



SAS Bulletin

Society for Archaeological Sciences

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From the Editor

With this double-issue, the *SAS Bulletin* is back on track, and we will return to quarterly production. Contributions from members and Associate Editors alike are welcomed, including reports on conferences, laboratory profiles, calls for papers, recent publications, job and fellowship announcements, etc.

Inside this issue you will find membership information. Please photocopy this form and distribute it to colleagues and students in archaeology or other disciplines, and point out the significant benefits of SAS membership: subscriptions to the *Bulletin* and to the *Journal of Archaeological Science* at a whopper of a discount; reduced-rate subscriptions to *Geoarchaeology* and other science-oriented archaeological publications, including our own *Advances in Archaeological and Museum Science* series with Plenum at 30% off; SAS-sponsored symposia at national and international meetings, and participation in SAS-NET and web-based electronic services. There are also special membership categories including student, retired, associate, and lifetime options..

Members should note that there is a change in the address of the SAS website; the new URL is: <http://www.wisc.edu/larch/sas/sas.htm>. We should all thank Jim Burton for the very fine job he has done creating and managing the SAS website and also SAS-NET.

I also bring your attention to the relocation of our Vice President/President-elect, Christine Prior, to the Rafter Radiocarbon Laboratory in New Zealand. You can find her new address and contact information on the back cover. Good luck, Chris!

Lastly, I welcome all members to attend our Annual Business Meeting, to be held in conjunction with the Society for American Archaeology Annual Meeting in Seattle, March 26, 1998, 4:30-6:30 pm. The SAA meeting will also feature an SAS-sponsored symposium, "Glass to Ceramics: Archaeometry in Archaeological Provenance and Technological Studies" (A.W. Simon & N.H. Olsen, organizers), as well as the Fryxell Symposium, "A Geophysical Contribution to Archaeology: Papers in Honor of John Weymouth" (R. Dalan, organizer). Other organized

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From the President

I have been so busy with administrative matters lately that I'd rather write about teaching than about being President. One of the questions we often ask ourselves is how do we train the next generation of archaeometrists? For some years, I have hoped to teach an undergraduate course in archaeometry. What better subject to teach at a liberal arts college than the application of techniques of the natural sciences to archaeology? This year I submitted a proposal for a new course, *Archaeometry - Natural Sciences as Applied to Archaeology*, which was accepted. I plan to teach this course for the first time next fall.

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The Society for Archaeological Sciences

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How you can join:

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symposia include: Interdisciplinary Approaches in Archaeology: Tradition and Prospects (J.E. Baxter, organizer); New Approaches to Phytolith Research in Archaeology (S.J. Pennington, organizer); and Archaeological Applications of Luminescence and Electron Spin Resonance Dating (J.K. Feathers, organizer). Individual presentations with contributions from the archaeological sciences may be found throughout the 1650 papers and posters to be given. I look forward to seeing you there.

Robert H. Tyskot

February 15, 1998

President (continued from page 1)

This new course dovetails with new curricular developments that are taking place college-wide. After satisfying distribution requirements, all students will be required to complete an Exploration, a group "of at least three courses outside the major field of study with demonstrated intellectual coherence and progression beyond the introductory level." Archaeometry will be part of an Exploration cluster in archaeology, along with archaeology classes from the Department of Anthropology, and classical archaeology courses from the Department of Classics. It would also satisfy the lab science distribution requirement. The course is formally cross-listed as a Geosciences and as an Anthropology course.

Prerequisites for the course are either one archaeology course or a previous lab science course. I am hoping to capitalize on the backgrounds, expertise and interests of the students to form interdisciplinary teams to examine real archaeometric problems in the field and in the lab. I would hope to use artifacts from the collections of the Anthropology and Classics Departments, and Lancaster's North Museum. We would use existing analytical methods in the various science departments, including archaeomagnetism, field geophysics, petrography, XRF, XRD, SEM, Mössbauer spectroscopy, and GC/mass spectrometry.

The majority of the grade would come from a lab-based project. This would be written up in segments as the semester progressed. My ideal would be to apply various analytical methods to a common group of artifacts. The students would work in groups and present posters on the results of their group's method. The students would write individual papers incorporating the results of all the groups.

The Catalog description of the course reads as follows: "How old is it? What is it? Where does it come from? How was it made? Where is it? Why did they live there? How did they live? This course will examine the application of various methods from the natural sciences to the study of archaeological environments and artifacts. Scientific principles underlying techniques will be discussed, as well as the application to archaeological problems. Major topics include: dating; analysis and characterization of artifacts; location of sites and features within sites; paleoenvironment and paleoecology. Labs and grading for the course will focus on

analysis of artifacts by students in teams, using multiple methods, with presentation of results by posters and term papers. The prerequisite is either one archaeology course or one lab science course." A preliminary course outline:

- A. Dating - How old is it?
 - 1. stratigraphy
 - 2. tree rings
 - 3. carbon-14
 - 4. archaeomagnetism
 - 5. thermoluminescence
 - 6. case studies
 - a. peopling of Europe, New World
 - b. destruction of Minoan civilization
 - c. Southwestern U.S.
 - d. Shroud of Turin
- B. Analysis/Characterization - What is it? Where does it come from? How was it made?
 - 1. techniques
 - a. chemical analysis
 - b. isotopic studies
 - c. microscopy
 - 2. applications
 - a. authenticity of artifacts
 - b. provenance of artifacts
 - c. technology of manufacture
 - 3. case studies
 - a. ceramics
 - b. marble
 - c. metallurgy
- C. Location - Where is it?
 - 1. remote sensing
 - 2. geophysical prospecting
 - 3. geochemical prospecting
 - 4. case studies
 - a. Cahokia Mounds
- D. Paleoenvironment and paleoecology - Why did they live there? How did they live?
 - 1. archaeological sediments
 - 2. paleogeomorphology
 - 3. prehistoric cultures and climate
 - 4. case studies
 - a. Mayan civilization and water
 - b. Anasazi and climate

For a textbook, I plan to use P. A. Parkes, *Current Scientific Techniques in Archaeology*, St. Martin's Press, New York, 1986. This will be supplemented by additional readings. I reviewed this book in the *Society for Archaeological Sciences Bulletin* 13(4): 4-8, 1990. It still seems to be the best text for an introductory undergraduate course.

I would be interested to hear from others who have taught or contemplated similar courses. I hope to learn from and contribute to the Teaching Archaeometry web page, at the University of Illinois (URL: www.uiuc.edu/unit/ATAM/teach/home.html). This page already contains information from two similar courses: Anth 131 - Archaeological Science, University of California, Berkeley, taught by Steve Shackley; Anth 221 - Materials and Civilization: An Overview of Archaeometry, University of Illinois, taught by Sarah Wiseman. Perhaps a future session of the Society for American Archaeology Annual Meeting or the Archaeometry Symposium can be devoted to teaching.

Rob Sternberg

March 3, 1998

Archaeological Ceramics

Charles C. Kolb, Associate Editor

This column has three major components: 1) a brief report on the British Museum conference "Ceramic Technology and Production" which was attended by your editor; 2) a tabulation of eleven new publications on ceramics (including individual chapter titles and their authors for the edited works); and 3) a research report. The latter is a new feature to be included in the column and I anticipate that this will be the initial contribution of what will become a series of status reports on current research. The report profiles the longitudinal research conducted by Dean E. Arnold (Wheaton College, IL) and is significant for providing insights into ceramic ethnoarchaeology. Dean was the recipient of the Society for American Archaeology's 1996 "Award for Excellence in Ceramic Studies."

Conference Report

"Ceramic Technology and Production," sponsored by the Department of Scientific Research at the British Museum in London was held 20-22 November 1997. The conference organizers, Andrew Middleton and Ian Freestone, created nine sessions with 37 oral presentations and a poster session with 45 invited participants; 36 of the oral papers and 34 of the posters were presented. A total of 132 delegates were registered for the conference and represented 22 nations. England and the United States had the most registrants, but 19 countries had at least two delegates; these included: Ireland, Scotland, Wales, France, Germany, Belgium, Holland, Switzerland, Andorra, Spain, Italy, Greece, Sweden, Poland, Russia, Israel, Japan, Canada, and Brazil.

The sessions scheduled over the three days included: "The Organisation of Production" (Parts I and II, nine papers), "Raw Materials and Resources" (Parts I and II, seven papers), "Interpreting Technological Processes" (Parts I and II, eight papers), "Technological Innovation and Change" (Parts I and II, eight papers), and "Social and Cultural Factors" (four papers). The oral presentations included eight topical papers, six from Western Europe, five from the Americas, five from East Asia, four from the Mediterranean/North Africa, three from Sub-Saharan Africa, three from the British Isles, and three from Southwestern Asia. Among the posters, 30 geographical/cultural areas or topics were represented, with five topical papers, six from England, and three from Greece among those presented. The session chairmen included Ian Freestone, David Peacock, David Gaimster, Michael S. Tite, H. Mommsen, Charles C. Kolb, Yuval Goren, and Andrew Middleton. A Thursday evening reception at the Museum of Mankind featured the exhibition "Pottery in the Making," demonstrations of pottery manufacture, and gallery talks by Ian Freestone and David Gaimster.

Presenters from the United States (and their geographical areas or topics) included: C. Dean Wilson, Eric Blinman, and James Skibo (Southwestern United States), Louise Cort, Leedom Lefferts, and Charlotte Reith (Mainland Southeast Asia), Helen Loney (Italy), Pamela Vandiver (East Asia), Clint Swink (Mesa Verde), David V. Hill (West Texas/Northeastern

Chihuahua), W. David Kingery ("Ceramics and Science Prior to the Industrial Revolution"), Dean E. Arnold (Ticul, Yucatan, Mexico), and Charles C. Kolb (Teotihuacan, Mexico).

This was an excellent, well-organized conference which afforded researchers from the New World to meet and learn from their overseas colleagues and vice versa. Although this was a "one-time" event, one hopes that focused international conferences of this type can be held in the future. As a scientific conference, "Ceramic Technology and Production" was associated with the exceptional exhibition "Pottery in the Making" and a book of the same name. A detailed review of the book *Pottery in the Making* has been prepared by Charles C. Kolb and is being published in *La Tinaja: Newsletter of Archaeological Ceramics* 10(4), Fall 1997.

New Publications: Edited Works

Pottery in the Making: World Ceramic Traditions, Ian Freestone and David Gaimster (editors). London: Published for the Trustees of the British Museum by the British Museum Press, 240 pp., 1997, ISBN 0-7141-1782-X; paperback, 19.88 Pounds Sterling UK. *Pottery in the Making: Ceramic Traditions*, Ian Freestone and David Gaimster (editors). Washington: Smithsonian Institution Press, 240 pp., 1997, ISBN 1-56098-797-9, paperback, \$35.00. The British volume is currently available from the British Museum Press, 46 Bloomsbury Street, London WC1B 3QQ, 0171-323-1234, FAX 0171-436-7315. Because the coverage of the volume is not "global" in scope, the American edition deletes "World" from the title so as not to imply a comprehensive coverage of pottery traditions. The American edition will be available in late February 1998 and may be ordered from the Smithsonian Institution Press, Marketing Department, 470 L'Enfant Plaza, SW, Suite 7100, Washington, D.C. 20560, 800/782-4612, 202/287-3738, FAX 202/287-3184.

The volume contains an editors' foreward, acknowledgements, and an "Introduction," while the narrative has 32 chapters (written by 26 authors), each six pages in length with three columns of text per page; each of the chapters is accompanied by from three to ten illustrations and have separate endnotes. There are 199 color and black-and-white illustrations, a total of 1,045 endnote references, a glossary of 143 technical terms, endnotes, a twelve-page bibliography including approximately 1,170 items, a list of references for the illustrations, and a detailed five-page three-column index.

Gaimster and Freestone's "Introduction" is followed by an initial group of five chapters which focus upon the link between sedentism and pottery making in case studies collectively entitled "Early Sedentary Communities." The chapter titles and authors are: "Jomon Pottery in Ancient Japan" (Victor Harris), "Early Pottery in the Middle Nile Valley" (Derek Welsby), "Early Prehistoric Pottery in Britain" (Gillian Varndell and Ian Freestone), "Prehistoric Ceramics in Mesopotamia" (St. John Simpson), and "Pottery in Predynastic Egypt" (A.J. Spencer). A section entitled "Urbanisation" includes six essays which document the adoption of new fabrication and firing techniques as a response to greater demand and market economies in Mesopotamia, Dynastic Egypt, the Roman Empire, and Japan, etc. The chapter

titles and authors include: "Early Urban Ceramic Industries in Mesopotamia" (St John Simpson), "Ceramic Changes in the Transition from Prehistoric to Roman Britain" (Val Rigby and Ian Freestone), "Dynastic Egyptian Pottery" (A.J. Spencer), "Canaanite Potter's Industries in Mesopotamia" (Pamela Magrill and Andrew Middleton), "Partho-Sasanian Ceramic Industries in Mesopotamia" (St. John Simpson), and "Ash-glazed Stonewares in Japan" (Victor Harris).

Nine chapters are grouped under the title of "Professional Workshops" and include diverse examples illustrating the professionalization of the craft, and the organization of production into workshops which may be discrete or clustered into industrial complexes. The chapter titles and their authors are: "Ancient Greek Pottery" (Dyfri Williams), "Highly Decorated Pottery in Medieval England" (Beverley Nenk), "Korean Celadons of the Koryo Dynasty" (Jane Portal), "Faience in the Ancient Medieval World" (A.J. Spencer and Louise Schofield), "Islamic Lustreware" (Sheila Canby), "Maiolica Production in Renaissance Italy" (Dora Thornton), "Stoneware Production in Medieval and Early Modern Germany" (David Gaimster), "Regional Decorative Traditions in English Post-Medieval Slipware" (David Gaimster), and "Urban Pottery Workshops in North Africa" (Julie Hodson). In "Rural Communities" the editors present three case studies, drawn from ethnographic and archaeological contexts, to document traditional methods of production which may persist because pottery making is a part-time activity in agricultural societies or has symbolic or ritual importance. The studies are: "Traditional Rural Potting in West Africa" (Nigel Barley), "Pottery in Early Anglo-Saxon England" (Cathy Haith), and "Early Iron Age Rural Ceramic Traditions in Iran" (St. John Simpson).

