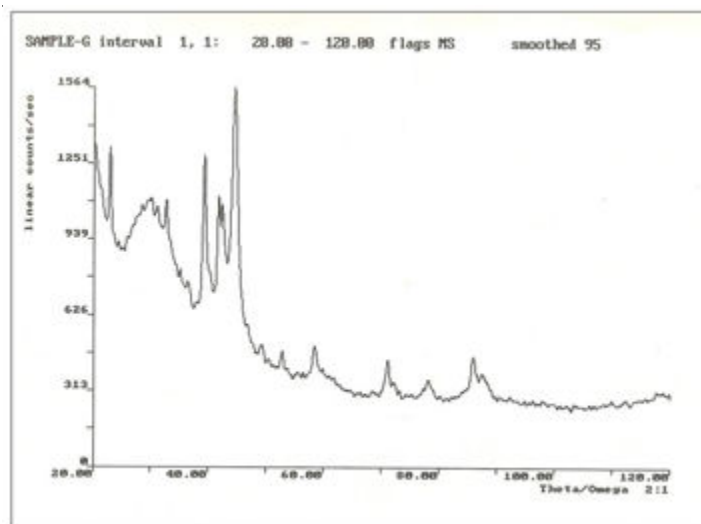


Figure 7. X- Ray diffractogram of the high-tin bronze.

Table 3. XRD Data (Radiation: Cu/Ni 35 kV/ 30mA, Wave-length: K α = 1.540598).

No.	Angle	d _{space}	Rel I	Identified Phase	Diffracting Plane (hkl)
1	22.90	3.88	84.20	Sn	111
2	30.05	2.97	70.80	Sn	200
3	32.61	2.74	70.40	Sn	101
4	39.22	2.30	82.20	Sn	220
5	41.73	2.16	71.40	β -phase	2
6	42.34	2.13	69.30	β -phase, α -Cu	111,111
7	44.46	2.03	100.00	β -phase	121
8	49.12	1.85	32.10	β -phase, α -Cu	200, 200
9	52.75	1.73	30.60	Sn	2
10	58.35	1.58	31.80	β -phase	122, 202
11	71.07	1.33	28.00	β -phase	320
12	78.13	1.22	23.00	β -phase, α -Cu	123, 203
13	85.86	1.13	29.00	β -phase	322
14	87.33	1.12	24.70	β -phase, β' -phase	241, 113
15	109.85	0.94	17.80	Sn	444

identification of phase change characteristics (Figure 10). For this bronze sample, two small endo peaks around 520 °C and 802 °C were observed in thermal analysis. This indicates the γ -eutectoid phase transformation at 520 °C and then further small peritectic transformation around 800 °C, after which the material fully enters the β -region of Cu-Sn phase diagram.

Micro-hardness

Micro-hardness data were obtained by the Knoop Micro Hardness Machine, VMHT by Leica. Hardness measures HK 288, 310 and 323 over matrix, β -phase and HK 206, 210 and 276 over β' -second phase at an indenting load of 10 gm wt. The matrix β -phase possessing 34.22 wt. % Sn shows higher hardness while second phase β' -phase containing 15.77 wt. %

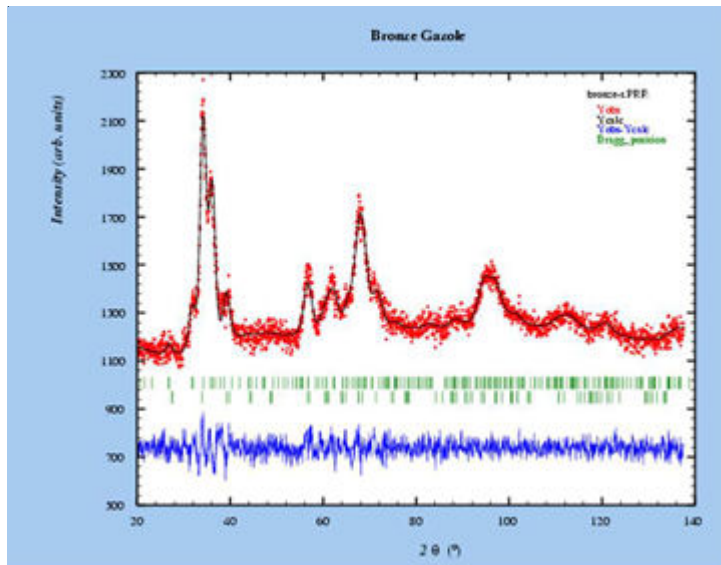


Figure 8. Neutron diffraction pattern.

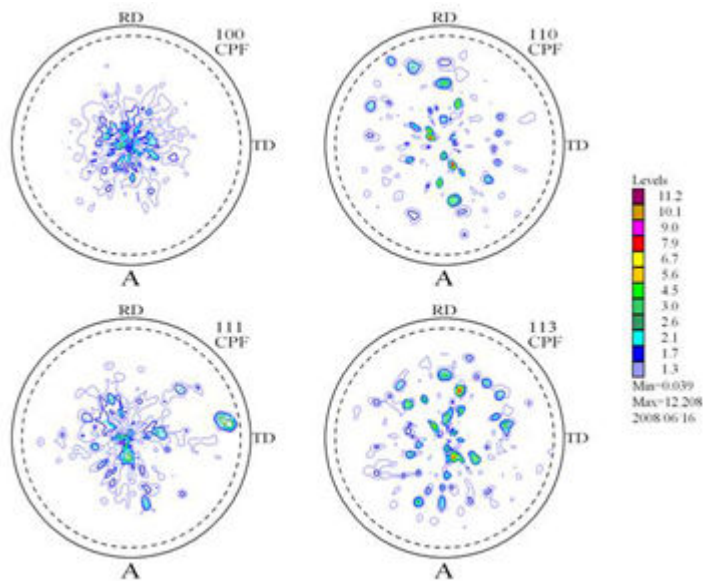


Figure 9. Pole figure of the high-tin bronze sample.

Sn measures lower hardness. The hardness measurement satisfies the common metallurgical prediction of the solid solution hardening (Haasen 1997) that harder phase should have a higher concentration of solute, tin.

Conclusion

The study of the high-tin bronze bowl at Gajole shows a beautiful manufacturing process of ancient metal workers. This unique process is a unit process of utensil manufacturing by the hot forging technique. The macrostructure clearly shows the fibrous structure of hot forging from the observation of the second phase. The microstructure shows two-way plastic



Figure 10. (a) Data for DTA indicating small endo peaks at 520 °C and 802 °C marked by arrows, (b) Data for TGA do not provide substantial information.

deformations of a cast stock (ingot) into upsetting as well as deep drawing operations simultaneously.

EDX analysis provides the compositions of individual phases of β and β' . The softening of the hard bronze material was done by the method of diffusion at high temperatures. At the high temperature during forging, the red hot cast ingot also became homogenized. The combination of the thermal treatment as well as the hot deformation, known in modern times as thermo-mechanical treatment (TMT), was practiced by the Bengal metal workers. The knowledge of TMT is an indicator of superior knowledge of metallurgy, which made possible the shaping of a hard and brittle alloy like high-tin bronze.

The creation of the composition as 75Cu/25Sn is also significant and a unique achievement. Because this material at red hot condition becomes almost single phase β or β' , it is fit for easy plastic deformation. This was determined by the X-ray analyses and neutron diffraction analysis.

The hardness of the high-tin bronze at Gajole corresponds to very high Knoop hardness values, as determined by the micro-hardness tester. The extreme hardness is significant, because it is comparable to general cutting tip hardness. The high-tin bronze or β -bronze is a peculiar alloy that is hard and brittle at room temperature but soft, ductile, and highly deformable at red hot temperatures.

The ancient metal workers had this technological information without the modern knowledge of phase diagrams. This confirms the impressive development of metallurgy in ancient Bengal.

Acknowledgements

The present paper was developed with a number of analyses carried out in different laboratories at the Bhabha Atomic Research Centre, Indian Institute of Technology Bombay, Jadavpur University, and Geological Survey of India. We are thankful for the support provided by Dr. Amitabha Das of BARC, Prof. Indradev Samajdar and Mr. Vijay Hiwarkar of IITB, and Mr. Sabyasachi Shome of GSI. We are also grateful to Dr. Gautam Sengupta, Director of Archaeology and Museum, Government of West Bengal and Secretary, Centre for Archaeological Studies & Training, Eastern India for his constant support and encouragement.

References

- Datta, P. K. (2005). Copper and copper alloys in Archaeological Perspective, in *Science in Archaeology and Archaeomaterials*, New Delhi, D.K. Printworld, pp. 207-270.
- Dieter, G. E. (1966). *Mechanical Metallurgy*, Int. Student Ed., McGraw-Hill Book Company, London, pp. 460-461.
- Haasen P. 1997. *Physical Metallurgy*, Cambridge University, Cambridge, UK, pp.66, 353-365.
- Hwang, J. D., B. J. Li, W. S. Hwang, and C. T. Hu. (1998). Comparison of phosphor bronze metal sheet produced by twin roll casting and horizontal continuous casting, *Journal of Materials Engineering and Performance* 7(4):495-503.
- JCPDS, Joint Committee on Powder Diffraction Standards, International Centre for Diffraction Data. (2001). Swartmore.
- Maity, P. C. *et al.* (1996). Archeological Survey in Gazole P.S. of Malda District: A Preliminary Report of the First Season's Work, *Pratna Sameeksha*, 4 & 5, pp. 151-172.
- Rollason, E. C. (1975). *Metallurgy for Engineers*, ELBS, UK, pp. 105, 117.

Archaeological Ceramics

Charles C. Kolb, Associate Editor

The column in this issue includes four topics: 1) Passings; 2) Reviews of Books; 3) Previous Meetings; and 4) Forthcoming Meetings.

Passings

William Timothy Sanders: On Wednesday evening 2 July 2008, Bill Sanders, Evan Pugh Professor Emeritus of Archaeological Anthropology at The Pennsylvania State University died following a fall at home on Monday which resulted in a vertebral fracture, complications, and coma. He was 82. As his colleague Ken Hirth wrote: "Bill was a pillar of

his family, our department, and the profession. We will all miss him very much." Sanders, along with cultural anthropologist Maurice Mook, human biologist Paul Baker, and archaeologist Fred Matson, left Penn State's joint Sociology and Anthropology department in 1965 and established a separate Department of Anthropology. They were instrumental in its growth and maturation. Sanders' research focused on cultural ecology and ancient settlement patterns in Mesoamerica, especially the Gulf Coast and Yucatan but especially the Basin of Mexico, the Copan Valley in Honduras, and Kaminaljuyu, Guatemala, with particular emphasis on the origin and development of urbanism and cultural evolution. He also taught and worked in Peru (particularly the excavations and mapping of the site of Pikillacta) and was an active archaeologist until the end, and a frequent commentator at SAA and at Dumbarton Oaks Pre-Columbian meetings. In retirement he continued to teach courses at Penn State until recently. He was an enthusiastic and superb teacher and loved his craft and was a prolific author and editor – as Mike Smith wrote: "Sanders has been a guiding light in archaeological publishing." The American Anthropological Association presented Sanders with its 1980 Alfred Vincent Kidder Award for Eminence in the Field of American Archaeology. In 1985, he was elected a member of the National Academy of Sciences for his definitive contributions to the field of anthropology, combining archaeology, ethnology, ethnohistory, and archival research along with field research and controlled excavations to recover household patterns and discern relative chronologies most often through stratigraphy and ceramic analysis.