Four contributions are included in the section entitled "Specialized Products" and illustrate single-product fabrication; the essays and authors are: "Tiles in Roman Britain" (Andrew Middleton), "Roman Pottery Lamps" (Don Bailey), "Terracotta Figurines of Eastern Gujarat" (T. Richard Blurton), and "Whistling Vessels from Pre-Hispanic Peru" (Colin McEwan). Four chapters are included under "Industrialisation" and demonstrate large-scale production involving manufactories or factories, export trade, the impact of global economies, and expanded home markets. The contributions are: "Ding and Other Whitewares of Northern China" (Jessica Harrison-Hall), "Mass Production of Roman Finewares" (Paul Roberts), "Chinese Porcelain from Jingdezhen" (Jessica Harrison-Hall), and "The Growth of the Staffordshire Ceramic Industry" (Aileen Dawson). The final chapter, "Tradition in Studio Pottery" (Emmanuel Cooper) considers ceramic objects "made largely by hand under studio conditions" since the second half of the 19th century.

Ceramics and Civilization, Volume VII: The Prehistory & History of Ceramic Kilns, Prudence M. Rice (editor), W.D. Kingery (series editor). Westerville, OH: American Ceramic Society, vii + 262 pp., 1997, ISSN 1042-1122, ISBN 1-57498-026-2; hardcover, \$76.00 ACerS members, \$95.00 U.S. list price; Book Code: CC07. Available from the American Ceramic Society, Customer Service Department, 735 Ceramic Place, Westerville, OH 43081; 614/794-5890, FAX 614/794-

5854, customersvc@acers.org, www.acers.org. The volume contains the proceedings of a conference "The Prehistory and History of Ceramic Kilns" held at the 98th Annual Meeting of the American Ceramic Society in Indianapolis, Indiana, 14-17 April 1996. Kingery provides a "Foreward" and Rice a "Preface," and there are 14 chapters (each with a separate bibliography); the book has a comprehensive index. The chapters titles and their authors include: "Introduction and Overview" (Prudence M. Rice), "Operational Principles of Ceramic Kilns" (W. David Kingery), "Inferring Firing Procedures from Sherds: Early Greek Kilns" (Karen D. Vitelli), "Pottery Firing Structures (Kilns) of the Indus During the Third Millennium B.C." (Heather M.-L. Miller), "The Jingdezhen Egg-Shaped Kiln" (Jing Quing Hu and H.T. Li), "Technology and Organization of Anasazi Trench Kilns" (Eric Blinman and Clint Swink), "The Variability and Evolution of Prehispanic Kilns on the Peruvian Coast" (Izumi Shimada), "Ceramic Firing in Ancient and Modern Oaxaca" (Gary M. Feinman and Andrew Balkansky), "Prehispanic Kilns at Matacapan, Veracruz, Mexico" (Christopher A. Pool), "The Fires Without and the Fires Within: Evidence for Ceramic Production Facilities at the Late Classic Site of La Sierra, Naco Valley, Northwestern Honduras and Its Environs" (Patricia Urban, E. Christian Wells, and Marne T. Ausec), "Brick and Tile Making in Spanish California with Related Old and New World Examples" (Julia G. Costello), "An Integrative Review and Examination of Glass Furnace Technology in Renaissance Italy" (W. Patrick McCray), "Unusual Old Kilns" (O.J. Whittemore), and "Concluding Comment" (Prudence M. Rice).

Materials Issues in Art and Archaeology V, Pamela B. Vandiver, James R. Druzik, John F. Merkel, and John Stewart (editors). Pittsburgh, PA: Materials Research Society, Symposium Proceedings Volume 462, 1997, ISBN 1-55899-366-5; hardcover, MRS members \$62.00, U.S. list price \$71.00, non-U.S. list price \$82.00; Book Code: 462-B. Available from the Materials Research Society, Publications Office, 9800 McKnight Road, Pittsburgh, PA 15237-6006, 412/367-3012, FAX 412/367-4373, info@mrs.org, and on the MRS website (www.mrs.org/publications/books/forms/). This volume includes the proceedings of a conference "Materials Issues in Art and Archaeology V" held at the Fall 1996 Meeting of the Materials Research Society in Boston, Massachusetts, 3-5 December 1996. The book has eight parts containing a total of forty-eight papers accompanied by an author index and a subject index; each chapter has a separate bibliography. Ten contributions concern ceramic materials. The ceramic papers and their authors are: "Provenance Determination from ICP-MS Elemental and Isotopic Compositions of El Paso Area Ceramics" (Nicholas E. Pingitore, Jr., Jeff D. Leach, Joshua Villalobos, John A. Peterson, and David Hill), "Refractory Ceramics from an Iron Age Bronze Melting Workshop at Khirbet edh-Dharih, Jordan" (Sabine Klein, Andreas Hauptmann, and Pamela B. Vandiver), "Incipient Maya Burnt-Lime Technology: Characterization and Chronological Variations in Preclassic Plaster, Stucco, and Mortar at Nakbe, Guatemala" (Eric F. Hansen, Carlos Rodriguez-Navarro, and Richard D. Hansen), "ICP-MS Isotopic Signatures of Lead Glaze Ceramics, Rio Grande Valley, New Mexico, 1315-1700"

(Nicholas E. Pingitore, Jr., David Hill, Joshua Lillalobos, Jeff Leach, and John A. Peterson), "An Examination of Contemporary Iznik-Style Turkish Ceramics" (P. Artal-Isbrand and R. Newman), "An Investigation of the Sources of Bronze Age Pottery from Goltepe and Kestel, Turkey by Neutron Activation" (E.C. DeSena and E.S. Friedman), "Analyses of Archaeological Ceramics from Classic Period Teotihuacan, Mexico, A.D. 50-750" (Charles C. Kolb), "The Alteration and Natural Consolidation Effects of a Ceramic Vessel in Archaeological Excavation from San Lorenzo Tenochtitlan, Veracruz, Mexico" (Ma. Eugenia G. Munoz, Margarita Lopez Fernandez, Adriana Cruz Lara Silva, Ann Cyphers, and Jorge E. Gama Castro), "The Pottery Technology from Pukit Tengkorak, a 3000-5000-Year-Old Site in Borneo, Malaysia" (Pamela B. Vandiver and Stephen Chia), and "The Evolution Process of the Ancient Chinese Yaozou Porcelain" (P.L. Leung, Luo Hongjie, Li Jiazhi, and Michael J. Stokes).

Pottery in Rajasthan: Ethnoarchaeology in Two Indian Cities, Carol Kramer. Washington, DC: Smithsonian Institution Press, Smithsonian Series in Archaeological Inquiry, 288 pp., ISBN 1-56098-740-5, 1997, \$49.95 (cloth), \$49.95. She is also the author of related works, *Village Ethnoarchaeology: Rural Iran in Archaeological Perspective* (1982) and editor of *Ethnoarchaeology: Implications of Ethnography for Archaeology* (1979). Her new volume focuses on traditional urban potters in the northwest Indian cities of Jodhpur and Udaipur who produce utilitarian earthenware, and details production methods, vessel types and quantities, as well as the craftsmen's sociocultural relationships with distributors, clients, and patrons. The book's seven chapters include an "Introduction," "Jodhpur and Udaipur," "The Ceramic Industry," "Shops," "Ceramic Distribution," "External Sources of Pottery," and "Conclusions," accompanied by appendices which provide maps of the potters' workshops and ceramic types. Kramer utilized interviews with more than 200 potters and vendors, and census and kinship data in her analysis. She raises important questions about trade, exchange, and craft specialization that are of special interest to archaeology, cultural anthropology, and students of complex societies as well as ceramic studies. The volume is illustrated with 31 black-and-white photographs, 80 line drawings, and 5 maps.

New Publications: The Roman World

Handbook of Mediterranean Roman Pottery, John W. Hayes. London: British Museum Press, 1997, 128 pp. paperback, ISBN 0714122165, 14.99 Pounds Sterling; Norman: University of Oklahoma Press, 1997, ISBN 0-8061-2939-5, \$27.95. Hayes presents an analysis of the stylistic and technical features which mark Roman period wares, illustrating how the vessels were fabricated, decorated, exchanged and traded, and used. The book focuses upon Roman pottery made in Italy and in the Roman provinces between 100 B.C. and A.D. 600. Among the ceramics considered are amphoras, red-gloss sigillata, African Red Slip, lead- and alkaline-glazed wares, coarse wares, and special function vessels.

Roman Pottery in Britain, Paul Tyers. London: Batsford, 1996, 208 pp., paperback, ISBN 0713474122, 35.00 Pounds Sterling. The volume presents an historical study of Roman

ceramics produced in Britain by detailing sources used for analysis (sites, clays, and kilns), the role of ceramics in society (chronological, economic, and functional parameters), and has a short history of Roman pottery fabricated in Britain from pre-Roman and Late Iron Age times through the Byzantine era. A second part to this well-illustrated book is an extremely valuable atlas and guide to ceramics including amphoras, terra sigillata, mortuaria, and Romano-British fine wares and coarse wares.

Prehistoric Pottery for the Archaeologist, second edition, Alex Gibson and Ann Woods. London: Pinter Publishers, Cassell Academic, 1997, 320 pp., paperback, ISBN 071851954X, 29.95 Pounds Sterling. In this revised edition the authors provide an introduction to the chronological development and technology of pottery with emphasis on British prehistoric ceramics. There is an extensively illustrated glossary in which pottery styles, types, materials, and technologies are explained in detail. Evidence from petrographic microscopy and experimental studies are also included.

New Publications: The Greek World

The American School of Classical Studies at Athens has announced the publication of two new volumes. For prices and ordering information please contact University Museum Publications, University of Pennsylvania Museum of Archaeology and Anthropology, at their website (www.upenn.edu/museum_pubs/frames.html). *Hellenistic Pottery: Athenian and Imported Wheelmade Table Ware and Related Material*, Susan I. Rotroff. Princeton: American School of Classical Studies, Athenian Agora Vol. XXIX, 1997. ISBN 0-87661-229-X. *Athenian Red-Figured and White Ground Pottery*, Mary B. Moore. Princeton: American School of Classical Studies, Athenian Agora Vol. XXX, 1997. ISBN 0-87661-230-3.

The Red and the Black: Studies in Greek Pottery, Brian A. Sparkes. London: Routledge, 1996, 208 pp., paperback, ISBN 0415126614, 14.99 Pounds Sterling; hardbound, ISBN 0415126606, 45.00 Pounds Sterling.

New Publications: The Andean Region

The Archaeology and Pottery of Nazca, Peru, Alfred L. Kroeber and Donald Collier, edited by Patrick Carmichael with a contribution by Katharina Schreiber. Walnut Creek, CA: AltaMira Press, due in Fall 1997. ISBN 0-7619-8964-1, \$39.95, cloth. The volume is sponsored by the Field Museum of Natural History, Chicago, IL and has over 400 illustrations. Ordering information can be obtained from the parent company, Sage Publications (website: www.sagepub.com).

Ceramic Ethnoarchaeology at Ticul, Yucatan, Mexico

Dean E. Arnold spent three weeks in Ticul, Yucatan, Mexico during the summer of 1997 in order to prepare his 32-year study of the evolution of contemporary pottery production for publication. Although part of a larger project funded by the National Endowment for the Humanities, the Wenner-Gren Foundation for Anthropological Research and the Wheaton College (Illinois) Alumni Association, one phase

of the project was to continue testing the assumptions of neutron activation analysis of pottery which Arnold began in 1970 using pottery and ceramic raw materials from contemporary communities of potters in Guatemala. In collaboration with Hector Neff (University of Missouri Reactor-MURR) and Ron Bishop (Smithsonian Institution Conservation Analytical Laboratory), the Guatemala research revealed that in a geologically diverse area, different communities of potters produced compositionally distinct pottery because they exploited their ceramic resources within discrete resource areas which had radii of less than 4 km (Arnold, Neff, and Bishop 1991). From a worldwide sample of pottery making communities, the 4 km radius was within the range of resource distances used in communities elsewhere in the world (Arnold 1981; 1985:32-60).

Until about 1989 all of the clay used in Ticul came from multiple mines within an area 100 m in diameter. Since that time, clay sources have expanded and pottery is now made with clay from four different mining areas. The goal of the 1997 season was to visit these new clay sources, define their composition, and determine whether they could be identified chemically in the pottery from the production units which use them.

Besides the clay sources, the temper source in Ticul has also changed since 1989. X-ray diffraction analyses by B.F. Bohor (formerly of the Illinois Geological Survey) revealed that the clay mineral attapulgite is the most important cultural constituent in the temper from Ticul (see Arnold 1971; 1991). Miners recognize that attapulgite is more abundant at the new source, is easier to mine there and they appear to include larger amounts of it in the temper.

Temper samples from the new source were collected, are currently being analyzed using neutron activation analysis and then will be compared to the analyses of sherds collected in Ticul in 1964, 1988, and 1994 in order to discover whether changes in the temper source can be identified in the compositional pattern of the pottery over time.

During a trip to Yucatan in 1994, samples of pottery collected from different communities of potters revealed that even in a much less diverse geological setting than Guatemala, potters still exploited raw materials within a radius similar to that of other pottery making communities. Neutron activation of these samples by Neff, Bishop, and Glascock (MURR) revealed that each community produced pottery that was compositionally distinct from one another.

The research also revealed that the chemical signature of the pottery from a community is not lost even when the clay source is shared with another community because Yucatan pottery contains significant amounts of clay minerals in the tempering materials (Arnold 1971; see also Shepard and Pollock 1971). So, two different communities can still be distinguished chemically by neutron activation analysis even though two communities use the same clay source.

We now know that neutron activation analysis of contemporary pottery from Guatemala and Yucatan provide a distinct chemical pattern of a community of potters and this pattern identifies a resource area uniquely exploited by the potters (Arnold 1981). While ethnographic data reveals that

this "resource area" is most often less than 3-4 km (Arnold 1985:32-60, 1991), it is clear that most of the unique chemical profile of the pottery from a community comes from the clay minerals (Neff, Bishop, and Arnold 1988). The careful selection of modern raw materials and pottery from contemporary pottery making communities and their analysis by neutron activation analysis has thus revealed that it is simply not possible to identify the clay sources and clay mines used for pottery - even in a contemporary context where the behavioral variables are known. Further, it is not possible to determine if the chemical composition of pottery comes from a single clay component in the pottery, a mixture of several clays (which occurs in many communities) or the clay minerals in the tempering component (which also occurs in many communities; see also Arnold 1992; 1993:73-80).