Following service during World War II and as a result of the GI Bill, Sanders was able to attend Harvard College and University where he was influenced by Gordon R. Willey. There he wrote *The "Urban Revolution" in Central Mexico* (unpublished undergraduate Honors Thesis, Department of Anthropology (1949) and received his Ph.D. from Harvard University in 1957 where his dissertation was *Tierra y Agua (Soil and Water): A Study of Ecological Factors in the Development of Meso-American Civilizations*, 2 vols. (xvii + 683 pp. 14 leaves). He would publish widely on Mesoamerican archaeology, notably: *Mesoamerica: The Evolution of a Civilization* (co-authored with Barbara J. Price, New York: Random House, 1968); *New World Prehistory: Archaeology of the American Indian* (co-authored with Joseph Marino) Englewood Cliffs, N.J: Prentice-Hall, 1970); *The Basin of Mexico: Ecological Processes in the Evolution of a Civilization* (co-authored with Jeffrey R. Parsons and Robert S. Santley, New York: Academic Press, 1979), and a textbook, *Out of the Past: An Introduction to Archaeology* (David L. Webster, Susan Toby Evans, and William T. Sanders; Mountain View, CA: Mayfield Publishing Co., 1993).

Among his seminal works was "The Central Mexican Symbiotic Region: A Study in Prehistoric Settlement Patterns" (*Prehistoric Settlement Patterns in the New World*, Gordon R. Willey (ed.), pp. 115-27. Viking Fund Publications in Anthropology. vol. 23, New York: Wenner-Gren Foundation for Anthropological Research, 1956). Ceramics provided a

significant source for building relative chronologies, especially in the Gulf Coast and the Yucatan; for example: *Prehistoric Ceramics and Settlement Patterns in Quintana Roo, Mexico* (Contributions to American Anthropology and History Vol. 12, No. 60, Publication 606; Washington: Carnegie Institution of Washington, 1960) and *Ceramic Stratigraphy at Santa Cruz, Chiapas, Mexico* (New World Archaeological Foundation Papers 9, Provo, UT: Brigham Young University, 1961). Linking ceramic chronology and large-scale settlement pattern studies in the Basin of Mexico, especially in the Teotihuacan Valley in the early 1960s resulted in the landmark multi-volume Teotihuacan Valley Reports (16 volumes and parts; 1975-2007) which was preceded by a preliminary report: *The Cultural Ecology of the Teotihuacan Valley* (University Park: The Pennsylvania State University, Department of Sociology and Anthropology, 1965) and other articles, "Life in a Classic Village" (In *Teotihuacán: Onceva Mesa Redonda*, pp. 123-43, Mexico, DF, Mexico: Sociedad Mexicana de Antropología, 1967).

Research in Guatemala and Honduras resulted in important monographs: *Teotihuacan and Kaminaljuyu: A Study in Prehistoric Culture Contact* (co-edited with Joseph Michels, University Park: Pennsylvania State University, 1977); *Excavaciones en el area urbana de Copain*, 4 vols. (William T. Sanders, director; Tegucigalpa, Honduras: Secretariia de Cultura y Turismo, Instituto Hondureño de Antropología e Historia, 1986-2000); and Sanders, Alba Guadalupe Mastache and Robert H. Cobean (eds.), *El urbanismo en mesoamérica / Urbanism in Mesoamerica. Proyecto Urbanismo de Mesoamérica / The Mesoamerican Urbanism Project*, Vol. 1 (University Park and Mexico City, The Pennsylvania State University and Instituto Nacional de Antropología e Historia, 2003). Three other volumes came from the KJ [Kaminaljuyu], Guatemala project (ceramics edited by Ron Wetherington, and settlement patterns and sociopolitical reconstruction of the KJ chiefdom – both by Michels), but Sander's hand is seen in these writings as well. Other major publications include: Sanders and Robert S. Santley, "A Tale of Three Cities: Energetics and Urbanization in Pre-Hispanic Central Mexico" (In *Prehistoric Settlement Patterns: Essays in Honor of Gordon R. Willey*, Evon Z. Vogt and Richard Leventhal [eds.], pp. 243-291, Albuquerque: University of New Mexico Press, 1983); *On the Evolution of Complex Societies: Essays in Honor of Harry Hoijer* (William Sanders, Henry Wright, and Robert McC. Adams; Timothy Earle [ed.], Malibu, CA: Published for the UCLA Dept. of Anthropology by Undena Publications, 1984); Sanders and David Webster, "The Mesoamerican Urban Tradition," *American Anthropologist* 90:521-546 (1988); "Three Valleys: Twenty-Five Years of Settlement Archaeology in Mesoamerica" (In *Settlement Pattern Studies in the Americas: Fifty Years Since Virú*, Brian R. Billman and Gary M. Feinman [eds.], pp. 12-21, Washington, DC: Smithsonian Institution Press, 1999); *Urban Influences at Rural Sites: Teotihuacán and its near Hinterlands* by Thomas Charlton, Cynthia Otis Charlton and William T. Sanders, FAMSIS Report [Foundation for the Advancement of Mesoamerican Studies, Inc.] (2000), <http://www.famsi.org/reports/97025/index.html>; "Tepetlaoztoc Project: Archaeological Investigations," *FAMSIS*

Report [Foundation for the Advancement of Mesoamerican Studies, Inc.] (2002), <http://www.famsi.org/reports/95047/index.html>; Sanders and Barbara J. Price "The Native Aristocracy and the Evolution of the Latifundio in the Teotihuacán Valley, 1521-1917" in *Ethnohistory* (2003); "The Aztecs and the Natural World: The Basin of Mexico as a Habitat for Pre-Hispanic Farmers" In *The Aztec Empire*, Felipe Solís (curator), New York: Guggenheim Museum, pp. 56-69, 2004).

The Teotihuacan Valley publications mentioned above were issued as follows (with references to ceramics): 1975 through 1993: Occasional Papers in Anthropology (OPA), Department of Anthropology, The Pennsylvania State University, University Park; 1993 through 2007: Occasional Papers in Anthropology (OPA), Matson Museum of Anthropology, The Pennsylvania State University, University Park. The Library of Congress has a complete set of these publications.

Sanders, W. T., M. West, C. Fletcher, and J. Marino (1975a) *The Teotihuacán Valley Project Final Report, Vol. 2: The Formative Period Occupation of the Valley, Part I: Texts and Tables*. OPA 10. [ceramics: pp. 28-44, 52-81, 90-106, 114-124]. Sanders, W. T., M. West, C. Fletcher, and J. Marino (1975b) *The Teotihuacán Valley Project Final Report, Vol. 2: The Formative Period Occupation of the Valley, Part II: Plates and Figures*. OPA 10. [ceramics: pp. 349-409]. Sanders, W. T. (ed.) (1986) *The Teotihuacán Valley Project Final Report, Volume 4: The Formative Period Occupation of the Valley, Part I: Excavations and Ceramics*. OPA 13. Evans, S. T. (1986) "Analysis of the Surface Sample Ceramics," in *The Teotihuacán Valley Project Final Report, Volume 4: The Formative Period Occupation of the Valley, Part I: Excavations and Ceramics*, edited by W. T. Sanders, pp. 283-365. OPA 13. Sanders, W. T. (1986) Ceramic Chronology. In *The Teotihuacán Valley Project Final Report, Volume 4: The Formative Period Occupation of the Valley, Part I: Excavations and Ceramics*, edited by W. T. Sanders, pp. 367-373. OPA 13. Sanders, W. T. (ed.) (1987) *The Teotihuacán Valley Project Final Report, Volume 4: The Formative Period Occupation of the Valley, Part II: Surface Survey and Special Studies*. OPA 15. Sanders, W. T. (ed.) (1994a) *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part I: The Excavations*. OPA 19. [ceramics: pp. 55-56, 64-65, 75-125; figurines: pp. 68-74] Sanders, W. T. (ed.) (1994b) *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part II: Artifact Analyses*. OPA 20. Sanders, W. T. (ed.) (1994c) *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part 3: The Surface Surveys*. OPA 21. Kolb, Charles C. Kolb "Teotihuacán Period Figurines: A Typological Classification, Their Spatial and Temporal Distribution in the Teotihuacán Valley," in *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley: Part 2: Artifact Analysis*, edited by W. T. Sanders, OPA 20, pp. 275-465 + 13 figs., 31 plates, 19 tables, 1 appendix [253 total pages]. Sanders,

W. T. (ed.) (1996) *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part 4: The Special Analyses, Miscellaneous Appendices, and Volume Bibliography*. OPA 24. Sanders, W. T. (1995) "Ceramic Vessels: Function and Chronology," in *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part II: Artifact Analyses*, edited by W. T. Sanders, pp. 140-274. OPA 20. Sanders, W. T. (1996) "Miscellaneous Lithic, Ceramic, Bone, and Shell Artifacts," in *The Teotihuacán Valley Project Final Report, Volume 3: The Teotihuacán Period Occupation of the Valley, Part 4: The Special Analyses, Miscellaneous Appendices, and Volume Bibliography*, edited by W. T. Sanders, pp. 840-861. OPA 24. Evans, S. T. and W. T. Sanders (eds.) (2000) *The Teotihuacán Valley Project Final Report, Volume 5: The Aztec Occupation of the Valley, Part 1: Natural Environment, 20th Century Occupation, Survey Methodology, and Site Descriptions*. OPA 25. Sanders, W. T. and S. T. Evans (eds.) (2000b) *The Teotihuacán Valley Project Final Report, Volume 5: The Aztec Occupation of the Valley, Part 2: Excavations at T.A. 40 and Related Projects*. OPA 26. [ceramics: p. 720; ceramic workshops: pp. 884-885]. Sanders, W. T. and S. T. Evans (eds.) (2001) *The Teotihuacán Valley Project Final Report, Volume 5: The Aztec Occupation of the Valley, Part 3: Syntheses and General Bibliography*. OPA 27. Sanders, W. T. and L. J. Gorenflo with R. S. Santley, D. L. Nichols, and R. A. Diehl (2007) *Prehispanic Settlement Patterns in the Cuautitlan Region, Mexico*. OPA 29.

Sanders was honored by a festschrift with contributions by Mexican and American colleagues, *Arqueologia Mesoamericana: Homenaje a William T. Sanders*, 2 vols. (Guadalupe Mastache de Escobar, Jeffrey R. Parsons, Robert S. Santley, and Mari Carmen. Serra Puche, coords.; México, DF, México: Instituto Nacional de Antropología e Historia, 1996). Mike Smith (Professor in the School of Human Evolution and Social Change, e.g. the former Anthropology Department at Arizona State University, has recently established a blog related to Sanders' life and contributions to archaeology: <http://publishingarchaeology.blogspot.com/2008/07/william-t-sanders.html>. Ancient World Bloggers also has a site: <http://ancientworldbloggers.blogspot.com/2008/07/william-t-sanders-2008.html>.

Bill Sanders trained nearly three dozen doctoral and Masters students and chaired numerous dissertation and thesis committees [he chaired mine; I first met Bill in 1959]. As another colleague said – "A great tree has fallen in the forest" – we shall all miss him.