Indeed, because of clay minerals in the tempering materials, the changes in the locations of clay sources over time and the mixing of different clays to produce pottery, the neutron activation analysis of pottery appears to reveal production communities (rather than clay sources) which obtain their raw materials in a resource area with a radius of less than 7 km when humans, rather than watercraft, are used to transport raw materials (see Arnold 1981, 1991). Since some of the contemporary resource distances within the 7 km range used modern transportation infrastructure, it is more likely that prehistoric production centers used resources from a distance of no greater than 3-4 km.

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Archaeometallurgy

Martha Goodway, Associate Editor

The Second Annual Meeting of Post-Graduate Researchers was hosted by the Department of Archaeology at the University of Edinburgh February 20-22 as a Symposium on Mediterranean Archaeology. For information write: SOMA '98 Administration, Department of Archaeology, University of Edinburgh, Old High School, Infirmary Street, Edinburgh EH1 1LT, United Kingdom. Tel 0131-650-2373/2553; fax 0131-662-4094; web: www.geo.ed.ac.uk/arch/soma/homepage.html; e-mail: soma@ed.ac.uk.

The 1998 Pittsburgh Conference (PITTCON) in New Orleans in March featured a half-day symposium on Archaeology and Art: Diverse Applications of Analytical Chemistry. For further information write The Pittsburgh Conference, Department CFP, 300 Penn Center Boulevard, Pittsburgh PA 15235-5503 USA. Tel 412-825-3220; fax 412-825-3224; E-mail: pittconinfo@pittcon.org; web: www.pittcon.org.

Vincent C. Pigott has edited Volume VII in the University Symposium Series, *The Archaeometallurgy of the Asian Old World*. It will be issued as University Monograph 89, and has papers on copper and bronze in the Eastern Mediterranean by James Muhly, the coming of iron by Jane Waldbaum, early metallurgy in Mesopotamia and Anatolia by Tamara Stech, metal technologies of the Indus valley by Jonathan Kenoyer and Heather Miller, and the transition to iron in China by Bennet Bronson. Although not yet available for ordering, information will be available from University Museum Publications, 33rd and Spruce Streets, Philadelphia PA 19104 USA; E-mail: publications@vax.museum.upenn.edu.

As part of an outreach effort to take the Smithsonian's collections to other parts of the United States, the Institution intends to make important long-term loans to the National Museum of Industrial History, which will open in 1998 in Bethlehem, Pennsylvania, in the old Bethlehem Steelworks plant. Among the loans will be metalworking tools such as the Van Horn planner of 1856, the Smith mortising machine of ca. 1868, and the 1851-56 Nasmyth steam hammer presently on display as part of the Centennial Exhibit in the Arts and Industries Building. Other plans for adaptive reuse of the Bethlehem Works, which closed in 1995, include a science museum.

The Archaeotechnology column in the *JOM, the Journal of the Mining, Metals, and Materials Society* conducted by Robert Ehrenreich presented "The practice and characterization of historic fire gilding techniques" by Kilian Anheuser in the November 1997 issue (pp. 58-62.) She performed replication experiments on surfaces of various copper alloys and her conclusions, though they challenge several recent papers, are consonant with the traditional fire gilding I observed in Patan, Nepal, more than a decade ago. I was not able to determine the substance that was used to prepare the copper alloy surface to take the application of amalgam, but it was clear to me that upon heating the mercury was, as she states, evaporated, not boiled off at a higher temperature. She also challenges the

published assumption that the amalgam would flow during heating; certainly I saw no evidence of this either. The result of heating is a matte coating of a particularly dirty shade of yellow that requires only careful burnishing to produce a shiny golden surface. Anheuser is a conservation scientist at the Staatliche Museen Berlin, Schlosstr. 1a, D-14059 Berlin, Germany. Tel: 49-30-320-91-298; fax 49-30-322-16-14.

Dr. Michael N. Geselowitz, who as a student at Harvard was active in archaeometallurgy, is now Director of the IEEE Center for the History of Electrical Engineering, located at Rutgers University.

A two-day conference organized by the archeodrome of Beaune on ancient copper and experimental metallurgy was held at Bourg en Bresse, France, in October. An informal one-day meeting was held in November at the Department of Materials in Oxford that ranged across medieval armor, architectural wrought iron, and antimony bronze to whither archaeometallurgy? If you can report on these meetings, or have any other archaeometallurgical news to share or comments to make, please write, fax, call or E-mail me.

Archaeological Dating

W. Jack Rink, Associate Editor

Cautions for Use of Thermoluminescence Dating of Sediment

The use of thermoluminescence (TL) dating of sediments at the sites of Jinmium (Fullagar et al. 1996) and Diring Yuriakh (Waters 1997) have yielded shockingly old ages that have created a storm in Palaeolithic archaeology (Gibbons 1997). At Jinmium, the results suggest that the peopling of Australia occurred about 110,000 years ago, more than twice as old as previously believed (Roberts et al. 1990). Similarly, the site of Diring Yuriakh in Siberia, a site regarded by many to not be any older than about 30,000 years has been dated to greater than about 250,000 years. In contrast to dating of sediments where optical exposure resets the clock, the more conventional applications of thermoluminescence dating of burned flint and pottery operate on the basis of resetting by heating. The great advantage of the latter methods is that heat is a potent agent to completely remove the pre-existing (geological) TL signals, whereas solar resetting can only partially deplete those TL signals in quartz and feldspar grains in sediments. Most workers agree that the TL results for Jinmium and Diring Yuriakh need confirmation using modern optical luminescence dating methods.

Recent improvements in luminescence dating technology have greatly enhanced our ability to date sedimentation events in this time range through the application of optical luminescence (OSL) dating, which is rapidly replacing the older technology of TL dating. Natural light exposure in air will only reduce the TL signal to a residual non-zero value. The size of the residual TL signal is dependent upon the type and duration of light exposure. Solar resetting of the TL signal is most efficient when the proportion of ultraviolet radiation is large, whereas low levels of visible light and ultraviolet light

will be the least efficient. Full sunlight has the highest UV levels, while daylight under cloud cover has less UV and underwater light has the least UV and reduced levels of visible light. Turbidity also reduces visible light in air and water by scattering processes. Solar resetting of OSL signals in quartz and infrared-stimulated luminescence (IRSL) in feldspar and quartz also obey the same general rules, but relative to TL signals, the rate of depletion is much more rapid for OSL and IRSL signals. In full sunlight this can occur in seconds to minutes. Furthermore, OSL and IRSL signals reach a true zero value rather than the non-zero value for TL in quartz and feldspar.

What does all this mean for the archaeologist who is trying to interpret the significance of dating results? It means that one can be more certain that OSL or IRSL signals were depleted to a known (zero) level than for TL signals under the same set of ancient conditions. Even underwater conditions are known to yield complete zeroing of OSL signals. Aeolian sediments are the best, while those deposited in water are less preferable. Moreover, there are techniques available in IRSL and OSL to test whether partial resetting of sediments occurred (e.g. Clarke 1996).

So, it seems that any TL date on sediment should at least be verified by IRSL or OSL. But there are also other problematic aspects to the use of these methods. As with radiocarbon dating, the question arises: What is the event that is being dated? Some have argued that artifacts can move down through sandy sediments, and therefore the age of the sediment may be older than that of the artifacts. Another problem is that burrowing rodents can move sediment and artifacts through a vertical dimension, and then the effects of time can obscure the evidence of the burrows. Certainly though, evidence of burrows in the youngest part of a site are a clue that past burrowing might have created disturbances in the archaeological and sedimentary record.

How can controversial dating results be best debated among dating experts and users? I believe that no matter how modern the dating technology, the ultimate test of a date is whether it can be reproduced by an independent lab with access to the original site. Reassessment of the original context is essential, because without additional dating and reconsideration of the depositional context, informed scientific debate cannot easily develop. After all, if a date cannot be reproduced by an independent group of researchers, then there is a basis for debate. But if a date stands up to critical appraisal, then there can be greater confidence that new ground has been broken, and Science can move forward. Are the dates for Jinmium and Diring Yuriakh right? Only time will tell, but see Roberts (1998) for an appraisal.

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Bioarchaeology

David B. Landon, Associate Editor

Comparative Vertebrate Collections at the University of Tennessee

The Department of Anthropology at the University of Tennessee has recently completed a multi-year, NSF sponsored project to stabilize and reorganize its comparative vertebrate collections. The Department has one of Eastern North America's preeminent zooarchaeological reference collections, with approximately 10,000 skeletons of over 1,150 species of vertebrates. Series of 20 or more skeletons have been collected for about 100 common species, allowing researchers to make detailed studies of intra-specific size and morphological variation.

Paul W. Parmalee began the collection in 1973, and it has been actively used and expanded ever since. The NSF project supported significant improvements in the storage conditions for the collection. Specimens were cleaned and degreased with five percent hydrogen peroxide or acetone, and fumigated with dichlorovinyl dimethyl phosphate. The clean skeletons were placed in acid free containers and arranged phylogenetically in airtight cabinets. The specimens have been divided into two groups. An adult male, adult female, and juvenile of each species are stored in the main teaching and basic identification laboratory. Additional specimens are housed in adjacent limited access laboratories, and are used primarily for research and institutional loans.

The cataloging system was also upgraded. The entire card catalog has been computerized using Paradox for DOS. Researchers can now search by a broad array of subjects: taxonomic category, locality, age, sex, etc. Modifications and additions to the data base are password protected while searches, saving files, and printing are available to visitors and occasional users.

The collection serves a variety of teaching, research, and public service functions. The Department of Anthropology offers both M.A. and Ph.D. degrees with concentrations in zooarchaeology, and three graduate classes in zooarchaeology make extensive use of the collections. Over 100 research publications, theses, and dissertations have incorporated work with the collection. A variety of cultural resource management contracting agencies indirectly use the collection through the

professional services of the zooarchaeology faculty and students. The Department also has a strong Forensic Anthropology Center, and forensics students and faculty frequently use the collection for the identification of non-human bone as part of forensics cases.

Researchers who would like more information about the collections may contact Dr. Walter Klippel, Department of Anthropology, University of Tennessee, 250 South Stadium Hall, Knoxville, TN 37996.

Geoarchaeology

Michael R. Waters, Associate Editor

This column will contain news and information about geoarchaeology. Geoarchaeology is a subdiscipline of archaeology concerned with the application of methods and concepts of the geosciences to archaeological research topics. In this column, I will provide information about new publications, conferences, organizations, and other topics related to geoarchaeology. Anyone having news or information that they would like to have shared with the readers of the *SAS Bulletin* should contact me (address on back cover). For my first column, I would like to make the readers of the *SAS Bulletin* aware of the many recent publications dealing with Geoarchaeology.

Journals

The primary journal dedicated to publishing the results of geoarchaeological studies around the world is *Geoarchaeology: An International Journal*. This journal was first published in 1986 under the editorship of Dr. Jack Donahue. The current editors are Dr. Paul Goldberg and Dr. Ofer Bar-Yosef. The journal is published 8 times per year and a complete volume usually contains over 1000 pages of information. Articles within the journal include results from geoarchaeological studies as well as archaeometric (geochemical, geophysical) studies. Also in each issue are numerous book reviews. This is a valuable source of information about current applications of the earth sciences to archaeology. One of the most current issues (vol. 12, no. 6, September 1997) is a special issue on the geoarchaeology of caves and cave sediments.

Other journals such as *American Antiquity*, *Journal of Field Archaeology*, *Journal of Archaeological Science*, *Geological Society of America Bulletin*, and *Geology* occasionally have articles centered around geoarchaeological research.

Books

Recently, several new books have appeared that deal with geoarchaeology. One monograph, *Archaeological Geology of the Archaic Period in North America*, edited by E. Arthur Bettis was published in late 1995 by the Geological Society of America. It was published as part of the GSA Special Paper Series and is number 297. This is a great book for anyone interested in the late Quaternary geology of the middle

Holocene of North America as well as the geoarchaeological implications of that geology. Also published by the Geological Society of America in 1995 was Vance Holliday's monograph *Stratigraphy and Paleoenvironments of Late Quaternary Valley Fills on the Southern High Plains*, memoir no. 186. This book details the stratigraphic and geochronological investigations of the valleys of the Llano Estacado. These books add to a growing list of geoarchaeologically related books published by the Geological Society of America. Still available from the GSA are Special Paper 204 by Vance Haynes, *Mastodon-Bearing Springs and Late Quaternary Geochronology of the Lower Pomme de Terre Valley, Missouri* (1985); Special Paper 242 edited by Leo Laporte, *Establishment of a Geologic Framework for Paleoanthropology*; and Special Paper 283 edited by Julie Stein, *Effects of Scale on Archaeological and Geoscientific Perspectives*; and Centennial Special Volume 4 edited by Norman Lasca and Jack Donahue, *Archaeological Geology of North America* (1990).

Also recently published are three other volumes. The first, *Paleoindian Geoarchaeology of the Southern High Plains* by Vance T. Holliday was published by the University of Texas Press in 1997. It deals with the history of geoarchaeological research on the Southern High Plains and discusses the stratigraphy and dating of key early human sites in this region. Cambridge Manuals in Archaeology has recently published (1997) a book by A. G. Brown entitled *Alluvial Geoarchaeology: Floodplain Archaeology and Environmental Change*. This book provides a detailed discussion of fluvial processes and examples of geoarchaeological investigations of streams from around the world. *Geoarchaeology: The Earth-Science Approach to Archaeological Interpretation* by George (Rip) Rapp, Jr. and Christopher L. Hill (Yale 1998) has just been released, and is a comprehensive textbook integrating all aspects of geoarchaeology. Finally, the University of Arizona Press recently just released my book, *Principles of Geoarchaeology: A North American Perspective*, in paperback. This book provides a comprehensive overview of the field of geoarchaeology with examples from North America.

Other books which are still available and should be examined by anyone interested in geoarchaeology include the following: *Archaeology as Human Ecology*, by Karl Butzer (Cambridge University Press 1982); *Formation Processes of the Archaeological Record*, by Michael Schiffer (University of New Mexico Press 1987); *Soils in Archaeology*, edited by Vance Holliday (Smithsonian Institution 1992); and *Archaeological Sediments in Context*, edited by Julie Stein and William Farrand (Center for the Study of the First Americans 1985).

Background: Associate Editor for Geoarchaeology

Michael Waters is an associate professor within the departments of anthropology and geography at Texas A&M University. He has been at Texas A&M for the last 11 years. He has conducted geoarchaeological studies in the American west, Russia, and Jamaica. His primary interests include geoarchaeology, late Quaternary geology, the problem of the peopling of the Americas, and human-land interactions.