Roxanna Maude Brown: Southeast Asian archaeologists, art historians, and ceramics experts were stunned to learn of the untimely passing on 14 May 2008 of Dr. Roxanna M. Brown, 62, world-renowned expert on Southeast Asian (SEA) ceramics, curator of the Southeast Asian Ceramics Museum at Bangkok University and editor of their excellent, highly informative newsletter: <http://museum.bu.ac.th/newsletter.html>, now on

hiatus. She died unexpectedly in Seattle reportedly of an infection brought on by a perforated ulcer while in federal custody on what many consider a very dubious indictment. She had traveled from Bangkok to Seattle to present a lecture on SEA ceramics at a conference co-sponsored by UCLA and the University of Washington. The most complete coverage of the tragic circumstances surrounding her arrest and death is available from the website of the *Seattle Times*, <http://seattletimes.nwsources.com/html/home/index.html>; type the name "Roxanna Brown" into the search engine. A 2004 article about her ground breaking research on SEA trade ceramics is available on the UCLA Internet site at <http://www.international.ucla.edu/cseas/article.asp?parentid=16359>. The Southeast Asian Archaeology Newsblog on Roxanna Brown is located at the website, <http://www.southeastasianarchaeology.com/?s=Roxanna+Brown>. Roxanna's brother, Fred Brown, has posted a moving portrait of her early life as a reporter in Vietnam during the Vietnam War on YouTube.

Roxanna was cremated in Seattle on 3 July 2008 with a service led by three Thai Buddhist monks. There also was a memorial service in Bangkok in mid-July. Other memorials were held at Wat Thai in Los Angeles, in Pasadena, and at the International Association of Buddhist Studies conference in Atlanta. Anyone wishing to sign a condolence letter to Roxanna's family, or a petition calling for a full investigation into the circumstances of her death, or to contribute to a fund for her family's expenses related to her death, please contact Prof. Justin McDaniel at UC Riverside (Department of Religious Studies, 3046 INTN, University of California, Riverside, Riverside, CA 92521); telephone 951/827-4530, e-mail justinm@ucr.edu. We have lost a splendid and caring colleague and friend, and Southeast Asian art history and ceramic archaeology are diminished by her passing.

Roxanna M. Brown's major publications include: (1973a) *The Dating and Identification of Southeast Asian Ceramics*, Unpublished M.A. thesis, University of Singapore, Singapore; (1973b) "Ceramic Excavations in the Philippines," *Transactions of the Southeast Asian Ceramic Society* [Singapore]; (1973c) "Thai Celadons," *Arts of Asia* 3(2): 39-44; (1973d) "Khmer Ceramics," *Arts of Asia*, 3(3): 30-35; (1974a) *The Legacy of Phra Ruang*, Bluet & Sons, Ltd, London; (1974b) "The History of Ceramic Finds in Sulawesi," *Transactions of the Southeast Asian Ceramic Society* [Singapore]; (1975-1976) "Preliminary Report on the Koh Khram Sunken Ship," *Oriental Art* 21: 356-370; (1977) *The Ceramics of South-East Asia, Their Dating and Identification*, Oxford University Press, Singapore (Reprinted 1988); (1978) *Legend and Reality, Early Ceramics from South-East Asia*, Oxford University Press, Kuala Lumpur; (1981) "Khmer Ceramics of the Korat Plateau: Unraveling the Mysteries" in *Southeast Asian Ceramic Society, Khmer Ceramics 9th-14th Century*, Southeast Asian Ceramic Society, Singapore, pp. 41-50; (1988) *The Ceramics of South-East Asia, Their Dating and Identification*, 2nd ed. rev. Oxford University Press, Singapore. Reprinted Chicago: Art Media Resources, Ltd., 2000; (1989) *Guandong Ceramics*

from Butuan and Other Philippine Sites, Oriental Ceramic Society of the Philippines, Makatai, Metro Manila, The Philippines; (1990) *Guandong Ceramics from Butuan and Other Philippine Sites*, Kuala Lumpur: Oxford University Press; (1997a) "Ceramics Inventory" in Mathers, W. A., and Flecker, M. (eds.), *Archaeological Recovery of the Java Sea Wreck*, Pacific Sea Resources, Annapolis, MD, pp. 116-181; (1997b) "Xuande-marked trade wares and the 'Ming gap'," *Oriental Art* 43(2): 2-6; (1997c) "Exhibition Review: Chinese and Vietnamese Blue and White Wares found in the Philippines," *Oriental Art* 43(2): 41-44; (1999) "Last Shipments from the Thai Sawankhalok Kilns: in Brown, R. L. (ed.), *Art from Thailand*, Marg Publications, Mumbai, India, pp. 93-103; (2000) *The Ceramics of South-East Asia: Their Dating and Identification*, 2nd ed., Art Media Resources, Chicago (reprint of the 1988 ed.); (2001) "Fashions in Ceramics" in Sabapathy, T. K. (ed.), *Museum Catalogue*, National University of Singapore, Singapore; (2002) "Sangkhalok and Asia" in Charnvit Kasetsiri (ed.), *Sangkhalok-Sukhothai-Ayutthaya and Asia*, Toyota Thailand Foundation and The Foundation for the Promotion of Social Science and Humanities Textbooks Project, Bangkok, Thailand, pp. 74-92; (2003) *The Ming Gap and Shipwreck Ceramics in Southeast Asia*, Unpublished Ph.D. dissertation, Department of Art History, University of California, Los Angeles; (2005) "Ming Ban-Ming Gap: Southeast Asian Shipwreck Evidence for Shortages of Chinese Trade Ceramics" in Pei-kai Cheng, Guo Li and Chui Ki Wan (eds.), *Proceedings: Chinese Export Ceramics and Maritime Trade, 12th-15th Centuries*, Chinese Civilisation Centre, City University of Hong Kong and City University of Hong Kong Interdisciplinary Research Project, Hong Kong, pp. 78-104; and R. M. Brown (ed.) (1989) *Guandong Ceramics from Butuan and Other Philippine Sites*, Oriental Ceramic Society of the Philippines/Oxford University Press, Manila, The Philippines. Her co-authored publications include: Brown, R. M., with Childress, V., and Gluckman, M. (1974) "Khmer Kiln Site — Surin Province," *Journal of the Siam Society* 62: 239-252; Brown, R. M., with Childress, V. (1978) "Khmer Pottery at Prasat Ban Phluang," *Arts of Asia* 8(1): 67-73; Brown, R. M., with Burns, P. (1991) "Eleventh-century Cham-Philippine Foreign Affairs," *Ancient Town of Hoi An*, Foreign Languages Publishing House, Hanoi; Brown, R. M., and Sjostrand, S. (2000a) *Turiang: A Fourteenth Century Wreck in Southeast Asian Waters*, Pacific Asia Museum, Pasadena, CA; Brown, R. M., and Sjostrand, S. (2000b) *Turiang: A 14th Century Chinese Shipwreck, Upsetting Southeast Asian Ceramic History*, <http://www.maritimeasia.ws>; Brown, R. M., and Sjostrand, S. (2002) *Maritime Archaeology and Shipwreck Ceramics in Malaysia*, Department of Museums and Antiquities, Kuala Lumpur, Malaysia; and Brown, R. M., and Joseph, A. (eds.) (1979) *South-East Asian and Chinese Trade Pottery: An Exhibition Catalog*, The Oriental Ceramics Society of Hong Kong, Hong Kong.

Reviews of Books

Deborah L. Huntley, *Ancestral Zuni Glaze-Decorated Pottery: Viewing Pueblo IV Regional Organization through*

Ceramic Production and Exchange. Anthropological Papers of the University of Arizona 72. Tucson: University of Arizona Press, 2008. xi + 104 pp. ISBN 978-0-8165-2564-5, \$17.95 (paperback). The author received her doctorate from Arizona State University in 2004 and is currently Preservation Archaeologist at the Center for Desert Archaeology in Tucson. She has been working in the American Southwest, particularly in Arizona and New Mexico, for more than ten years and specializes in ceramic analysis. Huntley and her colleagues, Judith A. Habicht-Mauche and Suzanne L. Eckert, edited the acclaimed volume entitled *The Social Life of Pots: Glaze Wares and Cultural Dynamics in the Southwest, AD 1250-1680* (Tucson: University of Arizona Press, 2006).

The focus of her research presented is this monograph is on the Pueblo IV period (1275–1600 CE), an era that experienced significant modifications to the regional settlement patterns and social configurations across the ancestral Pueblo Southwest. Early in this era, Pueblo potters began making distinctive polychrome vessels, frequently decorated with technologically innovative glaze paints. Archaeologists and archaeometrists correlate these ceramic innovations with the introduction of new ideologies and religious practices to this region. Huntley does not employ the use of the tilde in the narrative, using Zuni rather than Zuñi.

The study is presented in six well-written, detailed, and informative chapters supplemented by 38 figures and 29 tables; a splendid color cover illustrates three distinctive polychromes discussed in the narrative. In addition, there are 273 references and a five-page three-column index conflating proper nouns and topical entries. Huntley explores interaction networks among residents of settlement clusters in the Zuni region of west-central New Mexico during the thirteenth and fourteenth centuries CE. Her analysis focuses on the production and exchange of polychrome and utilitarian ceramics, glaze-paint recipes, the uses of particular colors on the polychrome vessels, and the sources of the glaze-paint ores. The ceramic sample was obtained from collections of previously excavated materials from nine nucleated pueblos that were occupied during all or a portion of the period from 1275-1400 CE. Employing multiple analytical techniques (notably electron microprobe, INAA, and lead isotope analyses), her research reported in this volume provides a case study for documenting multiple scales of interaction in prehistory. The potters consistently used locally available clays to produce the polychrome and utilitarian vessels. Evidence suggests that the utility pottery was exchanged at the level of the individual pueblo or the pueblo cluster, but that polychrome ceramics were frequently exchanged throughout the region. Pueblos in the El Morro Valley (eastern Zuni region) were the recipients of polychrome ceramic bowls from other parts of the Zuni region. Huntley sees this pattern as exemplifying the formation and maintenance of interpueblo alliances with integrative rituals held in the El Morro Valley settlements.

"Chapter 1: The Pueblo IV Zuni Region" (pp. 1-15) considers regional chronology and settlement patterns, describes

the nine pueblos (Pueblo de los Muertos, Atsinna, Cienega, Mirabal, Heshotauthla, Lower Pescado, Box S, Ojo Bonito, and Spier 170), and characterizes the sociopolitical organization of the Pueblo IV period. In "Chapter 2: Production and Distribution of Ancestral Zuni Glaze-decorated Pottery" (pp. 16-30), she reviews parameters of production and exchange, glaze-decorated type descriptions and previous compositional studies (ICPES, INAA, and AAS) and sample sizes. Huntley then discusses her samples (465 decorated and plain ceramics and 29 clay samples) and the specimens selected for electron microprobe ($n = 333$), lead isotope via Hr ICP-MS ($n = 283$), and INAA ($n = 178$) analyses. Lastly, she considers the ceramic assemblage seriation and expected results. The third chapter, "Tracking Ceramic Production and Exchange using INAA" (pp. 31-43), begins with a brief review of regional geology, followed by a discussion of INAA methodology, the compositional groups, and intraregional exchange. She notes that there is a clear west to east directional component to decorated ceramic exchange in the Zuni region.

"Chapter 4: Glaze Recipes, Use of Color, and Patterns of Regional Interaction" (pp. 44-59) reviews Pueblo glaze technology and the methodology of electron microprobe analysis. She then discusses glaze compositions, experimentation, glaze recipes, and the colors of glazes and slips. She finds that through time glaze paint compositions changed from low lead to high lead and a reduction of compositional variability in the latter glazes. Glaze color mattered less to the potter than glaze finish so that high lead glaze and light-colored slip produced a vessel with greater "brilliance." "Lead Ore Use and Long-distance Interaction" (pp. 60-72), covers principles of lead isotope analysis, the geological distribution and prehistoric use of ore deposits, and the methodology, sample preparation, and instrumentation related to Hr ICP-MS. Huntley also reviews ore source groups, glaze recipes, and intercluster and interpueblo patterns of ore utilization. The data supports the hypothesis that potters in the Pueblo IV Zuni region used several different resources from distant ore deposits to make glaze paints.

In "Chapter 6: A Multiscalar Perspective on Production, Exchange, and Pueblo IV Zuni Regional Organization" (pp. 73-81), she concludes that ceramics were used to negotiate relationships at multiple levels and scales within pueblo clusters (local interaction spheres), among pueblo clusters (regional alliances), and between west-central New Mexico and other regions. Notable among these is that strategies, such as the manipulation of interpueblo alliances or control over long-distance resources, may have been instrumental in the concentration social power. Researchers concerned with pottery are presented with a significant corpus of detailed information and technological and contextual data on glaze-decorated ceramics. In addition, archaeologists concerned with sociocultural, economic, and religious aspects of Puebloan society, especially students of political anthropology interested in power and leadership in ancestral Pueblo societies are presented by compelling arguments. Huntley's research again demonstrates the value of using extant museum collections that have appropriate excavation or survey documentation in

conjunction with "modern" analytical techniques. She ably demonstrates that it is possible to extract much additional information regarding the organization and scales of ceramic production and distribution, intra- and intercommunal interactions, and regional social dynamics. Huntley has presented us with a solid piece of research — a model — and prepared another excellent volume in the esteemed Anthropological Papers of the University of Arizona series. Scholars of the American Southwest will find this research clearly presented with compelling arguments, and appropriate conclusions generated by the physico-chemical data and her knowledge of west-central New Mexico. We have come a long way since Anna O Shepard's pioneering analyses. Researchers in Southwest Asia should find the approaches that Huntley has taken useful in their own studies.

Gary M. Feinman, and T. Douglas Price (editors), *Archaeology at the Millennium: A Sourcebook*. Heidelberg and New York: Springer, 2007. xvi + 512 pp., ISBN: 978-0-387-72610-6, \$69.95/€58,80 (paperback). Newly republished in paperback, this set of essays is designed as a comprehensive handbook and potential textbook that documents the status of archaeological studies in 2001. *Archaeology at the Millennium* outlines where the discipline has been and where it is going at the turn of the 21st century. An international roster of prominent archaeologists has prepared meaningful assessments regarding the place and contribution of archaeology in the sciences and humanities. The topics of the chapters include major questions in archaeology. Ceramics are other forms of material culture are noted frequently in the presentations. The authors of each chapter review the history of research on the subject and the direction of future research. The volume is divided into four parts, each of which is introduced by a summary statement outlining the chapters in the section. Part I deals with the history of archaeology and the advance of archaeological theory. Part II ranges over the first four million years of our evolution as a cultural species and covers the first hominids to complex hunter-gatherers. Part III concerns the origins of agriculture and features discussions of such issues as craft production, the division of labor, warfare, and the rise of social inequality. Part IV analyzes the rise of states and empires in both the Old and New World; the archaeology of the classical Mediterranean states is also included in this section. A final chapter concerns the future of archaeology. The contents include: "Foreword" by Patty Jo Watson. Part I: Introduction: 1. "Archaeology at the Millennium: Of Paradigms and Practice" by G. M. Feinman and T. Douglas Price; 2. "An Aspect of Archaeology's Recent Past and Its Relevance in the New Millennium" by J. A. Sabloff and W. Ashmore. Part II: Introduction to Part II. 3. "Paleoanthropology at the Millennium" by K. Schick and N. Toth. 4. "Fully Modern Humans" by R. G. Klein. 5. "Holocene Hunter-Gatherers" by R. L. Bettinger. Part III: Introduction to Part III. 6. "The Transition to Food Production" by B. D. Smith. 7. "Richman, Poorman, Beggarman, Chief: The Dynamics of Social Inequality" by B. Hayden. 8. "Craft Production Systems" by C. L. Costin. 9. "Warfare and the Evolution of Culture" by J. Haas. Part IV: Introduction to Part IV. 10. "Understanding Ancient State Societies in the Old World" by G. J. Stein. 11.

“State Formation in the New World” by *L. Manzanilla*. 12. “Classical Archaeology and Anthropological Archaeology in North America: A Meeting of Minds at the Millennium?” by *J. L. Davis*. 13. “Empires” by *C. M. Sinopoli*. Part V: Conclusion. 14. “The Archaeology of the Future” by *T. D. Price and G. M. Feinman*. This sourcebook provides an in-depth and up-to-date statement on the condition and direction of one of the most dynamic of the social sciences and humanities. This volume defines the intellectual state of the discipline and is central to understanding humankind and is a useful handbook and potential textbook. In addition, the bibliographies are particularly useful.

Arthur Dunkelman and others, *The Jay I. Kislak Collection at the Library of Congress: A Catalog of the Gift of The Jay I. Kislak Foundation to the Library of Congress*. Washington, DC: Library of Congress/Stanford University Press, 2007, xi + 216 pp., ISBN 978-0-8444-1180-4, \$60.00. Jay I. Kislak, a real estate broker and mortgage banker, was also a book collector and art connoisseur, donated his extensive collection to the Library of Congress in April 2004. On that occasion, Librarian of Congress James H. Billington stated that “The Kislak Collection represents a lifetime of collecting informed by passion and intellect.” To celebrate the donation of the Jay I. Kislak Collection, the Library of Congress created an exhibition featuring fifty highlights from more than 4,000 rare books, maps, documents, paintings, prints, and artifacts including ceramics and stone objects. The objects on exhibit and additional information are still available on the LC Internet site at <http://www.loc.gov/exhibits/kislak>.

Dunkelman, the Curator of the Kislak Collection, and six other scholars (among them anthropologists Jerald T. Milanich, Robert J. Sharer, and George Stuart) contributed essays to this volume, an illustrated and annotated catalog of the Kislak Collection. The curator has contributed an “Acknowledgment” (pp. xxi-xxi) and “Foreword” (pp. xiii-xv), while Billington wrote a “Preface” (pp. ix-xi) to this ten-chapter volume. Altogether, there are 25 contributors from the disciplines of art history, cartography, librarianship/rare books, history, and archaeology. The contents and essayists are: I “From the Olmec to Columbus” (pp. 1-54, essay by Sharer, pp. 1-2); II “Columbus and the Encounter” (pp. 55-61, essay by John Lombardi, pp. 55-56); III “The Conquest” (pp. 63-95); IV “The New Geography” (pp. 97-117, essay by Ralph Ehrenberg, pp. 97-98); V “Histories and Chronicles” (pp. 119-121); VI “Voyages and Travels” (pp. 123-135, essay by Norman Fierling, pp. 123-124); VII “The Social Order” (pp. 137-141); VIII “Natural History, Ethnography, and Archaeology” (pp. 143-171, essay by Stuart, pp. 143-144); IX “Florida and the Circum-Caribbean” (pp. 173-194, essay by Milanich, pp. 173-174); and X “The New Nation” (pp. 199-203). There are 131 references (pp. 205-209), and useful index (pp. 213-216); 907 items are illustrated.

The Library of Congress collections are an unusual place for scholars to look for ceramic collections, but Chapters I and III have illustrations and description of important earthenware objects, most never before illustrated (#number refers to an

illustration). “From the Olmec to Columbus” (pp. 1-54) considers 48 objects from the Preclassic and Classic, with emphasis on the Olmec and Lowland Maya. Among these are: House Model (200 BC-AD 300, #138), Large Vase (Late Classic Maya, AD 600-900, #96), and Diving Bat Container (Postclassic Maya, AD 900-1200, #105). There are also male and “Baby-face” figurines from Las Bocas (Middle Preclassic, 1100-500 BC), a Blackware Bowl, Large Bottle, and a Tall Black Background Vase. John Carlson (Center for Archaeoastronomy, University of Maryland) has contributed compelling essays (pp. 3-11) on Late Classic Maya (AD 600-900) miniature flasks, several with medallion decorations and others with codex-style paintings. There are also Late Classic Maya figurines from Jaina and Late Classic period Bowl and Creamware Vessel and a Classic period Vase. In Chapter III “The Conquest” (pp. 63-95), there are some remarkable Aztec period ceramic artifacts including a standing statue, Hollow Warrior with a Feline Helmet (AD 1200-1500, #202), and three biconical incense burners — two are paired (AD 1200-1500, #203, 204). Readers will also find other valuable resources, notably the depictions of cartography, manuscripts, other documents, and paintings and drawings as well as artifacts created in bone, shell, stone, and metals. New World archaeologists, especially Mesoamericanists will find the catalog and the objects useful for research.

Fredrik Hiebert and Pierre Cambon (eds.) (2008) *Afghanistan: Hidden Treasures from the National Museum, Kabul*. Washington, DC: National Geographic. 304 pp., ISBN 978-1-4262-0295-7. \$40.00 (paper). This exhibition will be at the National Gallery of Art in Washington, DC through 7 September 2008; Asian Art Museum of San Francisco from 24 October 2008 through 25 January 2009; The Museum of Fine Arts, Houston (Texas) from 22 February through 17 May 2009, and The Metropolitan Museum of Art in New York City from 23 June through 20 September 2009. The exhibition has some ceramic materials, notably from the site of Aī Khanoum (pp. 109-111), which include an inscribed amphora fragment, inscribed vessel fragment, and unfired clay head. The authors and essays in the catalog include: Omar Khan Massoudi, “The National Museum of Afghanistan,” pp. 35-43; Carla Grissman and Fredrik Hiebert, “Saving Afghanistan’s Heritage,” pp. 45-53; Fredrik Hiebert, “The Lost Worlds of Afghanistan,” pp. 55-64; Jean-François Jarrige, “The Treasure of Tepe Fullol,” pp. 67-77; Fredrik Hiebert, “Tepe Fullol Catalog,” pp. 78-79; Paul Bernard, “The Greek Colony at Aī Khanoum and Hellenism in Central Asia,” pp. 81-105; Paul Bernard, “Aī Khanoum Catalog,” pp. 106-129; Sanjyot Mehendale, “Begram: At the Heart of the Silk Roads,” pp. 131-143; Pierre Cambon, “Begram: Alexandria of the Caucasus, Capital of the Kushan Empire,” pp. 145-161 [the Table of Contents erroneously lists it as pp. 143-161.]; Sanjyot Mehendale, “Begram Catalog,” pp. 162-209; Viktor Ivanovich Sarianidi, “Ancient Bactria’s Golden Hoard,” pp. 211-217; Véronique Schiltz, “Tillya Tepe, the Hill of Gold: A Nomad Necropolis,” pp. 219-231; and Véronique Schiltz, “Tillya Tepe Catalog,” pp. 232-293.