Remote Sensing and GIS

Apostolos Sarris, Associate Editor

Conference Reports

The First International Workshop on "Electric, Magnetic and Electromagnetic Methods Applied to Cultural Heritage" (EMEMACH 97), held at Ostuni, Italy, September 29 - October 1, 1997, attracted a large number of scientists, mainly from European countries. The main topics of the workshop covered the areas of 1) Geophysics for Archaeology, 2) NDT for Historical Buildings, 3) Natural Risks and Cultural Heritage, 4) EM: Methods and Applications, 5) Magnetics: Methods and Applications, 6) Remote Sensing, Imaging and EM Tomography, 7) Integration of Techniques and Methods, 8) GPR: Methods and Applications and 9) Miscellaneous. Most case studies were dealing with the application of geophysical detection techniques on Italian and other European sites.

The 1st symposium of "Remote Sensing Applications in Archaeology" was held at the St. Cloud State University, Minnesota, in March 1997. The conference was jointly organized by B. Richason (Spatial Analysis Research Centre, SCSU), R. Rothaus (Archaeological Computing Laboratory, SCSU), T. Wilkinson (Oriental Institute) & J. Sanders (Oriental Institute). The symposium included presentations on fieldwork applications and techniques, discussion sessions with NASA and JPL representatives on future remote sensing platforms and projects along with software and data type demonstrations. Satellite remote sensing (Landsat, SPOT, SIR, IRS), including the use of Declassified Intelligence Satellite Imagery, aerial photography, GIS technologies & Global Positioning Systems applications were explicitly presented, covering a number of case studies from U.S.A., Europe, Arabian Peninsula and Mesopotamia. The recent developments of airborne thermal and multispectral/hyperspectral scanners and the future 1m spatial resolution satellite systems, that have been announced to be launched by the end of the year, were also discussed. The symposium was especially successful in identifying the advantages of satellite and aerial remote sensing in subjects related to the definition of areas of archaeological interest, archaeological resource management, settlement patterns recognition and environmental archaeology. Most of the abstracts presented in the conference can also be found on the web (eleftheria.stcloud.msus.edu/rsaa/program.cfm).

Other Symposia

23rd General Assembly of the European Geophysical Society, Acropolis, Nice, France, 20-24 April, 1998. Details from: EGS Office, Max Planck Str. 13, 37191 Katlenburg-Lindau, Germany, tel. +49-5556-1440, fax +49-5556-4709, web: email: The scientific programme includes symposia on "Geophysical and Geological Signatures of Past and Present Climate Change", "Rockmagnetism, Palaeomagnetism and Environmental Magnetism", and "Archaeology and Archaeomagnetism".

HAZARDS '98, 7th International Conference on Natural and Man-Made Hazards, International Society for the

preservation and Mitigation of Natural Hazards, Chania, Crete, Greece. Details from: Dr. G.A. Papadopoulos, Institute of Geodynamics, National Observatory of Athens, 11810 Athens, Greece, tel.+30-1-3462-664, fax. +30-1-3426-005, email: m.sachp@egeados.gein.noa.gr

Conference Report

Archaeological Sciences '97 Durham

Contributed by Andrew Millard, Department of Archaeology, University of Durham, South Road, Durham DH1 3LE UK (A.R.Millard@Durham.ac.uk)

Caveat: The editor was brave enough to ask me to write a report on a conference that I had organized. The report may not entirely reflect what the delegates experienced!

The 6th biennial Archaeological Sciences meeting in the UK was held 2-4 September at Durham University, hosted by the Department of Archaeology. About 50 papers were presented, mostly by British workers, but with contributions from Greece, Germany, Italy and Russia. There were 5 oral sessions covering Technology, Materials Analysis and Provenance (4 papers), Biochemical Studies (15 papers), Environmental Studies (10 papers), Geoarchaeology (10 papers), Chronological Studies (4 papers), together with 2 keynote addresses and a poster session (7 papers). The delegates also had the opportunity to enjoy the two major buildings of Durham's World Heritage Site, through a guided tour of the spectacular Romanesque Cathedral and a conference dinner in the Castle (parts of which are Norman).

In comparison to past conferences in the series there was a remarkable emphasis on biological topics, derived entirely from the subjects of submitted papers, rather than due to any choice of the organizers. Perhaps this reflects trends in research topics and funding, but it may also have something to do with the closeness of the Bradford-Harvard *Metals in Antiquity* conference (10-13 September), although the proximity of the Association for Environmental Archaeology's *Ethnography, History and Environmental Archaeology* conference (6-9 September) appears to have had little effect.

In the space available I cannot possibly do justice to all the excellent papers presented, so I will pick out some of the highlights for me personally, which are biased by my interests and also by the very fact that the organizer has to miss papers in order to organize things!

In the keynote papers, Don Brothwell (York) gave us a fascinating insight into the history of the classification of the sciences and the place that archaeology has had in various schemes, ranging from most fundamental of sciences through to something that is only marginally scientific. He suggested

that some current trends in archaeology are by their very non-scientific nature doomed to die out whilst the importance of science in archaeology will grow in the coming century. In contrast to this long timespan, Martin Jones (Cambridge) considered the place of science-based archaeology within more ephemeral structures - the recent and current funding structures of British science. He reminded us that here in the UK we work within a funding framework that now emphasises the "end-user" of research work, and the possible contributions that that work can make to the national economy. For archaeological sciences the end-user is the heritage tourism industry, which now contributes a significant proportion of national income. If we are to maintain and increase funding for our subject, then we have to make the political case which shows how important it is in site interpretation. On the nitty-gritty of grant applications we were reminded that the application to fund a novel technique should keep in mind a second step: how, once established, that technique can be applied to big questions.

In the session on biochemical techniques we were presented with an enormous range of applications of analyses of every sort of ancient biomolecule. Steph Dudd (Bristol) reported on work investigating the possibility of detecting milk fats in pottery. Using measurements of the $\delta^{13}\text{C}$ of individual fatty acids, combined with the triacylglyceride distributions of lipids extracted from pottery, it has proved possible to distinguish adipose and milk fat, despite the similarities in the composition of the degraded forms of both. This raises exciting possibilities in detecting milk economies in areas where bones do not survive.

Christina Cattaneo (Milan) spoke about a comparative study of methods of species identification for bone fragments and artefacts. In the many situations where morphological identification of species cannot be made there has been interest in the use of immunological and genetic methods. By comparing histological, immunological and DNA techniques on a variety of fragmentary and cremated bones, it was possible to show that for a human/non-human distinction, then histology was sufficient for 90% of bones, and that of the biomolecular techniques albumin detection was more successful than mitochondrial DNA. Hi-tech is not always best!

Another application of biomolecular techniques to bone was reported by Angela Child (Newcastle), who has been seeking to detect mycolic acids which are particular to mycobacteria, and in particular trying to identify those specific to *Mycobacterium tuberculosis*. The results are only preliminary but in a number of burials from the site of a C19th infirmary with a recorded rate of death from TB it has been possible to detect the mycolic acids of *M. tuberculosis*, and arrive at a rate of infection remarkably close to the recorded one. Given other results which suggest that lipids may survive better than DNA in bone this is an interesting alternative route

to palaeopathological information, and in particular, incidence rates of disease.

Greg Hodgins (Oxford) gave a fascinating talk on his work to establish species specific antibodies for collagen in order to distinguish different sources of glue for art historical objects. Complete specificity is not possible with affinity purification of polyclonal antibodies, but much useful information can be derived. At the end of a long day of presentations the audience were held captive by an account of Paginini's reputed use of his wife's gut for violin strings, and the immunological disproof of this story which is now available.

In the environmental studies session topics ranged from bone diagenesis studies with Alistair Pike's (Oxford) account of how catastrophic dissolution can flood your lab with acid, to the identification of food remains in a charred biscuit (Frances McLaren, London) and, as the warm-up to the coffee break, an account of whipworm infestations in bog bodies from Andrew Jones (York Archaeological Trust).

Seal bones were the subject for Lisa Hodgetts (Durham), who described how age at death of juvenile Harp and Ring Seals has elucidated the seasonal occupation of Younger Stone Age houses in northern Norway. Apparently different houses were occupied at different times of year. Another home player, Alan Outram (Durham), presented a critique of skeletal element utility indexes as currently used and suggested an improved method which allows easier identification of transportation models and direct comparisons with optimal foraging models.

A poster display accompanied by casts of footprints presented by Gordon Roberts (Liverpool John Moores), demonstrated the wealth of ephemeral archaeological and palaeoenvironmental evidence which can be exposed by coastal erosion of Holocene silts. Direct evidence for humans hunting particular species is available, amongst an enormous number of identified species. These remains are only briefly available for study before they are themselves destroyed by the same erosion that exposed them.

In the geoarchaeology session, David Jenkins (University of Wales, Bangor) reported on an innovative technique for soil chemistry analysis, using a portable XRF spectrometer. An area of several square kilometres on the Great Orme (North Wales) was surveyed for elemental evidence for past mining activities, with useful results including the identification of some possible sites which were not known before.

Clive Waddington and Dave Passmore (Newcastle) described an integrated landscape study which is using established fieldwalking methods combined with a geomorphological analysis of the area to investigate prehistoric activity in the Milfield Basin, Northumberland. By considering how geomorphological processes will distort and conceal lithic scatters a better interpretation of landscape use is achieved.

The contribution of archaeology to the study of sea-level change was the theme of Jane Sidell's (Museum of London

Archaeology Service) presentation. The traditional physical geography approaches to past sea-level are being supplemented in the Thames estuary by the use of the high resolution altitude and chronological data provided by the preserved water fronts of London. Dendrochronological dates and determinations of low tide level within centimetres are orders of magnitude more precise than other methods.

Piglets in Peat - Why? was the intriguing title under which Heather Gill-Robinson (York) discussed a series of experiments burying piglets in peat bogs and exhuming them periodically, to examine the state of soft tissue preservation. The *Why?* of this gruesome project is to help predict which peat bogs are most likely to preserve ancient human remains and so aid us in finding such remains and protecting likely sites from peatland destruction.

Under the heading of chronology came a variety in a small package, with astronomical dating in Babylon, ESR dating of tooth enamel and luminescence dating. James Steele (Durham) described to us the identification of what is currently the latest known astronomical observation from ancient Babylon. By a process of comparison and elimination it has been possible to identify a large solar eclipse recorded in a cuneiform tablet as that of 30 June AD 10. Here is a precision to which the other papers did not even aspire! Improved precision was, however, the topic for Sarah Barnett (Durham), who reported on studies of thermoluminescence and optically stimulated luminescence dating of pottery. Using a TL multiple aliquot technique to obtain palaeodoses allows a precision of 11%, but a new OSL single aliquot technique improves the precision to about 5% of the age. This is finding application in the Iron Age of northern Britain, where ceramics are common but undiagnostic, and the radiocarbon calibration curve plateau in the first millenium BC reduces the usefulness of that technique.

In conclusion, it was by all accounts a successful conference with a diverse programme reflecting the variety of applications of scientific techniques within archaeology. The proceedings are to be published in the *British Archaeological Reports* series, and (if all goes well) should appear in the summer of 1998. The University of Bristol has volunteered to organize a similar conference in 1999.

Book Reviews

Archaeometry: An Australasian Perspective. W. Ambrose and P. Duerden (eds.). Occasional Papers in Prehistory 12, Research School of Pacific and Asian Studies, The Australian National University Press, Canberra, Australia, 1982. 391 pp. A\$ 28.70 (paper). ISBN 0-86784-239-3.

Archaeometry: Further Australasian Studies. W. R. Ambrose and J. M. J. Mummery (eds.). Occasional Papers in Prehistory 14, Research School of Pacific and Asian Studies, The Australian National University Press, Canberra, Australia, 1987. 350 pp. A\$ 28.70 (paper). ISBN 0-7315-0040-7.

Archaeometry: Current Australasian Research. Barry L. Frankhauser and J. Roger Bird (eds.). Occasional Papers in Prehistory 22, Research School of Pacific and Asian Studies, The Australian National University Press, Canberra, Australia, 1993. 160 pp. A\$ 28.80 (paper).

Reviewed by Suzanne M. M. Young, Archaeometry Laboratories, Harvard University, Peabody Museum, 11 Divinity Avenue, Cambridge, MA, 02138 USA

These books are the proceedings of the 1st, 2nd, and 3rd Australian Archaeometry Conferences. The first two volumes prove to be much more than mere proceedings, and make an important contribution to the small base of archaeometric literature. The 3rd proceedings is more typical of this class of publication.

The 1982 volume is the first of its kind from Australia, and this is reflected in its contents. They start with a concerted attempt to define what is meant by the term 'archaeometry'. The first paper in the book is a history of scientific measurement in archaeology by Fleming. This is followed by "Ions and Eons", a wonderful paper by Rhys Jones, comprising a complete discussion of what archaeometry is - nothing, if not archaeology, according to Jones. That is the final statement in his paper, but not the final point. Jones makes it quite clear that studies must be done correctly, and well integrated into the field from which they come. This paper should be required reading for method and theory students as well as introductory archaeometry students everywhere. As stated, the point seems painfully obvious, yet from time to time it gets lost or overlooked - forests and trees come to mind! The defining is not as important as the doing, but if seeking the definition brings about a conscious evaluation, which in turn inspires excellent work, then may it always be included.

The 1982 volume contains 41 papers in sections on characterization studies, geoarchaeology, geomagnetism, palaeoecology and environment, chemical reaction rate dating, thermoluminescence dating, isotope dating, radiocarbon dating, and conservation and experimental archaeology. A very wide range of topics are covered, and covered very well. Each section contains a review article, usually at the start of the section, as well as application papers.

Association for the Study of Marble and Other Stones in Antiquity

Fifth International Conference
Museum of Fine Arts, Boston
June 11-15, 1998

www.oberlin.edu/~scarrier/ASMOSIA/Intro.html
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Among the most noteworthy are two useful papers on PIXE (one by J. Allen and P. Duerden, the other by W. R. Ambrose and P. Duerden); a re-examination of hearths and comparative study of palaeomagnetism by P. Clark and M. Barbetti; and two papers beginning seriously to address environmental and diagenesis studies. In "The degree of degradation of fossil material from archaeological sites: can the influence of past environments be defined?" M.J. Head presented a promising and important preliminary study of structural changes in wood and a discussion of factors affecting the incorporation of exogenous carbon. "Heavy metals in bones from archaeological sites: an indicator of palaeoenvironmental conditions" by B. Noller, R. Jones and J. Stockton is an excellent study as complete with archaeological discussion as with examination of physico-chemical aspects of metal migration between bone and soil. This is a very important emerging line of study. A new UK funding initiative, coordinated by A. Mark Pollard (Bradford) and Martin Jones (Cambridge), for research on the relationship between the environment and the diagenesis of archaeological material is currently under consideration by the Natural Environment Research Council.