Boletín del Laboratorio de Petrología y Conservación Cerámica [Vol.1, Año 1, N° 1 and 2] Dr. Guillermo A. De La

Fuente (Laboratorio de Petrología y Conservación Cerámica, Escuela de Arqueología, Universidad Nacional de Catamarca, Belgrano N° 300, 4700- Catamarca, ARGENTINA; Tel./Fax: 00-54-3833-425978) is the editor of this new publication. The articles which are in Spanish or English with bilingual abstracts; the illustrations are in color and monochrome black-and-white. The laboratory does not yet have a Web site but one is being developed; if readers are interested in obtaining electronic copies of these bulletins, please e-mail Guillermo at labceramicaunca@gmail.com.

The contents of the first two numbers are: *Boletín del Laboratorio de Petrología y Conservación Cerámica* 1(1), Año 1 (2007): De La Fuente, Guillermo, "Proteínas, amino ácidos y vasijas arqueológicas: comprendiendo los procesos," pp. 1-10; De La Fuente, Guillermo, "Petrología y tecnológica cerámica: una breve evaluación de los estudios de secciones delgadas (thin-sections) de cerámicas en arqueología," pp. 10-18; De La Fuente, Guillermo, "Arqueología bimolecular," pp. 19-24; and Navarro, Juanita, "Preparación y escritura de un artículo de conservación," pp. 24-30. *Boletín del Laboratorio de Petrología y Conservación Cerámica* 1(2), Año 1 (2008): López, Mariel Alejandra, "Alteraciones de superficies y pastas de cerámica arqueológica: Un caso de estudio en Quebrada de Humahuaca, Jujuy, Argentina," pp. 1-12; Ots, María José, "Aportes del análisis petrográfico de Cortes Delgado para la Caracterización y Clasificación de; Estilo Cerámico Viluco Inka," pp.12-21; and De La Fuente, Guillermo, "Post-depositional chemical alterations in archaeological ceramics: A critical review and their implications for conservation," pp. 21-37. These are very valuable contributions to ceramic studies.

The following five volumes will be reviewed in the next issue of the *Bulletin*: Chandra L. Reedy, *Thin-Section Petrography of Stone and Ceramic Cultural Materials*. London: Archaeopress, 2008; Bradley D. Fahlman, *Materials Chemistry*. Dordrecht, The Netherlands: Springer, 1st ed. 2007; Corr. 2nd printing, 2007; Mark Pollard, Ben Stern, and Catherine M. Batt, *Analytical Chemistry in Archaeology*, Cambridge Manuals in Archaeology, Cambridge and New York: Cambridge University Press, 2006; Zvi Goffer, *Archaeological Chemistry*, 2nd ed., New York: John Wiley & Sons, 2007; and Mark A. Pollard and Carl Heron, *Archaeological Chemistry*, 2nd ed., London: PSC Publishing (The Royal Society of Chemistry), 2008. The reviews of the Pollard, Stern and Batt volume (2006) and the new editions of Goffer (2007) and Pollard and Heron (2008) will focus on ceramics and related materials and will be comparative, but will include assessments of other aspects of archaeological chemistry presented in these new books.

Previous Meetings

Petrography of Archaeological Materials, a symposium organized by Patrick Sean Quinn, was held at the Department of Archaeology, University of Sheffield, 15-17 February 2008. It was co-hosted by the Ceramic Petrology Group (CPG) and the Department. The meeting also had a successful microscope

workshop and an AGM of the Ceramic Petrology Group. Information on future activities of the CPG, starting in 2009 will be made available on this website soon. An edited volume featuring papers presented at this session as well as other petrographic studies is in progress and will be published by Archaeopress. For more information, contact Patrick Quinn, Department of Archaeology, University of Sheffield, patrick.quinn@sheffield.ac.uk.

The papers delivered in February included two keynote presentations: Lara Maritan "The Role of Petrography in the Study of Archaeological Ceramics" and Evangelia Kiriatzi "Beyond Characterisation: Ceramic Petrology as a Tool for Understanding Human Practice and Landscape History." The presentations were: Chandra Reedy "New Digital Image Analysis Approaches to Thin Section Petrography of Cultural Materials"; Ben Jervis "Making Identities in Saxon Chichester: A Theoretical Application of Ceramic Petrology"; Jonathan Dicks "Dating Romano-British Ceramics by Thin Section Petrology"; Ruth Siddall "Echoes of Rome in the 13th Century and Beyond: Mortar Recipes from the Sanctuary Pavement at Westminster Abby"; Mary Owenby "Petrographic Analysis of Middle Bronze Age Canaanite Jars from Memphis, Egypt"; Roberta Tomber "Revisiting Indian Cooking Pots in Roman Egypt"; Laura Gagné "White Painted Wares from Dhenia and Alambra, Cyprus"; Edward Farber, Peter Day, and Vassilis Kilikoglou "Fine Grained Middle Bronze Age Ceramics from Crete: Combining Petrographic and Microstructural Analysis"; Marie-Claude Boileau "Dark Age Crete: Petrographic Analysis of Coarse Pottery from Knossos and Sybrita at the Beginning of the 1st Millennium BC"; Chris Doherty "Recent Petrographic Analysis at Catalhoyuk, Turkey"; Pete Hommel, Peter Jordan, Peter Day, Noemi Müller and Viktor Vetrov "Ceramic Technology amongst Early Post-Glacial Hunter-Gatherer Communities of Eastern Siberia"; Charlotte Hobday and Ruth Siddall "Making and Mixing Roman Paints: The Teachings of Petrographic Analysis"; Ana Jorge "Ceramic Technology and Style during the Iberian Chalcolithic to Bronze Age Transition: A Case Study from Northern-Central Portugal"; Daniel Alberto Santacreu "Technological and Social Characterization of Late Bronze and Iron Age Pottery from Majorca (Spain)"; Patrick Quinn and Margie Burton "Way Out West: Compositional Analysis of Prehistoric Ceramics from the Anza Borrego Desert, Southern California"; Isabel Villaseñor and Ruth Siddall "Glass Inclusion and Hydraulic Phases in Lowland Maya Plasters: Volcanic or Meteoritic?"; Michela Spataro "The Earliest Potters in the Central Balkans: Technological Choices and Cultural Transmission"; and Louise Joyner "A Petrographic Study of Late Neolithic Clay-Based Construction Materials from Makriyakos, Macedonia, Greece."

The 19th Annual Pope Memorial Lecture, "Below the Surface – Discovering Thailand's Most Famous Kiln Site," was held at the Freer Gallery of Art, Smithsonian Institution, Washington, DC, 1 June 2008. Australian archaeologist Don Hein discussed his research on a major ceramic production center in Thailand. His lecture also celebrated the debut of the museums' first online catalog of the Hauge Collection of

Ceramics in Mainland Southeast Asia. The exhibition, *Taking Shape: Ceramics in Southeast Asia* features some of these art objects in the gallery connecting the Sackler with the Freer. Sawankhalok, located in north central Thailand, was an early stoneware ceramic production site where the first kilns were dug cave-like into the natural ground, a method used in China for thousands of years. There was also a tour of the Sackler storage area on 2 June, at which Hein offered further comments on Thai ceramics.

Hein has conducted research on ceramic archaeology in Thailand beginning in 1980 and his work includes excavations at the famous Sawankhalok kilns at Si Satchanalai, north-central Thailand. High-fired celadon stoneware was produced there since at least the 1200s, perhaps even before the Sukhothai Kingdom was established. There were four developmental periods of stoneware production at Si Satchanalai, beginning with the “Mon” (1200-1300 CE), and culminating with the classic Sawankhalok celadon, white and brown-decorated export wares of the 15-16th centuries. The early Mon kilns produced glazed stonewares in a variety of shapes. Si Satchanalai potters of all periods produced celadon and iron-painted wares with floral and fish designs, but only the final export, period saw monochrome white and brown ceramics. At that time Sawankhalok (and Sukhothai) potters were competing with Vietnamese, Chinese, Persian and perhaps Burmese potteries to increase their market share of foreign markets, which probably explains their innovations in decoration and the production of finer wares.

Mon potters were indigenous, not Chinese as some have speculated, but not otherwise identifiable. Mon kiln technology initially came from potters who migrated from the Lan Na region of northern Thailand. Thai kiln technology (and all Southeast Asian high fired stoneware “know-how”) ultimately derives from Chinese updraft kilns that developed early in the first millennium in the loess regions of north China. In the second half of the 13th century there was foreign intervention in the Sawankhalok production process. From excavation evidence it is clear that new ideas appeared, such as underglaze slips and new styles of drawing. This new technology possibly came with potters arriving from the Cham area of central Vietnam or perhaps Burma. The foreign potters worked together with the indigenous Mon. However, this foreign influence did not last, perhaps because their production technology did not work out. By the time of the export phase of the 15th -16th centuries, the Si Satchanalai’s ceramic industry used the larger and more efficient cross-draft kiln, which had evolved from the original updraft kilns derived from northern Thailand. More than 1000 Sawankhalok kilns have been identified at Si Satchanalai. However, probably no more than 50 or so kilns were functioning at any one time in this over a period of 300 years. Among these 1000 kilns were approximately 20 which produced metal products. In the midst of the Sawankhalok stoneware kilns were bonfire firing sites producing earthenwares.

In the 16th century, Chinese porcelain exports reappeared in substantial quantities and before long Thai (and Vietnamese

and Burmese) retreated from the overseas markets. It was about this time that the “egg-shaped” kilns appeared in Jingdezhen, China. These egg-shaped kilns are cross-draft kilns, which had no immediate Chinese antecedent. Cross-draft kilns offered specific commercial advantages over existing south Chinese kilns, including the hill climbing “dragon” kilns; they were easier to fill and had a faster turn-around cycle. Hein proposed that the technology for egg-shaped kilns came from Sawankhalok.

The Si-Satchanalai site was divided physically and chronologically into two main production phases, each representing a time period of about 250 to 300 years. During the first of these phases, which included only the Ban Ko Noi and Bang Nong O kiln complexes, in-ground kilns were used. Production at these early kilns was less organised than in the second phase, and appears to have been family-based. The ceramics of the early period were made from secondary clay, producing rather crude utilitarian black and unglazed ware. The most sophisticated products of the time were underglaze decorated dishes with painted decoration applied on a “whitish” slip, referred to as Mon ware. Subsequently better clay was discovered and the kilns were improved. This clay allowed underglaze decoration to be applied directly on the clay without the use of slip. These products are referred to as MASW or Mon Associated Stoneware which was fired in in-ground kilns. Slow improvements of the kilns were documented before a major shift to the use of above-ground kilns. During this time, an early type of green-glazed ware was also introduced, sometimes including incised decorations and was called TRSW or Transitional Stone Ware. The second phase included the newly established Ban Pa Yang kiln complex and was characterized by above-ground brick kilns producing export ware. These products, made from the better clay and covered by a matured celadon glaze, were called LASW or Later Associated Stoneware.

“*Dan Kwean: A ‘Traditional’ Pottery-making Community in Thailand*” was presented by Louis Katz (Associate Professor of Ceramics at Texas A&M University, Corpus Christi.) on 25 June 2008 at the Freer Gallery of Art, Smithsonian Institution, Washington, DC. Potter Louis Katz spent a year in Dan Kwean, a village in northeast Thailand where stoneware production has undergone a dramatic transformation in recent decades. His research was funded by a Fulbright grant to document Thai traditional pottery from an artist’s point of view. Katz narrated video made during that year and described how Dan Kwean’s production may be considered “traditional,” even as production has transformed from jars for local farmers to ceramics for an international market. This lecture complemented the Sackler Gallery exhibition, *Taking Shape: Ceramics in Southeast Asia*.

The Third International Congress on Underwater Archaeology (IKUWA3) was held 10-12 July 2008 in London. Under the patronage of UNESCO, the congress was organized by the Nautical Archaeology Society (NAS), the Institute of Field Archaeologists (IFA), and the Institute of Archaeology

University College London (UCL), and supported by a Steering Committee comprised of representatives of NAS, IFA, UCL, DEGUWA, DAI, HWTMA, GSU, Verb and der Landesarchäologen, English Heritage, and Historic Scotland, IKUWA3 will be the largest conference on underwater archaeology ever held in Britain. More than 120 papers were delivered on a dozen topics including: Submerged Prehistoric Archaeology, Traditional Indian Boat Carpentry, Acoustic Positioning Systems, Fresh Water Archaeology, Shipwreck Collecting Behaviour, Maritime Landscapes, Seismic Reconnaissance, Managing Underwater Cultural Heritage, Integrated teaching and research, and Ethics and Economics of recovering material from the sea. Unfortunately, the paper titles and abstracts are not listed on the Internet site <http://www.ikuwa3.com/index.php>. The congress was preceded by a 3-day Professional Development Field School, 7-9 July 2008, and followed by optional excursions including a tour of the *Mary Rose* (13th July 2008).

Forthcoming Meetings

The 2008 Pecos Conference will be held 7-10 August 2008 in Flagstaff, AZ. The schedule of presentations is not posted as of mid-July. For more information, please visit the web site at http://www.swanet.org/2008_pecos_conference/index.html.

Maritime Archaeology and Ancient Trade in the Mediterranean is a conference organized by the Oxford Centre for Maritime Archaeology and will be held in Madrid, Spain, 18-20 September 2008. The purpose of the conference is to explore the contribution of archaeology to the understanding of maritime trade and exchange in the region of the ancient Mediterranean. Papers will focus on the results of recent research in four sessions on: 1) Conceptual issues in maritime trade, 2) Ships and shipping, 3) Ports and connectivity, and 4) Landscapes of maritime trade. The conference is part of an Oxford-based series of lectures and seminars on ancient trade in the Mediterranean and will lead to the publication of a monograph on this topic. The deadline for the submission of abstracts was 30 June. There are likely some papers on archaeological ceramics in these sessions. For further information, please visit the Web site at <http://www.ocma.ox.ac.uk/events> or contact Damian Robinson at the Oxford Centre for Maritime Archaeology, Institute of Archaeology, University of Oxford, 36 Beaumont Street, Oxford, OX1 2PG, UK; damian.robinson@arch.ox.ac.uk.

L'Académie Internationale de Pipe holds its annual conference in Liverpool on 19 September 2008. Six symposium papers will be presented focusing on "The Pipe and its Socio-economic Context." The authors and their topics include an "Introduction" by Peter Davey, "Argentina" by Daniel Schávelzon, "Australia" by Kris Courtney, "Bavaria" by Natasha Mehler, "Japan" by Barney Suzuki, and "West Africa" by Lynne Stumpe. Information is available from J. J. Woodstock, 42 North Sudley Road, Aigburth, Liverpool L 17 0BG, <http://www.acad-inter-pipe.com>.

The Society for Clay Pipe Research will hold its 24th annual conference at Liverpool University's Victoria Gallery and Museum on 20 September and at Norton Priory Museum outside of Runcorn on 21 September 2008. The main theme of the meeting is pipes and pipe production in the northwest in the light of recent discoveries from excavations in Liverpool. Visit the society's web site at <http://www.dawnmist.demon.co.uk/scprjoin.htm> or contact Peter Hammond by email at claypipepeter@aol.com.

The 15th Biennial Mogollon Archaeology Conference will take place 2-4 October 2008 at the Western New Mexico University Museum in Silver City, NM. For additional information, please visit the Internet site at http://www.swanet.org/2008_pecos_conference/pecos_downloads/misc/15_mogollon_conf.pdf. The Organizer and Program Chair is Cynthia Ann Bettison (MAC 2008 Organizer/Program Chair, bettisonc@wnmu.edu, WNMU Museum, P.O. Box 680, Silver City, NM 88062; Telephone 575/538-6386). The deadline for abstracts is 1 August 2008.

Book Reviews

Deborah L. Huntley, Associate Editor

Histories of Maize: Multidisciplinary Approaches to the Prehistory, Linguistics, Biogeography, Domestication, and Evolution of Maize. John Staller, Robert Tykot, and Bruce Benz (editors). Academic Press: San Diego, 2006. xxv + 678 pp., 222 figures, 112 tables, 27 color plates, one appendix, index. Price: \$155 USD (cloth). ISBN:978-0-12-369364-8.

Reviewed by Michael W. Diehl, Desert Archaeology, Inc, 3975 N. Tucson Blvd, Tucson, AZ 85716, USA

Histories of Maize is the product of a four part symposium that occurred at the 2004 annual meeting of the Society for American Archaeology. I'll cut to the chase first and provide a content review after that. Any anthropology department with an active archaeological research program dealing with a maize-using culture, any large CRM firm, and every university library should have a copy of *Histories of Maize*. It is a high-quality, ambitious, detailed, broad, and often very technical treatment of the genesis, origins, history, evolution, archaeological occurrence, and social and dietary importance of maize.

Contributors represent a strong sample of the leading scholars in the fields of archaeology, agricultural science, botany, dendroclimatology, ecology, genetics, geosciences, and linguistics who are dealing with the genesis and subsequent spread of maize. It is tempting to suggest that the volume is a sufficient "stand alone" resource on the subject. Although it is very strong, it complements, rather than replaces Johannesson and Hastorf's (1994) edited volume, and the less-well known Toll (editor, 1995).

Every contributor to *Histories of Maize* can look with pride on the final volume. It is, however, a daunting task to review. All of the chapters are detailed and quite technical within the areas they address; it must be recognized that the encapsulated review that follows is insufficient to represent the depth and range of materials that each chapter covers.

The volume is divided into five thematically grouped “parts.” Part I, “Histories of Maize: Genetic, Morphological, and Microbotanical Evidence” (Chapters 1- 9) explores morphological, genetic, pollen, and phytolith evidence for the genesis of maize from ancestral teosinte, and the archaeological occurrence of maize macrobotanical or microbotanical tissues in the oldest maize sites from Mexico, Central America, South America, and the US Southwest.

Part II: “Stable Isotope Analysis and Human Diet” (Chapters 10-22) presents case studies that relate stable isotopes to the relative consumption of maize versus other foods by prehistoric denizens of coastal and highland Mayan, coastal Mexican, Chilean, Peruvian, American midcontinental Mississippian, coastal and interior Floridian sites, as well as sites in the upper Great Lakes region, and the eastern Colorado Plateau.

Part III: “Histories of Maize: The Spread of Maize in Central and South America” (Chapters 23-32) documents the archaeological contexts and other implications of the spread of maize into the Caribbean islands, through the Isthmus of Panama, Columbia, El Salvador, Costa Rica, northern Peru and also the Lake Titicaca region, northern Chile, and Bolivia.

Part IV, “Histories of Maize: North American and Northern Mexico” (Chapters 33-40) reviews archaeological evidence for the timing, social and economic circumstances, and effects of the introduction of maize to Chihuahua, central New Mexico, the northern Rio Grande Valley, Mississippian polities of the American midcontinent, the southeastern northeastern United States, New England, and Ontario.

Finally, Part V, “Histories of Maize: The Language of Maize” (Chapters 41-47) explores the timing of dispersion of maize into the American prairie states, and the language of maize as it relates to ideology and cosmology throughout Mesoamerica, South America, and North America. Benz and Staller close the volume (Chapter 48) with a reprise of the volume.

Of the major “parts,” the first one (“Genetic, Morphological, and Microbotanical Evidence”) provides the best depth of coverage and has the best narrative continuity; if one wanted to know “Where did maize come from, when, and how do we know that?” answered in a single source, the first part of *Histories of Maize* delivers the goods.

The final part (“The Language of Maize”) might have been better placed immediately after Part I, since the linguistic studies devote substantial effort to tracing the linguistic roots of maize

in language groups and refining glottochronological estimates for the occurrence of significant events that resulted in the transmission of common language elements or beliefs among modern cultures.

The regional case studies in Parts III and IV complement Part I, as these document the social and economic contexts in which maize was initially adopted, and the social and economic effects of its use, as maize dispersed throughout the Americas. Any scholar working in for example, the American Southwest, is likely to be interested in the adoption of maize in the American midcontinent and South America because of the range and scope of archaeological efforts to understand the effects of maize cultivation.

Part II (“Stable Isotope Analysis and Human Diet”) provides a strong suite of examples of the kinds of claims now in vogue and made on the basis of stable isotopes. Some critical research questions, however – particularly as these relate to the calibration of isotopic indices and actual diet composition – are left largely unaddressed.

Tykot’s useful introduction to the subject (Chapter 10) touches lightly on such issues through five paragraphs, where he notes that isotopic ratios in bones are only in part controlled by the relative proportions of C_3 and C_4 pathway plants; they are also affected by kinds and qualities of proteins and differences (for example body size, digestive physiology, and the like) among individuals.

Furthermore, there appears to be, among the various chapters in Part II, a kind of interpretive homology that equates “ate lots of C_4 plants, or animals that fed on C_4 plants” with “ate lots of maize.” Aridlands and grasslands environments are replete with economically valuable wild C_4 plants for which ethnographic examples of consumption are numerous.

Where diets are broad and contain lots of examples of C_4 plants, isotope ratios indicative of the consumption of C_4 plants possibly may not be treated as determinative of primary reliance on maize agriculture. Studies in this section raise new questions that mandate more research exploring the relationship between foods, digestion, and isotopic enrichment of human osteoskeletal anatomy.

Histories of Maize is not a volume that could serve as a single source text on archaeological occurrences of maize, in the sense that there are whole suites of commonly-researched questions that are not addressed. This is not meant as a criticism of the volume since Staller et al. never claimed that the volume should be a kind of “maize o-pedia” reference for all archaeologists.

But for the record, if one were interested in the nutritional balance of maize with other resources, yields of maize varieties, yields of prehistoric maizes, ways that maize might be stored, yield loss in storage, planting intervals, soil, moisture and light requirements of different varieties, one would look elsewhere.

References

- Johanneson, Sissel, and Christine A. Hastorf (editors). (1994). *Corn and Culture in the Prehistoric New World*. Westview Press, Boulder, Colorado.
- Toll, H. Wolcott (editor). (1995). *Soil, Water, Biology and Belief in Prehistoric and Traditional Southwestern Agriculture*. Special Publication No. 2. New Mexico Archaeological Council, Albuquerque, New Mexico.

Pollen and Micro-Invertebrates from Modern Earthen Canals and Other Fluvial Environments along the Middle Gila River: Implications for Archaeological Interpretation. Karen R. Adams, Susan J. Smith, and Manuel Palacios-Fest, Anthropological Research Papers No. 1: Gila River Indian Community, Sacaton, Arizona, 2002, xi + 76 pp., 7 figures, 13 tables, 1 appendix. Price: \$12.95 (paper). ISBN 0-9723347-0-X.