The first volume brings itself to a close with a directory of Australian archaeometry and conservation. This is a highly useful practice and a very good idea.

The 1987 volume of 37 papers continues in the tradition established by the 1982 volume of providing reviews and updates on the topics included. It perfectly complements the first volume in its choice of topics. It covers the chemistry of rock art, residues and microscopic remains, pedology and diagenesis, electron spin resonance and thermoluminescence dating, carbon, beryllium and chlorine isotope dating, artifact composition and computation, conservation, and technical studies of Chinese bronzes.

Still concerned with definition, this time the discussion was provided by A. Anderson who argues for the use of the term "Archaeological Science" rather than "Archaeometry". This self-consciousness serves to focus the attention on interests truly shared in art, archaeology, and science; to find and develop reliable instrumental methods; and to keep contributors focused on the broader stage of archaeometry or archaeological science rather than on very narrow specialist booths.

The volume also holds many noteworthy papers, to mention a few: A. Rosenfeld's "Rock Art and Archaeometry" is a presentation of well-defined neglected problems, a paper very well suited for delivery to this community and capable of addressing such matters; H.J. Hall's "The detection and identification of parasites in Prehistory" is a fascinating paper which draws attention to the remarkably great potential of palaeoparasitological studies and clearly outlines what recovery techniques are necessary for such studies; in "The Ageing Chemist – can Electron Spin Resonance (ESR) help", D.A. Caddie *et al.* give a very thoughtful and honest evaluation of this technique and its problems. There are many more very well integrated reports and case studies found in this volume.

These first two volumes, with such complete reviews followed by a collection of application research papers, serving as case studies (in conjunction with some articles that update

advances since the 1980s) could be used as texts in an introductory survey course on archaeometry. They did very well "serve the interests of both sides of the 'specialist fence'", as was their stated goal. Unfortunately this was not achieved with the 3rd volume.

Something rather drastic seems to have happened to the archaeometric population in Australia in the late 1980s or early 1990s. The 1993 volume contains only 21 papers - almost half of each of the two previous volumes. It is broken into 5 sections: residues and microscopic remains; characterization studies; dating; prospection and geoarchaeology; and metals. This final section contains only a single paper. It becomes a simple conference proceeding in that the collection of papers contain as many weak, vague, inconclusive, and preliminary report type papers as good research papers, and the sections no longer hold together. The book lacks any kind of unity and makes no better a read than any broad conference proceedings would. Given the drop in quality of the work and the diminished number of research papers, it looks like the strength of the archaeometric population suddenly disappeared during those years. Where did they go?

A few papers stand out in the 1993 volume. J.R. Bird's "Ion beam analysis in art and archaeology" is a very concise but useful introduction and includes discussion of a very broad range of archaeological materials. W.R. Ambrose's "Obsidian hydration dating" and A. McConnell's and J.W. Magee's "The contribution of microscopic analysis of archaeological sediments to the reconstruction of the human past in Australasia" are good reviews of their methods complete with the history of development and practical problems as well as examples of use. "New views on the origins of copper metallurgy" by P. Budd, A.M. Pollard, R.G. Thomas, and P.A. Williams is a provocative and well argued paper, but it seems a bit lost or lonely tacked on to the end of this string of papers on organics, dating, and prospection.

In the preface this volume claims to "reinforce the definition of archaeometry as the application of the natural sciences to archaeological problems," but it does so by simply providing a collection of examples. A few good ones, quite complete and well presented, stand out, such as "Taphonomy and tool-use: A role for phytoliths in use-wear and residues analysis". But it suffers in the publication in being surrounded by weak, vague and inconclusive work. While not yet ready for publication, much of this work should indeed be pursued. Unfortunately this volume can stand as an example of what is wrong with the 'publish or perish' academic system in which the majority of us struggle.

On the cover of the 3rd proceedings is a diagram of the "four elements" as postulated by Empedocles in ca. 430 BC. This concept formed the foundation upon which alchemy was built. Robert Boyle, in *The Sceptical Chymist* (1661), made the destructive cracks in this foundation by questioning the validity of the very definition of "element" - in particular, these four "elements" as elements. Out of this raised consciousness - this ability to look at whole pictures and form questions, even about accepted concepts - chemistry was eventually born. I found this cover an appropriate step back since this volume was more than a step back from the preceding two.

Finding the right path and staying on it are among the most difficult accomplishments in any science. Led by Jones' paper in the first volume, the first two proceedings strove towards this goal, but the spirit was lost in the third as a step back to ill-defined elements was often made. Questions need to be constantly asked. Effort has to be expended into maintaining high standards. We can only hope the participants of the fourth meeting, held in February 1997, can reach for the level of scholarship and conscious evaluation achieved in their first two proceedings. We look forward to the papers from a very large debate on the earliest arrival of humans to Australia, at the heart of which is the dating methods of thermoluminescence and radiocarbon, their limitations and accuracy.

Watching the close of the radiocarbon lab at the Australian National University, one can only hope that the world is not seeing the collapse of Archaeometry or Archaeological Science in Australia. Archaeometry in Australia was off to a wonderful start as evidenced by the first two volumes in this series. The first two meetings succeeded in reaching a much larger audience including field archaeologists and historians. Current debates in Australia make it clear that many researchers, not themselves natural scientists, are educated in Archaeometric studies relevant to their own interests. Australia has in many ways broken down barriers and reached a point toward which Archaeometry in other countries still strives. Archaeometrists have the responsibility of integrating their work into the archaeology, but meetings of specialists can be quite useful for evaluating and educating each other in ways that archaeologists cannot. It would be a quite loss to Australia for a field which started off with such promise to collapse. I hope that the third volume and the closing of the ANU radiocarbon lab are not a harbinger of things to come.

Statistics for Archaeologists: A Commonsense Approach.

Robert D. Drennan. Plenum Press, New York and London, 1996. 278 pp. \$42.50 (cloth), ISBN 0-306-45327-4; \$24.50 (paper), ISBN 0-306-45326-6.

Reviewed by Robert E. Dewar, Department of Anthropology, University of Connecticut, Storrs, CT 06269 USA

Introductions to statistics for archaeologists are quite varied in their style, the topics they cover, the order of presentation of material, the extent to which they detail the mathematical underpinnings of the statistical tools they present, and in the fundamental philosophy of their authors. Drennan's book is quite explicitly shaped both by his experience teaching statistics to undergraduate and graduate students interested in archaeology, and by his approach to statistics in general. Its attractiveness to other instructors will depend in part on their reaction to Drennan's approach to statistics, and how readily they can adapt this book to their own courses. Apart from these issues, however, there is a great deal to recommend this book. It is written in an engaging style by an author who does not hide his prejudices or his opinions, and it is consistently focused

on the practical problems of archaeological analysis. Drennan assumes, for the most part, that students will be using statistics software in the course, and makes efforts to make the output of most packages comprehensible. The book's price strikes me as low enough that I could envision asking students to purchase both it and an instructional statistics package like *Student Systat*.

The most important issue for most archaeologists selecting a text will be the extent to which it conforms to their taste in statistical approaches, and Drennan's approach will not have universal appeal, though I am happy to say that I find it very congenial. First, his approach is explicitly and strongly influenced by John Tukey's *Exploratory Data Analysis* (1977). Thus, he considers early in the text differing ways of describing the location of a distribution (means and modes), its spread (standard deviation and midspread), examines shapes of distributions with box and stem-and-leaf plots, and emphasizes the robustness of different ways of examining data when there are outliers. He discusses methods of standardizing data and controlling the shape of distributions with transformations. Second, and before we ever meet a "p value", Drennan carefully discusses the nature of samples, the utility of a random sample, and the difficulties archaeologists must often face in determining just exactly what populations they are sampling, how they may be biased, and what substantively can be done about it. Finally, he emphasizes the concept of the standard error, the construction of confidence intervals, and their use in interpretation. He builds a case against reliance on tests of null hypotheses, arguing that an all-or-nothing approach to significance should be replaced with scales of increasing confidence of significance, both statistical and substantive.

The introduction discusses the problems that we all face in teaching statistics to students who are often poorly prepared in mathematics, and frequently without confidence in their abilities. He avoids presenting mathematical proofs and derivations for the statistical tools he discusses, primarily because "the language of abstract mathematics...remains utterly impenetrable to many archaeologists" (p. ix). On the other hand, he attempts to avoid presenting the tools in a "cookbook" approach. Thus, each chapter attempts to explain the basic logic of the methods presented, and always links the analysis to data through developed examples. For simpler techniques, he moves step-by-step through the calculations involved, but for more complex techniques, like the calculation of confidence intervals around regression lines, he assumes that the calculations themselves will be done by computer, and that the formulae involved are essentially irrelevant to his students. Throughout, he avoids using arcane terms derived from classical usage in statistics.

In comparison with most competing texts, Drennan presents a unique range of statistical tools - many classical tools are ignored, while others, particularly with regard to dealing with different kinds of sampling, are presented in greater detail here than in competing books. The tools are all limited to those concerned with one variable, or the relation between two variables; there are no multivariate statistics presented. Among commonly encountered techniques, he presents one and two-sample t-tests, chi-square, linear

regression and Spearman's rank correlation in detail and has a more limited discussion of ANOVA. There are briefer discussions of measures of association and the analysis of residuals. Throughout he considers the question of the robustness of the techniques to ill-shaped distributions and outliers, and offers alternatives, like analyses based on trimmed means and standard deviations, and the careful examination of bivariate plots when interpreting regressions. Unusual, but welcome, are his discussions of techniques for dealing with stratified and cluster samples.

Probably every instructor will want to supplement Drennan's coverage, and present additional statistics or techniques. What I find tremendously appealing is the consistency of discussion throughout the volume. All of the examples link the analysis performed to the interpretations that can be made, in the context of sample size, potential bias, and substantive significance. Drennan assumes that instructors will be teaching a particular statistical software package to students in the same course that they are using this book. Depending upon the package employed, the manuals may be of great value in teaching other techniques, but standard statistics packages can give no coverage to the peculiar aspects of archaeological data, and the ways that archaeological inference and research are constrained. This is the greatest value of this book.

There are problem sets for each chapter, but there are no correct answers given, in keeping with its design for use in the classroom rather than as a stand-alone introduction. The book concludes with suggestions for further reading that reflect the tenor and some of the sources for Drennan's approaches. There are brief reviews of texts in statistics, primarily those that focus on the EDA approach or on the details of sampling. He comments on other available introductions to statistics for archaeologists, with particular attention to the ways that they differ from his book. He concludes by saluting seven papers about statistics by archaeologists that have clearly influenced his thinking.

I am sure that none of us will ever be completely satisfied with any textbook that is not our own product, but Drennan's text is certainly a better choice for the course I would like to teach than any of its competitors. For instructors who find exploratory data analysis and a reasoned approach to confirmatory statistics attractive, this text is certainly worth a careful review. I, at least, will be using it next semester.

Reference

Tukey, John W. 1977. *Exploratory Data Analysis*. Reading, MA: Addison-Wesley.

Paleoethnobotany: A Handbook of Procedures. Deborah M. Pearsall. Academic Press, San Diego, 1989. 470 pp. \$63.00.

Reviewed by Mark Nesbitt, Institute of Archaeology, University College London, 31-34 Gordon Square, London WC1H 0PY England, UK

This book surveys techniques of recovery, analysis and interpretation of the three main types of plant remain studied from archaeological sites: macroremains (mainly seeds and charcoal), pollen, and phytoliths. This is an ambitious remit, particularly given that paleoethnobotany is a young field with techniques that are usually passed on by hands-on teaching, and which are relatively little mentioned in the literature.

A particularly attractive feature of this book is its detailed coverage of topics such as recovery and identification that, while unglamorous and often little discussed, are critical to the validity of the final interpretation. The coverage of topics such as flotation, laboratory sub-sampling of large samples, or building a reference collection draws on literature from around the world, is extensively illustrated and clearly laid out in text that is refreshingly readable and jargon-free.

For some topics I would have liked to hear more of the author's views. For example, flotation techniques are exhaustively covered in 60 pages. Many of the techniques described are archaic, offering slow, poor recovery of macroremains, but are given equal treatment alongside the SMAP/Siraf-type pump-driven flotation machines that are in standard use amongst archaeobotanists worldwide. Although the advantages of this type of flotation machine are evident from data presented in tables and hints in the text, its advantages are implicit rather than explicitly stated.

Sampling strategy for flotation - a difficult and controversial topic - receives just four pages of discussion. Here the advice - to take samples of a standard size, starting with 10 liters of archaeological deposit - appears to reflect the author's own experience with well preserved desiccated plant remains in Peru (shown in a mouth-watering photograph on page 80). However, standard sample sizes for macroremains in Europe and the Near East are typically in the region of 30 to 50 litres, sometimes (e.g. for Neolithic sites) much more.

The book shuttles back and forth between American examples, with which the author is highly familiar, and the rest of the world. What works well for paleoethnobotany in one region often does not for another. It may be that, in attempting to offer worldwide coverage, a more sharply focused critique of approaches to sampling and interpretation has inevitably been lost. In contrast Hastorf and Popper (1988), in an edited volume that usefully complements this one, offer a series of thematic chapters of global application that are explicitly based on regional case studies.

This book's detailed coverage of the practical details of paleoethnobotany make it a useful learning aid for any novice paleoethnobotanist, especially one with limited access to hands-on teaching. The wide range of topics covered and literature cited also make this a valuable reference for the more experienced, as first port of call for reliable information on almost any aspect of paleoethnobotanical methodology. Several years after publication *Paleoethnobotany* remains a valuable sourcebook for anyone interested in the field.

Hastorf, C.A. & V.S. Popper (eds.). 1988. *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*. Chicago: University of Chicago Press.

Himalayan Bronzes: Technology, Style, and Choices.