Reviewed by James Schoenwetter, Emeritus College Arizona State University, Tempe AZ 85287, USA

Though volume 3 is already available, this study constitutes the initial volume of a projected series of volumes that will publish results of the Gila River Indian Community's (GRIC) Cultural Resource Management Program. I found it an excellently conceived study that effectively documents both the ways canal deposit sediment samples should be used to produce paleoenvironmental reconstructions archaeologists find useful, and the ways differing forms of paleoecological data reinforce and amplify each other. While brief, the work is highly focused and directly on point. Its wide variety of aims are succinctly stated (p.4); the means for achieving them are presented explicitly with clear evidence of the author's expert appreciation of methodological weakness and pitfalls; and its conclusions are aptly expressed in tabular (Table 13) as well as text (pp. 51-2) form. In short, it's a good book that's likely to prove a valuable resource.

One of the more interesting aims of the project was to summarize the literature of previous similar studies conducted on prehistoric irrigation canal deposits, highlighting the diversity of archaeologically relevant topics they had explored. The results of this review are nicely presented in a table (Table 3) that will be helpful to those using the volume as a reference work.

Considering the range of aims the study hoped to fulfill, one might expect the authors to have sampled a larger number of collecting stations and analyzed a greater number of sediment samples from each one. Such an approach would have achieved the result with less risk of failure and would have provided a mathematically supported proof of each conclusion. But it would not have been any more appropriate. The object of the effort was to obtain a representative sample of sediment particle size, palynological, and mollusk and ostracode data. A

statistically supported proof of representativeness is legitimate, but so is demonstration that the data in fact sort into statistically valid patterns that distinguish known ecosystem categories. Adams *et al.* choice to employ the latter approach held a greater risk of failure, but it turned out to successfully fulfill the project's goals at far less expense. They took pains to note, however (pp 40-43), that their samples document substantial palynological variability occurring among samples ostensibly representing the same vegetation/hydrographic condition. Single canal sediment samples, therefore, should not be expected to regularly yield sufficient evidence to support environmental interpretation.

Their stated intent (p.1) is "examination of pollen, mollusks, ostracodes and sediment particle size from modern...earthen canals and other fluvial locations...to provide *analog* data for interpreting prehistoric canals." (emphasis mine) Sorry, but that intent cannot be fulfilled, because geological and biological phenomena occurring at the present time are *homologues* of those that occurred in the past, not *analogues*. It is not a matter that is discussed in the Method and Theory classes and symposia that archaeologists attend, but the fact is that natural scientists and social scientists do and are obliged to use the principle of uniformity (the present is the key to the past) in very different ways.

A modern earthen canal is the *analog* of a prehistoric earthen canal because both are products of human behavior that—to the best of our knowledge—is not controlled by natural laws. Though the two may appear to be expressions of the same behavior, the archaeologist must recognize that they might not be. S/he is therefore logically required to report the existence of any evidence s/he can find that suggests the prehistoric feature is *not* a canal, and should make the evidence that suggests it *is* a canal explicit.

The pollen grains, mollusk and ostracode remains and sediment particles of samples of the deposits of a prehistoric canal are the *homologues* of such phenomena in modern canal deposits. It's not a matter of "might be"; the principle of uniformity requires and obligates us to assume they are products of the same physical laws and processes of biology. Unless evidence exists to the contrary, of course. But the observer of such data is not obliged to seek such evidence; that is the responsibility of the critic of the identification.

Could the distinction prove more than trivial? Consider this scenario: Adams *et al.*'s conclusion that unique biological assemblages characterize the deposits of prehistoric earthen canals of different rank is based on their study of the deposits of modern earthen canals of different ranks. In the future, an archaeologist might sample the deposits of a prehistoric canal s/he has recognized as analogous to a modern main canal but which the "specialist" recognizes to contain the sort of biological assemblage homologous to one characteristic of a distribution canal. Irrespective of the reasons the archaeologist may believe validly support the main canal interpretation supported by analogy, the distribution canal interpretation supported by

homology must be acknowledged as superior and preferable, since immutable laws of nature determine the characteristics of biological assemblages. In fact, the character of the fossil evidence and the principle of uniformity *demand* the interpretation supported by homology. Conviction that the interpretation “makes no cultural sense” is not a valid argument for its dismissal, nor is failure to give the interpretation credence a scientifically justifiable basis for ignoring it. But don’t be surprised if this sort of thing happens. It happened to me (Schoenwetter 1990:103-104).

References

Schoenwetter, James. (1990). Lessons from an Alternative View. *Powers of Observation: Alternative Views in Archaeology*, edited by S.A. Nelson and A.B. Kehoe, Archaeological Papers of the American Anthropological Association No.2:103-112.

Projectile Point Typology: Gila River Indian Community, Arizona. Chris Loendorf and Glen E. Rice, Gila River Indian Community, Anthropological Research Papers No. 2: Gila River Indian Community, Sacaton, Arizona, 2004. xvi + 151 pp., 39 tables, 30 figures (5 color photographs), 1 supplemental compact disk. \$19.95 (paper). ISBN 0-9723347-1-8

Reviewed by Bruce B. Huckell, Maxwell Museum of Anthropology and Department of Anthropology, University of New Mexico, Albuquerque, NM 87131 USA

Projectile points are one aspect of Southwestern US archaeological material culture that over the years has received limited attention from professional archaeologists. This small volume is a very welcome addition to the study of these artifacts, and is focused on a sample of 708 completed points recovered primarily from an ambitious cultural resource management survey of the entire 146,000 acres of the Gila River Indian Community. Chris Loendorf and Glen Rice have put considerable effort into the analysis of the points recovered (as of 2002) from this project, and have created a report with considerable food for thought.

Organized into four chapters and four appendices—two printed and two contained on a supplemental compact disk—the volume begins with a short foreword by former Gila River Cultural Resource Management Program Coordinator John Ravesloot and a preface by Loendorf and Rice that describe the context of the study. The four chapters that follow begin with a discussion of the methods and issues in projectile point analysis. This short (16 pages) chapter contains brief sections that present matters of lithic technology, raw material availability on the reservation and the surrounding region, the geomorphic history of the reservation area and its potential effects on the sample, point classification approaches used in the study, explanation of point production methods, and serration. The purpose of the chapter is to set the stage for what follows and

to identify the various ways in which the study of projectile points has been approached, particularly in the southern half of Arizona. Theoretical issues of larger concern in the classification of points—including matters of breakage and reworking, individual variation in knapper ability, variation in raw material choice, and what makes a point chronologically or socially diagnostic—are briefly presented as well. Definitions of morphological and metric variables used in the study are provided, and the employment of a basically morphological classification scheme for the study is justified. The one chosen for primary use is that of Sliva (1997), augmented by those of Justice (2002) and Hoffman (1997).

Two classes of points, large and small, are created to divide the sample; shoulder width was the variable used to separate the classes. One minor quibble is that although the text states that shoulder width was used, Figure 2 does not show that measurement; one assumes that it is the same as blade width. Chapter 2, Large Projectile Point Complex, describes the classification of 167 points that most likely represent the Archaic and Early Formative periods. Ten morphological styles are used, and are subdivided by Early, Archaic, Middle Archaic, and Late Archaic/Early Formative time periods. Each of the styles is described individually, by quantities recovered, material type proportions, and ranges and averages for continuously measured morphological variables. Photographs are used to illustrate each style, although each style is represented by only a single point. Middle and Late Archaic point styles dominate the sample. The Gila River points are compared to those from other parts of Arizona, the Southwest, and occasionally the Great Basin, with attention focused on dating of the style as determined by radiometric ages obtained from those other regions.

Chapter 3 follows this same format and treats the small points, of which there are 687. Eighteen morphological styles are defined and used to classify and describe them. An interesting contrast to Chapter 2 with its use of named types (8 of the 10 styles), the 18 styles of small points are labeled entirely according to morphology. Readers will encounter names such as Narrow Side-Notched, Flanged, Upper Side-Notched, and U-shaped Base Triangular among this list, which are derived from Sliva’s classification system (although lacking the Hohokam period names used by Sliva). This system reflects a significant difference in the application of systematics among archaeologists who work with the last 1500 years of Southwestern prehistory: ceramic types and varieties receive names based on geography, while projectile points are relegated to morphological description. Hoffman (1997) was the first to attempt to apply geographic names to Hohokam projectile points, and Justice (2002) developed an entirely different suite of names he applied to small points from across the whole of the Southwest. Loendorf and Rice do what they can to bring the latter two typological systems into the picture, and it is clear that there is significant conflict among the three systems. Photographs are used to illustrate each style (again, one example per style), and metric data and chronological estimates are provided. A brief but interesting discussion of the Protohistoric/Historic point styles is presented as well.

Chapter 4, only two pages long, summarizes the first three chapters and underscores the fact that this is a preliminary system that can serve as a basis for future analyses.

The two printed appendices include prose descriptions, in table format, of the entire point sample (Appendix A) and scatterplot matrices of metric data (Length, Haft Width, Thickness, Base Width, and Blade Width) for each point style (Appendix B). The latter are rendered somewhat less useful in that the scatterplots are presented in the form of a 5 by 5 matrix and are dimensionless.

The volume makes several contributions that can be applauded. First, as noted above, monograph-length treatments of projectile points tend to be rare in the Southwest, and this is a very welcome exception. It is data-rich and spans several thousand years of prehistory from one important area of central Arizona. The authors do a good job of identifying some of the complexities involved in classifying project points, although they ultimately cannot meaningfully incorporate the various raw material, technological, stylistic, social, and temporal dimensions of variability into their treatment of the points. They do underscore the importance of appreciating the roles played by factors and how they influence the degree to which they enhance or compromise the ability of a particular style to serve as a cultural-temporal diagnostic. Particularly commendable is the inclusion of scanned images of all of the points on the Supplemental compact disk, which will allow serious devotees of projectile point studies to peruse several hundred points. I would also echo a point made in the summary chapter—only through the study of samples of projectile points from single-event deposits and single component sites will we ultimately begin to be able to parse the effects of the many variables that contribute to morphological and technological differences.

Unfortunately, the volume is marred throughout by a number of editorial errors. For example, “Armagosa” appears consistently instead of the proper form, Amargosa; the Cortaro point style appears occasionally in text and figures as “Cortero;” and some incorrect figure references in the text were noted for the many small points illustrated in Figure 7. In general, the authors have sought out and incorporated relevant literature into the book, although there are some gaps. One odd omission in the very brief discussion of the Chiricahua style was the absence of any comparison to the morphologically, technologically, and chronologically similar forms such as Northern, Sudden, or San Rafael Side-Notched in the Great Basin. The discussion of the Pinto-San Jose problem that follows covers six pages and incorporates several Great Basin sites.

Finally, one pet peeve I can’t let pass: on page 5 the authors describe “pot-lid fracturing and heat-induced crazing” as indicative of intentional heat treatment. Such thermal damage clearly postdates manufacture—you can’t flake such badly compromised stone—and is best attributed to unintentional burning. This error sadly is not uncommon in the literature, but continues to be repeated as if we were still in the BC (Before Crabtree) (cf. Crabtree and Butler 1964; Purdy 1974) era.

Altogether *Projectile Point Typology, Gila River Indian Community, Arizona* fills an important niche in the study of Southwestern projectile points, and its authors as well as the Cultural Resource Management Program of the Gila River Indian Community have done archaeologists a service in publishing it.