Chandra L. Reedy. University of Delaware Press, Newark, DE, 1997. 341pp., b&w illustrations, tables, figures, references, appendices, glossaries. \$95.00 (cloth). ISBN 0-87413-570-2.

Reviewed by S. Terry Childs, Archeology and Ethnography Program, National Park Service, Washington, DC 20240 USA

The primary objective of many art history projects is to determine where and by whom works of art were made. Chandra Reedy's study of 340 copper-based statues and her quest to attribute each of them to a regional affiliation in the isolated mountains of the Himalayas is no exception. What is exceptional about her study of a disparate group of medieval-period statues (7th-15th centuries AD) is the method and theory she applies. Reedy's rigorous methodology combines traditional art historical procedures with very different methods from art conservation, chemistry, geology, archaeology and the archeological sciences, multivariate statistics (stepwise discriminant analysis), and ethnography. She also employs the concept of technological style to help explain her regional groupings of bronze statues. She does this by focusing on three types of choices - visual, techno-visual, and purely technical - made by the artisans during statue manufacture, as well as aspects of the social, political, ideological, and economic contexts in which those decisions were made. The end product is a well-integrated and holistic examination of a corpus of art that not only provides plausible regional attributions for the pieces but lays the foundation upon which to investigate other art historical and anthropological problems.

Himalayan Bronzes is divided into eight chapters following in a fairly logical and useful sequence. Following an introductory chapter, Chapter Two focuses on critical background information dealing with the geography of eight regions in the Himalayas, religious functions of the statues, and the relatively meager archaeological and textual evidence available to better understand the culture history of the bronzes. The largest component of the chapter is a discussion of the art historical criteria used to establish the first tentative groupings of statues by geographical region. The visual stylistic elements used include facial characteristics, the shape and features of the headdress, the length and type of the garment, the type of base on which the statue is situated, and the posture of the figure. Sixty percent of the attributions based on such baseline criteria are deemed plausible by Reedy, while forty percent are uncertain. Reedy devotes the next four chapters to alternative analytical methods to increase the plausibility of the attributions.

Chapter Three focuses on the specific manufacturing sequence used to cast each statue, usually by the lost wax method, and to decorate it. This chapter is a fine integration of some ethnographic and textual research, as well as technical studies. Reedy uses binocular microscopy and x-radiography to record a number of technical features, including height, width, weight, number of sections individually cast, number of chaplets used, number and types of ancient repairs, type and location of inlay, type of solder, and evidence of relic materials inserted in a statue during its consecration. She

provides a series of clear and very useful photographs to illustrate these features. In order to identify a characteristic manufacturing process for each geographic region, she coded each statue's features and subjected the data to stepwise discriminant analysis. She found that some geographical regions had fairly distinct casting and decorating features, although considerable overlap still existed using this data set alone.

Chapter Four considers the variability of the metal resources in the Himalayas used to make the statues. Although Reedy provides useful background information for the non-metallurgist and the non-Himalayanist, the most interesting sections present the geology, sources of relevant ore, and evidence of mining in eight geographical regions. The evidence suggests that the Himalayas in general are not as rich in copper ores as adjacent areas, but that several Himalayan geographic regions had adequate resources to permit copper-based statue manufacture during the Medieval period. The discussion also provides intriguing tidbits of information about the social, economic, and ideological contexts of mining in the regions, although these are not thematically summarized. The results of the chemical analyses of the statues and the results of the statistical analysis performed on the chemical data are also presented. Notably, the discriminant analysis of the elemental data is quite effective in further discriminating regional groupings of the statues, but some difficult overlap is still present.

Since many of the statues were hollow cast around a clay core, Reedy examines the physical and chemical characteristics of the clay for about one third of her corpus in Chapter Five. She assumes that the clay cores were made of local materials, so their analysis provides another, quite unique dataset to further assess the regional origins of the statues. Petrographic microscopy was used to analyze the mineralogy of 112 statues for which clay cores both existed and were accessible (excellent photographs are provided). A subset of 57 was also subjected to neutron activation analysis to determine the chemical constituents. The discriminant analysis of these two data sets reveals that the mineralogical data did not significantly help distinguish the regional origins of the statues, while the elemental data has definite potential for excellent discrimination when a large sample size and significant analytical budget is available.

The next two chapters are the culmination of the analytical work considered in the previous chapters. Reedy presents the discriminant analysis of the combined art historical and technical data sets in Chapter Six. She is careful to elucidate the validation process used and the deductions made to identify the final regional groups of statues. Also included in Appendix 2 is an in-depth discussion of the statistical method written by Terry J. Reedy. In the end, this integrated methodology notably reduces the number of uncertain statue attributions to regional origin and changes the attribution of a few.

The regional styles and related iconography of the final eight regional groups of statues are then detailed. Chapter Seven is lengthy due to the large number of excellent photographs illustrating the range of statues in each regional group. Although well labeled, the number of photographs is

overwhelming at times. Given the enormous variability of the statues in some regional groups and my lack of expertise in the field of Himalayan art history, I felt considerable comfort by the end of the chapter knowing that the groupings were finalized using excellent technical data.

The last chapter attempts to utilize the new attributions of the 340 Himalayan bronzes as a foundation upon which to consider some art historical and anthropological issues related to the choices made during the manufacture of the statues. For example, Reedy examines economic (access to raw materials) versus aesthetic (personal or societal) considerations that might have influenced some of the technical choices made in three broad geographical areas, specifically whether to cast a statue hollow or solid, to gild it, or to inlay it with silver. Although she provides some ethnographic, archeological, and textual information about the organization and ethnic affiliations of the Himalayan craftsmen throughout the book, the data is insufficient to fully understand the complexity of possible influences on accessibility to the copper, gold, and silver resources, let alone the social and ideological factors involved in aesthetic choice. Such factors, to name a few, might include the geography and technology of travel, local mining technology, social relationships, trade dynamics, political control over local resources, systems of patronage, and ideological concepts of space, color, and power. A chapter devoted to a full explication of such cultural information by region would have been useful instead of the scattered morsels on religion and symbolism in Chapter Two, the organization of casting in Chapter Three, and the organization of mining and some information on trade in Chapter Four.

Reedy also reintroduces technological style in Chapter Eight, a concept that was noticeably missing from the previous discussions of the final regional groupings of bronzes. She presents a case study that identifies patterns of conscious visual, techno-visual, and technical choices made during bronze statue manufacture in three regions of Tibet. Although this is a valiant start at delineating technological styles, I believe Reedy needs considerably more information about the social, political, and economic system, as well as the ideology, of the bronze-making craftsmen in their respective societies to do justice to her task.

Himalayan Bronzes is a well integrated, well written book that will be of interest to a broad group of art historians who want to improve their methodology, Himalayanist art historians, and archaeologists interested in the archaeological sciences in general and Himalayan archaeology and art in particular. Reedy deserves extra praise for her attention to high quality photographs that admirably illustrate her points and the inclusion of her raw data in a series of appendices that are now readily available to her colleagues.

Alluvial Geoaerchaeology: Floodplain Archaeology and Environmental Change. A. G. Brown. Cambridge University Press, Cambridge, England, 1997. xxiii + 377 pp. £55 (cloth) or £19.95 (paperback).

Reviewed by Donald Thieme, Geoarcheology Research Associates, 5912 Spencer Avenue, Riverdale, NY 10471.

This book breaks much new ground, ranging over more of the globe and extending over a longer time frame than the standard reference from a North American perspective. Brown endorses a multi-disciplinary approach, integrating faunal, floral, and fluvial changes. This brings “multiple stratigraphies” as developed at Franchthi Cave into open, alluvial settings. The time depth of Old World prehistory enables correlation with the oxygen isotope timescale and encompasses interglacial environments which differ from the present but can be systematically compared. The archaeological perspective is timely and sophisticated, showing an awareness of British post-processualism and emphasizing human impacts on alluvial valleys.

Brown’s strongest suit is his discussion of sites and rivers in the UK, particularly the Thames and Severn sequences. He pays appropriate attention to the unique depositional settings of the lower Thames in which were found the hominid fossils at Swanscombe (p. 162-164) and associated Paleolithic industries at Clacton-on-Sea (p. 164-167). Independent stratigraphic sequences at Swanscombe include lithology, paleosols, molluscan fauna, and Uranium series age estimates which can be correlated by erosional hiatuses. Less well known sites along tributary streams are also summarized, however, including: Sproughton along the river Gipping (p. 197), Shippea Hill along a paleochannel of the Little Ouse (p. 203-206), and Thatcham at the margin of an early Holocene floodplain lake in the valley of the river Kennett (p. 206-208).

Brown’s discussion of North American alluvial geoaerchaeology (p. 167-184) is weaker and should be considerably revised for future editions. Archaeological sites and “regions” mentioned in the text are supposed to be plotted on Figure 5.7 but several of the most important are missing and the discussion is poorly organized. He seems to have intended the organization to follow the route of migration, which means that Clovis is not actually discussed until near the end (p. 174). Figure 5.7 labels the entire Brazos River “Blackwater Draw” and neither Folsom nor Dent are plotted. Figure 5.8 duplicates Vance T. Holliday’s map of sites in the vicinity of Kersey, Colorado which Figure 5.7 indicates as the “Kersey and Jurgens sites.” The sites that Holliday studied are Jurgens, Frazier, Klein, and Powars (Brown has “Powers” on p. 170). These may be minor errors but their abundance suggests a lack of attention to detail.

Although Brown makes some interesting comparisons both within North America and between the work of North American and British geoaerchaeologists, he sometimes lacks historical perspective. His discussion of the American Southwest, e.g. the “Sulphur Springs valley” is plotted on Figure 5.7 but human remains of Sulphur Springs woman are discussed several pages before the discussion of the Whitwater Draw site (p. 175) and the pioneering study by Sayles and Antevs is not cited. The “Santa Cruz” label on Figure 5.7 refers to the San Xavier reach of the Santa Cruz River studied by Waters which is not in fact an archaeological site. Brown could have discussed recent paleoenvironmental studies on the Colorado Plateau in this section, and the studies of Hohokam canals beginning with Haury’s work at Snaketown would have been a nice addition to his chapter on “Managed Floodplains.”

Brown's summary of hydrographic changes in the Nile basin comes at the beginning of the book (p. 1-13) but encapsulates many of the issues raised in subsequent chapters. He uses a flowchart (p. 5) to suggest linkages between climate change, drainage basin responses, and cultural phenomena ranging from agricultural technology to patterns of social and political organization, to mythology. Management of the Nile flood included construction of canals, dikes to contain floodwaters and facilitate transport, embankments, and in upper Egypt the construction of large floodbasins (p.9). A later chapter on "managed floodplains" features Brown's own research on the Middle Severn fish weirs (p. 259-261) of the UK which were large enough to hinder river navigation in the 13th and 14th centuries AD.

Alluvial Geoarchaeology is an essential addition to the library of anyone practicing "geo-archaeology" today, from whichever side of the hyphen we originate academically. The book's weaknesses are perhaps to be expected since it breaks so much new ground. Brown summarizes flume studies and field experiments with artifacts and bones (p. 91-96) which probably are not referenced in extant geomorphology texts. He seems unaware, however, of much relevant literature on taphonomy and formation processes from paleontological-archaeological method and theory (e.g. Dating methods (p. 48-58) is merely adequate although he includes a unique discussion of the use of artifacts for relative age control (p. 58-59).

Brown mixes terms from several European chronologies in a manner that will confuse rather than enlighten North American readers (e.g. Table 5.2 on p. 156). The use of the oxygen isotope chronology is pioneering and may be helpful for students with previous exposure to geochronology. Soils are discussed using the UK system with only marginal reference to the more traditional USDA or FAO soil taxonomies (p. 96-97). Examples of paleosol indications of climates different from the present are also drawn exclusively from the UK (p. 100-103). Micromorphology is mentioned briefly (p. 101-102) and illustrated with an example from the pre-Neolithic in the lower Welland valley in eastern England. The chapter on floodplain ecology and paleoecology (p. 104-146) is strong but omits the "dendrogeomorphology" techniques widely applied in the United States.

University instructors may not find this "manual" easy to incorporate into either undergraduate or graduate curriculae, at least in the United States. The book's conceptual sophistication means that it will not stand alone as a primer on geomorphology for archaeologists. The fundamentals of fluvial geomorphology are covered in two appendices but instructors will need to supplement it with more orthodox texts and primary literature for most teaching purposes. Even some graduate students in the United States may be scared off by Brown's heralding of "the complexity of terrace deposition, the importance of thresholds, and the multiplicity of conditions under which aggradation and incision may occur (p. 151)." Instructors in several fields should consider assigning individual chapters. Chapters 6 and 8 would be particularly applicable for a course in Old World Archaeology, for example. Brown does an excellent job of linking British Isles, continental

Europe, and the Near East to Holocene environmental change and the environmental consequences of human settlement.

Cahokia's Countryside: Household Archaeology, Settlement Patterns, and Social Power. Mark Mehrer. Northern Illinois University Press, Dekalb, Illinois, 1995. xvii + 213 pp., works cited and index. \$28.95 (paperback). ISBN 0-87580-565-5.

Reviewed by James W. Cogswell, University of Missouri, Columbia, MO 65202 USA

Mehrer's book on the relations of archaeological evidence to social structure in the American Bottom deserves a place in archaeologists' libraries and would be useful as an upper-level college text for courses on the prehistory of the region. This book helps to bridge the gap between site-specific reports resulting from American Bottom archaeological projects and the more synthetic and speculative interpretations based on this archaeological record.

Concerning technical matters, the text is well written, easy to read, and notably bereft of typographical errors. Tables and figures are appropriate and are closely matched to the relevant text. The references cited are adequate and current for the 1995 publication date. The relatively low price makes this book available to a wide audience.

The title is somewhat misleading, because while Mehrer discusses debris-discard patterns in features, house forms, and related house/feature patterning, he delves very little into what these patternings might mean in the realm of "social power." Instead, his analysis focuses on whether the diachronic archaeological information from the Cahokian suburbs parallels that from central Cahokia. Mehrer does not hang his study on a particular anthropological framework. For example, his statement (p. 166) that "the study of households can proceed [without] a determination being made about whether they are parts of a state, a chiefdom, or some other specific form of government" should be appreciated by readers who are tired of treatises that try to force archaeological evidence into a preconceived sociopolitical structure.

The structure of the book follows a logical, if not predictable, pattern. Chapter 1 provides a brief outline of the American Bottom setting and culture history. There are no surprises in this chapter, and supplemental readings are required to complete his outline. Chapter 2 presents the author's operational definitions and the theory used to structure his analysis. Chapter 3 focuses on the sites selected for his analysis and analytical-unit descriptions. Chapter 4 is devoted to analysis of debris, feature, feature location, house type, and house/feature patternings, using frequency distributions over time and discriminant analysis as the primary analytical techniques. Limitations of the archaeological record that affect this analysis are also frankly discussed. Discussions of debris and feature analysis provide little in the way of substantive results (see my comments below). To my reading, Mehrer's main findings in this chapter are that household architecture and related feature patternings changed through time.

Mississippian-period structures show little relation to Late Woodland structures. During the Mississippian period, structural diversity increased to peak in the Stirling phase and declined in later phases. Chapter 5, titled "Interpretation," is essentially that: After first summarizing the analytical data, Mehrer summarizes interpretations of previous researchers before presenting his interpretation of his analysis, interspersed with ethnographic examples. Very little use of the theory presented in Chapter 2 is used to explain Mehrer's observations. Chapter 6, "Conclusions," is only five pages long and expands the scenario presented in Chapter 5 in more general terms.

I fault the book on several points. First is the lack of an explicit, stated goal early in the book for Mehrer's endeavor. The reader is finally rewarded on p. 161 (out of 167 pages of text) where the author provides the punchline: "Long-standing interpretations regarding the process of population nucleation in the American Bottom...were not confirmed." Why not set us up for this conclusion so we would know why we are reading this book, and why not give us more background on those long-standing interpretations? Second, I find many occasions where the author presents assumptions as accepted fact. For example, in the first paragraph of Chapter 3 (p. 31) Mehrer states that "The development of complex society not only created ceremonial centers in the American Bottom but also transformed the way rural communities were organized and the way family life was conducted." This statement may be true, but I have yet to see an objective demonstration of its veracity, and Mehrer's analyses in this book do not help to confirm it. Third, I found the relative lack of explicit statements about his findings extremely frustrating. Mehrer's use of "may have", "possibly", "probably", and so on render many of his conclusions suggestive but essentially meaningless. Finally, I am concerned with the subtle way that the scientific process occasionally is abrogated in the book. Another example illustrates this: The second paragraph in Chapter 3 states, "The arrangement of buildings and pits...are *expected* to be related to the processes of cultural change experienced throughout the region" (my emphasis). The application of objective science in archaeology requires elimination of such expectations in our theoretical orientation as well as in our reports.

It should be clear by now that Mehrer and I react to the archaeological record under different paradigms. The bottom line is that Mehrer has produced an analysis of American Bottom household archaeology that will be useful for students, teachers, and scholars regardless of their paradigm.

The Last Voyage of *El Nuevo Constante*: The Wreck and Recovery of an Eighteenth-Century Spanish Ship Off the Louisiana Coast. Charles E. Pearson and Paul E. Hoffman, Louisiana State University Press, Baton Rouge and London, 1995. 264 pp., illustrations, tables, maps, references. \$29.95 Tr. ISBN 0-8071-1918-0.

Reviewed by Michael K. Faught, Director of Program in Underwater Archaeology, Department of Anthropology, Florida State University, Tallahassee, FL 32306 USA

Nautical archaeologists are often forced to ascertain the age, function, and nationality of a shipwreck strictly from her artifacts and hull remains. Only a limited history can be reconstructed from this "etic" archaeological record. Some shipwrecks, on the other hand, are "identified", or named, either because researchers use clues in historical documents to find a particular vessel, or because they have inferred the identity of a discovered wreck through comparison of written records and details of the sunken remains. Such is the case with *El Nuevo Constante*, a wrecked vessel identified by concordance between archaeological and written records. Because of this identity, more narratives and records regarding a richer, emic history have been reconstructed by Pearson and Hoffman in this well written, but essentially descriptive volume.

Located one mile offshore of southwestern Louisiana, the wreck of *El Nuevo Constante* was discovered and partially salvaged by shrimpers off the Gulf Coast of Louisiana in 1979. The wreckage was surrounded by very fine grain sediments, a good environment for preservation, but poor for diver visibility once the disciplined archaeology got underway. She contained preserved cargo and personal items, both organic and metallic remains (including some silver and gold). The lower sections of the vessel's hull were well preserved, but poor visibility conditions inhibited detailed photographic recording. Advised of the extent of the remains by the shrimpers, the state of Louisiana initiated record searches in Louisiana and in Spain. *Locational information from the documentary sources was accurate, and local geographic features retained various forms of the term "Constante"*. The record searches revealed rich written accounts of the ship's history, cargo and passenger manifest, as well as details of the sinking event and attempts to salvage her cargo within the first year of sinking. Consequently, a management plan, with state funding, was devised to remove the wreckage contents, study and map the hull remains, and to preserve the hull by leaving it *in situ*.

Pearson and Hoffman present a rich exposition of the development and character of mid-Eighteenth century trade systems, and trade routes, couching the wrecking of the *Constante* in the frame of Spain's increasing troubles in the mid-eighteenth century world trade market. They present details of the trade items most commonly moved at the time, and the bureaucratic maze necessary to traverse the oceans. Originally built by British shipwrights, *El Nuevo Constante* was eventually sold to the widow of a merchant of Cadiz, Spain to be used for shipping between the New World and the Old. Bound for Spain in a *flota* or convoy originating Vera Cruz, with a stop planned in Cuba, the vessel wrecked in a storm in September of 1766. The authors lay out the preparations for sailing, the last voyage and the early attempts at her salvage. These background discussions represent the rich, "emic" story so useful to compare and contrast written history with the archaeological record.

Phased archaeological field work was conducted on *El Nuevo Constante* in 1980 and 1981, first by remote sensing (sidescan sonar and magnetometer survey), then coring the surrounding sediments to understand the post wrecking deposition and depth of remains, and finally by induction dredge exposure. Diving operations took place in an extremely

low visibility, high energy, marine environment. The bottom sediments were very fine, and any disturbance created a mucky soup to work in. Images from the sidescan sonar revealed the lay of the wreck and the shape of the boat, and an ingenious grid with “braille-like” markers attached at ten foot intervals to orient the diving archaeologists on the wreck was deployed. Their diving operation included surface supplied air using face masks with radio communications. Much of the cargo and artifacts remaining with the vessel were found at the stern end, surely due more to post-depositional disturbance (salvage attempts and sea disturbance) than to their original contexts on the vessel. One major benefit of a shipwreck, from an archaeometrical perspective, is the particularistic, catastrophic, nature of its deposition - the “moment in time” of its sinking. When she went down, *El Nuevo Constante* contained a rich array of ceramic artifacts bound for sale in Europe. These products include Majolica, Rey and Guadalajara ceramic wares as cargo. These artifacts could be used for various materials science analyses, as well as design element and formal studies to develop better understanding of New World ceramic production processes and chronologies.

Preservation of nonmetal artifacts such as leather, cloth, turtle shell, and several varieties of dyestuff (including cochineal, annatto, indigo, and logwood) was very good. A substantial portion of the wooden structure of the vessel was preserved in place, and several types of wood used in her construction were recorded. Pearson and Hoffman detail the ballast stone types, remaining metal hardware, anchors, various fasteners and fittings, pieces of the rudder assemblage, some rigging (not usually preserved in shipwreck assemblages), as well as remains of the bilge pumps. Armament found among the wreckage included three cannons and several types of ammunition. Subsistence remains from the wreckage included animal bone fragments of cow, pig, goat or sheep and possibly turtles. In addition, wine bottle fragments, olive jars (*botijos*), fragments of metates and manos, and other utilitarian items were also recovered. Don't forget that “treasures” were also found in the wreck, including copper, silver, and gold.

It is to the authors' credit that they published this volume so as to bring documentation of this valuable cultural resource out of the “gray literature” and into a wider academic audience. While ultimately descriptive, the volume by Pearson and Hoffman is detailed and well balanced. It presents a strong argument for the wrecked vessel's identity by demonstrating resonance between cargo manifests, wrecking narratives, and assemblage characteristics. In sum, the particularist and the processualist, alike will find this book to represent an “ethnoarchaeological” picture of Euro-American occupation of the western Gulf of Mexico in the 18th century.

Paleoindian Geoarchaeology of the Southern High Plains.

Vance T. Holliday. University of Texas Press, Austin, 1997. xx + 297 p., 91 figures, 33 tables, 2 appendices, index. Price: \$50.00 (cloth), \$24.95 (paper). ISBN 0292731094.

Reviewed by Joe Alan Artz, Office of the State Archaeologist, University of Iowa, Iowa City, IA 52242 USA

This book is a scientific study of the landscapes and environments of Paleoindians on the Southern High Plains. It is also a story of seven decades of collaboration between archaeologists and geoscientists in the Llano Estacado, an area in northwest Texas and eastern New Mexico that has produced one of North America's finest Paleoindian records. Although written by one author to summarize his two decades of personal involvement in geoarchaeological research in the region, a spirit of collaboration pervades the book. Nowhere is this more apparent than in the preface, in which Holliday names over 70 individuals, including scientists, students, and ranchers, who have assisted him in his research.

Chapter 1 introduces each of the three terms that comprise the book's title. First, readers learn about the physiography, climate, vegetation, and geology of the Southern High Plains, and in particular the Llano Estacado. The origin and evolution of the term Paleoindian is then reviewed, from its initial informal use in 1940 by Frank Roberts of the Smithsonian Institution to its present day meaning as a dynamic period at the boundary between the Pleistocene and Holocene that witnessed the explosive peopling of the New World. The term “geoarchaeology” is not explicitly defined but its goals and many of its techniques are nicely summarized in a section on field methods. “My field research...,” Holliday writes, “integrated the archaeological data base with interpretations from stratigraphy, sedimentology, pedology, geomorphology, and geochronology” (p. 16).

Chapter 2 is a fascinating history of Paleoindian research on the Southern High Plains, beginning with the initial discovery of an association between human artifacts and extinct megafauna at Folsom, New Mexico, in 1926-28. Holliday conveys a fine sense of the personalities and paradigms that over the years have driven investigations in the region, and also of the fortuitous circumstances that have sometimes led to historic discoveries, such as gravel mining outside Clovis, New Mexico, or the building of a manmade lake at Lubbock, Texas. All five chapters of the book, in fact, are informed by an awareness of the contributions of previous researchers. For example, Holliday cites a 1989 publication edited by Jack Hofman as his primary source on Paleoindian culture history but his discussion of the topic makes extensive and equitable reference to the work of three generations of researchers including Krieger, Wormington, Knudson, and Wheat.

Chapter 3, comprising about one third the book's length, provides information on some twenty PaleoIndian sites that Holliday has investigated. Site-by-site discussions of landscape evolution give balanced consideration to evidence from soils, sediments, landforms, artifacts, and radiocarbon ages. Emphasis is placed on determining, from the geological context of archaeological remains at each site, the topographic and depositional setting at the time of Paleoindian occupation. Stratigraphy and geomorphology are illustrated with cross section drawings and maps, and lithostratigraphic correlations and radiocarbon ages are well documented in tables. The site descriptions are comprehensive but not exhaustive. Brief technical descriptions of major stratigraphic units are presented in an appendix, but detailed soil profile descriptions are lacking. Despite the importance of paleoenvironmental reconstruction

to the volume, primary data on pollen, diatoms, gastropods, phytoliths, and other important paleoecological evidence are often not presented. Skeptical readers may feel that Chapter 3, while readable, sometimes requires leaps of faith. If so, they can direct their leaps to other publications where details of the pedological and paleoecological research are published, e.g. Holliday's 1995 *Quaternary Valley Fills on the Southern High Plains* (Geological Society of America, Memoir 186).

Chapter 4 extends the geographic scope of the study to areas south, east, and north of the Southern High Plains (as far north, indeed, as the Wyoming Basin). The chapter documents the range of depositional contexts where Paleoindian sites have been found. Filled gullies and arroyos seem to be the most common context. Sites associated with alluvial fans, terrace surfaces, large valley fills, and playas are also documented. Perhaps not enough emphasis is given to the fact that many of the sites discussed are very deeply buried: Paleoindian components at the Aubrey and Richard Beene sites in eastern Texas were discovered 6–10 m below the present ground surface. For those of us who rarely find Paleoindian sites, the implications are obvious. We don't systematically search for contexts where such sites are most likely to be found, and we often simply don't dig deep enough.

Chapter 5 summarizes the chronology and paleoenvironments of Clovis, Folsom, and Late Paleoindian on the Southern High Plains. The environment of the Llano Estacado during the Clovis occupation (11,200-10,900 B.P.) was a cool, mesic grassland or savanna, with high energy stream flow in draws, marshes and ponds in uplands, with few or no eolian landforms. During Folsom times (10,900-10,000 B.P.) springs along the margins of the draws dwindled, and streams turned to freshwater marshes and ponds. Upland water tables fluctuated, playa lakes alternated between ponds and marshes, and eolian dunes and sandsheets began to spread over the landscape. Warming and drying continued in Late Paleoindian times (10,000-8,000 B.P.) in the earliest Holocene. Streamflow ceased and freshwater wetlands in the draws gave way to scattered alkaline marshes. Shortgrass prairie dominated the uplands which were subject to episodic drought.

Although known primarily as a geoscientist, Holliday had undergraduate training as an archaeologist. This background is quite apparent in Chapter 5. In a well written and sometimes critical review of archaeological classification practices, Holliday correctly observes that Paleoindian "cultural chronology" is actually an "artifact chronology" built from radiocarbon ages on strata yielding projectile points and extended to undated sites through morphological and technological analysis of the points themselves. In a few places, Holliday uses the term "geocultural" to express this notion of a shared geochronologic framework (p. 176, 197), a neologism I find inappropriate. Without a doubt, for latest Pleistocene and Holocene times in North America, particularly in localities like the Llano Estacado, archaeological chronology and Quaternary geochronology are at least siblings if not conjoined twins, but what in heaven's name is a "geoculture?"

After summarizing the cultural chronology, he reviews the landscape settings in which Paleoindian sites have been found, then turns to the problem of time trends in the Paleoindian

utilization of the landscape through time. He concludes that, on the Llano Estacado, occupational intensity and settlement diversity reached its peak during the Folsom occupation, then dwindled as Late Paleoindians adapted to the increasingly arid Holocene climate.