References

- Crabtree, Don E. and B. Robert Butler. (1964). Notes on Experiments in Flint Knapping: 1, Heat Treatment of Silica Materials. *Tebiwa* 7: 1-6.
- Hoffman, Charles M. (1997). Alliance Formation and Social Interaction during the Sedentary Period: A Stylistic Analysis of Hohokam Projectile Points. Unpublished doctoral dissertation, Department of Anthropology, Arizona State University, Tempe.
- Justice, Noel D. (2002). *Stone Age Spear and Arrow Points of the Southwestern United States*. Indiana University Press, Bloomington.
- Purdy, Barbara A. (1974). Investigations Concerning the Thermal Alteration of Silica Minerals: An Archaeological Approach. *Tebiwa* 17: 37-66.
- Sliva, R. Jane. (1997). *An Introduction to the Study and Analysis of Flaked Stone Artifacts and Lithic Technology*. Center for Desert Archaeology, Tucson.

From Hohokam to O’odham: The Protohistoric Occupation of the Middle Gila River Valley, Central Arizona. E. Christian Wells, Anthropological Research Papers No. 3: Gila River Indian Community, Sacaton, Arizona, 2006, 74 pages, 8 tables, 10 figures. Price: \$12.95 (paper). ISBN: 0-9723347-2-6.

Reviewed by David R. Abbott, School of Human Evolution and Social Change, Arizona State University, Tempe, AZ 85287-2402, USA

For more than a millennium, Hohokam farmers along the lower Salt and middle Gila Rivers built and managed the largest and most complex irrigation systems in the prehistoric New World north of Peru. Massive platform mounds surrounded by imposing compound walls towered over densely packed towns and villages and tens of thousands of irrigated hectares. But by the time the Spanish entrada pushed into the Arizona desert, only sparse settlements without monumental architecture were present along small-scale canals in the middle Gila River valley, and nothing but an abandoned landscape existed along the lower Salt. What happened to the Hohokam is a mystery that has titillated the imagination of the public and archaeologists alike for more than a century.

Many years ago, Emil Haury postulated that a direct ancestral connection would eventually be established between the last of the archaeologically recognizable Hohokam people (ca. A.D. 1450) and the historic Akimel O’odham inhabitants

of the middle Gila River valley, who were first described in some detail at the beginning of the 1700s. Haury reasoned that the evidence for a protohistoric (A.D. 1450-1700) link would be found in the surface evidence from archaeological sites along the Gila River. Christian Wells and fellow researchers from the Gila River Indian Community (GRIC) have taken up the challenge with data from more than 1000 sites recorded across 525 sq. km. of intensely surveyed tribal land. If Haury was right, then we would have every reason to believe that the necessary evidence exists in the exceptional GRIC database.

In *From Hohokam to O'odam*, Wells first highlights the challenge by reviewing the sparse and inconclusive evidence for the protohistoric in southern and central Arizona. Indeed, unambiguous diagnostics specifically for the protohistoric have so far eluded scholars. Wells then summarizes the ethnohistoric and archaeological data specifically from GRIC lands and reasons that the most likely places to find the "missing" protohistoric is at multi-component sites containing both late prehistoric and early historic materials. But teasing out definitive evidence from the mixture of prehistoric and historic remains will be difficult at best.

Undaunted, Wells designs a quantitative strategy reliant on pottery information, and uses data from well-dated excavated sites across the Salt-Gila basin to model the assemblages in use immediately prior to and after the protohistoric interval. Then, using a correspondence analysis, Wells compares the models to the GRIC middle Gila survey data and identifies several protohistoric candidates that distinctly vary from late Hohokam, early O'odham, and, interestingly, from mere mixtures of late Hohokam and early O'odham materials. Could these assemblages contain unique protohistoric diagnostics? Wells cautiously resists jumping to conclusions, noting the absence of securely dated excavation contexts, but his results point to especially promising locations to dig. He then concludes the book with a suite of research questions to address, assuming that protohistoric contexts are identified and unearthed.

What distinguishes the protohistoric candidates in the GRIC survey data are high percentages of buff ware pottery (33-49% of the total assemblage) and moderate percentages of red ware (8-21%). The buff wares are particularly interesting because the Hohokam buff ware tradition virtually disappeared by the end of the prehistoric era. Did that tradition make a resurgence during the protohistoric? If so, how are the protohistoric buff wares different from their Hohokam predecessors, marking them as unique temporal diagnostics? These and related questions are of the utmost importance and should guide future pottery research along the middle Gila.

Perhaps future excavations by GRIC archaeologists will finally establish an unbroken continuum from Hohokam to O'odham in the middle Gila River valley, or, perhaps, future work will force us to look elsewhere. Either way, *From Hohokam to O'odham* pushes us one step closer to solving the mystery of what happened to the Hohokam.

Upcoming Conferences

Rachel S. Popelka-Filcoff, Associate Editor

2008

9-11 September. International Aerial Archaeology Conference AARG 2008, Ljubljana, Slovenia. Contact: Dave Cowley, dave.cowley@rcahms.gov.uk.

10 September. Cambridge 2008, History and Heritage of Glass, Cambridge, UK. General information: <http://www.cambridge2008.sgthome.co.uk/pages/HandHProg.htm>.

11-16 September. 13th International Conference On Soil Micromorphology, Chengdu, China. General information: <http://icsm.imde.ac.cn>.

14-16 September. International Symposium on Biomolecular Archaeology, York, UK. General information: <http://www.york.ac.uk/depts/arch/ISBA3/index.html>.

14-19 September. 11th International Conference on Accelerator Mass Spectrometry (AMS11), Rome, Italy. General information: <http://www.ams11.org>.

22-26 September. ICOM (International Council of Museums) Committee for Conservation, New Delhi, India. General information: <http://icom-cc.icom.museum/TriennialMeetings>.

5-9 October. The 2008 Joint Meeting of The Geological Society of America, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, Gulf Coast Association of Geological Societies with the Gulf Coast Section of SEPM; Houston, Texas, USA. General information: <https://www.acsmeetings.org/2008>.

10-11 October. 39th Annual Binghamton Geomorphology Symposium, Fluvial Deposits and Environmental History, Austin, Texas, USA. Contact: pfhudson@mail.utexas.edu. General information: <https://webpace.utexas.edu/hudsonpf/binghamton.html>.

19-22 October. 9th International Conference on Ancient DNA and Associated Biomolecules, Pompeii, Italy. General information: <http://www.ancientdna9.it/index.aspx>.

19-23 November. Ceramic Ecology XXII (as part of the American Anthropological Association meetings), San Francisco, California, USA. General information: <http://www.aaanet.org/mtgs/mtgs.htm>.

22-24 October. Synchrotron Radiation in Art and Archaeology, Barcelona, Spain. General information: <http://www.sr2a-2008.info>.

29-30 October. Geoarchaeology and Archaeomineralogy: Impact of Earth Sciences in the Study of Material Culture, Sofia, Bulgaria. General information: <http://mgu.bg.docs/CircularEN.doc>.

29-31 October. Productive Affinities: Successful Collaborations Between Museums and Academia, Chicago, Illinois, USA. Contact: mrc@northwestern.edu. General information: <http://www.matsci.northwestern.edu/aic/news.htm>.

15-20 November. Archaeology of Southwestern Asia and Adjacent Areas (9th ASWA), United Arab Emirates. General information: http://www.alexandriaarchive.org/icaz/ASWA_2008/index.html.

19-22 November. American Schools of Oriental Research Annual Meeting, Boston, Massachusetts, USA. General information: <http://www.asor.org/AM/am.html>.

19-23 November. American Anthropological Association Annual Meeting, San Francisco, California, USA. General information: <http://www.aaanet.org/mtgs/mtgs.htm>.

7-11 December. 6th Conference on Science and Technology in Archaeology & Conservation, Rome, Italy. Contact: takasheh@index.com.jo. General information: <http://conference.legadoandalusi.es/en>.

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

2009

5-7 January. Sustainability: Fifth International Conference on Environmental, Cultural, Economic and Social Stability, La Tour Koenig, Pointe aux Sables, Mauritius. General information: <http://s09.cgpublisher.com>.

6-11 January. Society for Historic Archaeology Conference on Historical and Underwater Archaeology, Toronto, Ontario, Canada. General information: <http://www.sha.org>.

8-11 January. 110th Joint AIA/APA Annual Meeting, Philadelphia, Pennsylvania, USA. General information: <http://www.archaeological.org/webinfo.php?page=10096>.

10-12 March. Climate Change: Global Risks, Challenges and Decisions, Copenhagen, Denmark. Contact: c.turney@exeter.ac.uk. General information: www.climatecongress.ku.dk.

22-26 March. 237th National Meeting and Exposition, American Chemical Society, Salt Lake City, Utah, USA. General information: <http://www.acs.org>.

22-26 March. Annual Conference on Computer Applications and Quantitative Methods in Archaeology, Williamsburg, Virginia, USA. General information: <http://www.caa2008.org>.

31 March-April 4. American Association of Physical Anthropologists Annual Meeting, Chicago, Illinois, USA. Contact: Lorena Madrigal, madrigal@cas.usf.edu. General information: <http://physanth.org/annmeet>.

31 March-April 4. Paleoanthropology Society Meetings, held in conjunction with the American Association of Physical Anthropologists Annual Meeting, Chicago, Illinois, USA. General information: <http://www.paleoanthro.org/meeting.htm>.

15-17 April. Geoarchaeology 2009 "Landscape to Laboratory and Back Again," Sheffield, UK. Contact: geoarch@shef.ac.uk. General information: <http://www.shef.ac.uk/scidr/geoarchaeology2009>.

22-26 April. SAA 74th Annual Meeting, Atlanta, Georgia, USA. General information: <http://www.saa.org/meetings/index.html>.

25-29 May. DIG: Developing International Geoarchaeology Conference and Instrumental Neutron Activation Analysis Workshop, McMaster University, Hamilton, Ontario, Canada. Contact: dig@mcmaster.ca. General information: <http://socserv.mcmaster.ca/dig>.

6-11 June. 46th Annual meeting of the Clay Minerals Society "Clays of the Big Sky," Billings, Montana, USA. Contact: Richard Brown, rbrown@wyoben.com. General information: <http://www.clays.org/home/HomeAnnualMeeting.html>.

21-26 June. Goldschmidt 2009 "Challenges to Our Volatile Planet," Davos, Switzerland. General information: <http://www.goldschmidt2009.org>.

23-26 June. 11th International Paleolimnology Symposium, Guadalajara, Jalisco, Mexico. General information: <http://www.paleolim.org/index.php/symposia>.

6-11 July. 7th International Conference on Geomorphology (ANZIAG)- Ancient Landscapes- Modern Perspectives. Melbourne, Australia. General information: <http://www.geomorphology2009.com>.

6-11 September. 24th International Meeting on Organic Geochemistry, Bremen, Germany. General information: <http://www.marum.de/imog2009>.

14-19 September. 5th International Congress on the Application of Raman Spectroscopy in Art and Archaeology (RAA2009-Bilbao), Bilbao, Spain. Contact: kepa.castro@ehu.es. General information: <http://www.quimica-analitica.ehu.es/RAA2009>.

ENDNOTE

You may have noticed a difference in the way this issue of the *SAS Bulletin* looks and feels. Due to new policies and restrictions, the United States Postal Service now requires that all U.S. addresses must be printed onto bulk mail newsletters. To comply, the *SAS Bulletin* cover had to change its finish, from glossy to matte. We hope you enjoy the new look! *ECW*

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