Holliday's in-depth consideration of point typology at times seems to digress from his main theme. Ten of the fifth chapter's 56 pages, for example, are devoted to the problem of classifying unfluted lanceolate points. By chapter's end, however, the reason for the "digression" is clear. Accurate dating and culture classification are absolutely essential to evaluating occupational time trends. Holliday's appreciation of this fact and his willingness to grapple with the often confusing details of archaeological typology turns this book into a truly interdisciplinary work, a vigorous blending of archaeological and geoscience approaches.

This book is a positive reflection, not only on the author's career of collaboration with archaeologists, but also on the long tradition of such collaboration in his study region. The book's importance to Plains Paleoindian studies comes down to the inseparability of the archaeological record from its stratigraphic context. The sound stratigraphic and geochronologic framework established by Holliday provide an essential foundation for archaeological analyses of Paleoindian culture.

Book Reviews in Upcoming Issues

Ancient Mining (Robert Shepherd), by **F. Beardsley**; *Ground Penetrating Radar: An Introduction for Archaeologists* (Lawrence Conyers & Dean Goodman), by **S. Ball** (Indiana); *Traces of the Past: Unraveling the Secrets of Archaeology Through Chemistry* (Joseph B. Lambert), by **Jim Burton**; *Geological Methods for Archaeology* (N. Herz & E. Garrison), by **Brooks Ellwood**; *Prehistoric Long-Distance Interaction in Oceania: An Interdisciplinary Approach* (M. Weisler), by **Tom Dye**; *Use Wear Analysis on Bone and Antler Tools of the Mackenzie Inuit* (Genevieve M. LeMoine), by **Susanne J. Miller**; *Origins of Agriculture in the Lowland Neotropics* (D. Pearsall & D. Piperno), by **Linda S. Cummings**; *Projectile Technology* (H. Knecht), by **John Dockall**; *The Origins of Native Americans: Evidence from Anthropological Genetics* (M.H. Crawford), by **David Browman**; *Archaeological Sciences 1995* (A. Sinclair *et al.*), by **Robert H. Tykot**; *The Origins and Ancient History of Wine* (P. McGovern *et al.* eds.), by **R. Evershed**; *Feeding Colonial Boston: A Zooarchaeological Study* (D.B. Landon), by **B. Baker**; *Archaeological Prospecting, Image Processing and Remote Sensing* (I. Scollar *et al.*), and *Moundbuilders of the Amazon* (A. Roosevelt), by **J. Ebert**; *Chemical Characterization of Ceramic Pastes* (H. Neff ed.), by **W. Barnett**; *The Industrial Revolution in Metals* (J. Day & R.F. Tylecote), and *Early Metallurgical Sites in Great Britain* (C.R. Blick ed.), by **D. Killick**; *Pottery in Archaeology* (C. Orton *et al.*), and *Vertebrate Taphonomy* (R. Lee Lyman), by **T. Oudemans**.

P.S. This is a friendly reminder to the **reviewers!**

New SAS Sponsored Publications

Advances in Archaeological and Museum Science Series, Plenum Publishing, New York

Chronometric Dating in Archaeology. Advances in Archaeological and Museum Science, volume 2. 1997. Edited by R. E. Taylor, University of California, Riverside, and Martin J. Aitken, Oxford University, England. ISBN: 0-306-45715-6. 416 pp. (cloth). \$95.00 (US and Canada); \$114.00 (elsewhere). Text adoption price on orders of six or more copies: \$45.00 each.

Description

Since World War II there has been tremendous success in the development of new methods for dating artifacts; the so-called "radiocarbon revolution" was only the first such discovery. The increasing accuracy of the various new techniques has brought about major changes in archaeological research strategies. This important new text compiles the work of some of today's most innovative archaeologists who summarize progress in their respective techniques over the last 30 years -- with an emphasis on developments of the last five -- and the status of current research.

Contents

Climatostratigraphy (M.J. Aitken, S. Stokes); Dendrochronology (J.S. Dean); Radiocarbon Dating (R.E. Taylor); Potassium-Argon/Argon-Argon Dating Methods (R.C. Walter); Fission-Track Dating (J. Westgate *et al.*); Uranium Series Dating (H.P. Schwarcz); Luminescence Dating (M.J. Aitken); Electron Spin Resonance Dating (R. Grun); Protein and Amino Acid Diagenesis Dating (P.E. Hare *et al.*); Obsidian Hydration Dating (I. Friedman *et al.*); Archaeomagnetic Dating (R.S. Sternberg); Surface Dating Using Rock Varnish (J.S. Schneider, P.R. Bierman); Index.

Archaeological Obsidian Studies: Method and Theory.

Advances in Archaeological and Museum Science, volume 3. Edited by M. Steven Shackley, University of California, Berkeley. 1998. ISBN: 0-306-45804-7. 237 pp. (cloth). \$49.50 (US and Canada); \$59.40 (elsewhere). Text adoption price on orders of six or more copies: \$29.50 each.

Description

The use of obsidian archaeometry has expanded dramatically in the last 20 years, due partly to technological advances and partly to recognition by archaeologists that archaeometrists provide much more information than mere measurement. Since the mid-70s, however, no book has appeared to document the latest advances. Archaeological Obsidian Studies, the only volume of its kind in print, corrects this situation by presenting the current state of the science, from volcanic glass geochemistry to hydration analysis. Archaeologists, museum professionals, geologists, materials scientists, and students will find this volume to be an indispensable guide to modern archaeometric theory and methodology, both in the lab and in the field.

Contents

Current Issues and Future Directions in Archaeological Volcanic Glass Studies: An Introduction (M.S. Shackley); A Systematic Approach to Obsidian Source Characterization (M.D. Glascock *et al.*); Mediterranean Islands and Multiple Flows: The Sources and Exploitation of Sardinian Obsidian (R.H. Tykot); Intrasource Chemical Variability and Secondary Depositional Processes: Lessons from the American Southwest (M.S. Shackley); Characterization of Archaeological Volcanic Glass from Oceania: The Utility of Three Techniques (M.I. Weisler, D.A. Clague); Application of PIXE-PIGME to Archaeological Analysis of Changing Patterns of Obsidian Use in West New Britain, Papua New Guinea (G.R. Summerhayes *et al.*); Factors Affecting the Energy-Dispersive X-Ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian (M.K. Davis *et al.*); Laboratory Obsidian Hydration Rates: Theory, Method, and Application (C.M. Stevenson *et al.*); Obsidian Hydration Dating at a Recent Age Obsidian Mining Site in Papua, New Guinea (W.R. Ambrose); Perspective in the 1990s on Method and Theory in Archaeological Volcanic Glass Studies (R.C. Green); Index.

Research Positions at Oxford

The following 2 positions are available at the Research Laboratory for Archaeology, University of Oxford:

Applications are invited for a Chemistry Graduate Research Assistant, at Grade 1B (stlg 15,159 - stlg 19,371) in the Research Laboratory for Archaeology. This post is initially for two years, with the strong likelihood of extension. Applicants should have an enthusiasm for a wide range of chemical techniques and approaches, and some interest in the complex chemistry of the environment. The main role of the post is to assist Prof. Robert Hedges in a variety of research programmes including developments within the Radiocarbon Accelerator Unit. Knowledge of a range of organic analytical techniques is necessary. The laboratory has two stable isotope ratio mass spectrometers, and experience in working with large complex instrumentation would be advantageous. Much of the work is concerned with the chemistry of archaeological material such as bone, and an informed interest in archaeology would be useful.

Applications are invited for a 3 year post in the Radiocarbon Accelerator Unit, at Grade 1A (salary range stlg 15,159 - stlg 22,785). The post is part-funded by NERC to develop the dating of insect remains, but includes a wider remit to improve chemical procedures in radiocarbon dating. The ideal candidate would have experience of hplc and related chemical techniques, knowledge of insect biology, and of the issues of carbon chemistry relevant to radiocarbon dating.

Applicants are strongly encouraged to discuss details of this post with Prof. Hedges. A letter of application, together with a c.v., two referees, and any other relevant information should be sent to Prof. R.E.M. Hedges, RLAHA, 6 Keble Road, Oxford OX1 3QJ (e-mail: robert.hedges@rlaha.ox.ac.uk, and tel. 01865-273930, fax: 01865-273932) to reach him by March 23rd.

Recent Publications

Accelerator Mass Spectrometry: Ultrasensitive Analysis for Global Science. C. Tuniz, J.R. Bird, D. Fink and G.F. Herzog. CRC Press, 1998. 398 pp. \$89.95 (cloth). ISBN: 0-8493-4538-3.

Archaeological Sciences 1995. Proceedings of a Conference on the Application of Scientific Techniques to the Study of Archaeology. Anthony Sinclair, Elizabeth Slater & John Gowlett (eds.). Oxbow Monograph 64, Oxbow Books, Oxford, 1997. \$120.00/£65.00 (cloth). ISBN 1-900188-04X.

Early Ironworking in Europe. Archaeology and Experiment. Volume 1: Regional Studies; Volume 2: Experimental and Technical Studies. Peter and Susan Crew (eds.). 1998. ca. 250 pp. each. £25 each. Plas Tan y Bwlch, Snowdonia National Park Study Centre, Maentwrog, Blaenau Ffestiniog, Gwynedd LL41 3YU.

Geological Methods for Archaeology. Norman Herz & Ervan G. Garrison. Oxford University Press, 1998. viii + 343 pp., includes notes and index. \$75.00 (cloth). ISBN 0-19-50924-1. Fourteen chapters on sites and the environment; dating techniques; site exploration; and artifact analysis.

Materials Issues in Art and Archaeology V. P.B. Vandiver, J.R. Druzik, J.F. Merkel & J. Stewart (eds.). MRS Symposium Proceedings Series volume 462, 1997. 48 papers, 427 pp. \$71.00 US, \$82.99 (non-US) (cloth). ISBN 1-55899-366-5.

The State-of-the-Art of Phytoliths in Soils and Plants. A. Pinilla, J. Juan-Tresserras & M.J. Machado (eds.). Monografía 4 del Centro de Ciencias Medioambientales, CISC, Madrid, 1997. 292 pp. 6.000 pts. ISBN 84-00-07674-5. This publication contains 28 papers out of the 54 presented in the 1st European Meeting on Phytolith Research (Madrid, Spain, september 1996). 25 are in English, 3 in Spanish. Orders to: A. Pinilla, Centro de Ciencias Medioambientales, CSIC; Serrano, 115 dpdo., E-28006-Madrid, Spain; fax: +34-1-5640800; email: ebvnp90@fresno.csic.es

SASweb and SASnet

The *Society for Archaeological Sciences* web page has moved to <http://www.wisc.edu/larch/sas/sas.htm>. Please update your bookmarks and any links on your own web pages. The SAS page includes information about our *Society*, an email list of members, back issues of the *SAS Bulletin*, and extensive well-organized links to archaeometric laboratories, funding agencies, publications, and professional societies.

SASnet, an electronic network for the Society for Archaeological Sciences, has been established to facilitate discussion about the applications of methods from the physical sciences to archaeological problems and provide rapid communication among archaeometrists and archaeologists. It's intended to provide a resource for archaeologists who need access to technical expertise and a forum for physical scientists to discuss the development of archaeological applications of their methods.

To subscribe, send the following single-line message, with the subject line blank, to: listserv@relay.doit.wisc.edu

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If you would like a listing of available user commands, send the following single-line message, with the subject line blank, to: listserv@relay.doit.wisc.edu

help

This is a moderated list. The moderator reserves the right to make decisions regarding the posting of messages. Those that are judged to fall outside the mission and scope of this list will be returned to the sender, with an explanation for the rejection; or with a suggestion to 'revise and submit', or a request for clarification. All messages not returned will be posted. No messages will be posted anonymously.

Questions or concerns regarding SAS-web or SASnet should be directed to the manager, James Burton (jhburton@facstaff.wisc.edu).

On the Web

Archaeological Computing

ads.ahds.ac.uk/ahds/project/computing/methods.html

Archaeological Sciences 1997

www.dur.ac.uk/Archaeology/confs/ArchSci97.html

Archaeometry '98

origo.hnm.hu/ametry98/homep1.html

Arch-Metals

www.mailbase.ac.uk/lists/arch-metals/

Association for the Study of Marble and Other Stones in Antiquity

ocaxp1.cc.oberlin.edu/~scarrier/ASMOSIA/Intro.html

Conservation Research

www.mailbase.ac.uk/lists/conservation-research/

GIS-Archaeology

www.mailbase.ac.uk/lists/gisarch/

Historical Metallurgy Society

users.ox.ac.uk/~salter/hms/index.html

Industrial Archaeology

www.mailbase.ac.uk/lists/ind-arch/

International Association for Obsidian Studies

www.peak.org/obsidian/obsidian.html

Missouri University Research Reactor (MURR)

www.missouri.edu/~murrwww/archlab.html

Oxford Research Lab for Archaeology & the History of Art

units.ox.ac.uk/departments/rlaha/

Stable Isotope Geochemistry

beluga.uvm.edu/geowww/isogeochem.html

Call for Papers

The Origins, Spread, and Significance of Maize Agriculture in the New World

A Symposium to be held at the 4th Meeting of the World Archaeology Congress, January 10-14, 1999, Cape Town, South Africa. Please submit inquiries, prospective titles and abstracts by April 15, 1998 to Robert H. Tykot, email: rtykot@luna.cas.usf.edu

Call for Papers

Animal, Vegetable, Mineral: Using Specialist Studies in Archaeological Interpretation
Boston University, October 31, 1998

The Graduate Student Association of the Department of Archaeology at Boston University is pleased to announce the Fourth Annual Open Forum for Graduate Students, on the theme of integrating specialist studies into archaeological interpretation. The goal of the conference is to provide a venue for encouraging the use of specialist studies in broader syntheses of human culture.

Although specialist studies are often isolated in archaeological discussions and publications, their results frequently have significant implications for questions beyond typology, species, or technology. For example, broad questions such as social identity, class, and status, economic and spatial organization, and regional interaction may be addressed through the use of various specialist studies. While many archaeologists include specialized studies in their research designs, the resulting data are often not fully incorporated into final reports. This conference will examine how feedback between various lines of evidence can strengthen archaeological interpretation.

Papers may address any chronological period and geographic area, and are limited to twenty minutes in length. Collaborative papers co-authored by specialists and non-specialists are particularly encouraged, as are interdisciplinary papers. For example, a paper might integrate more than one line of specialist evidence into a general synthesis in order to inform interpretation of a whole site or region. Papers may examine one type of evidence from the perspective of several disciplines, for example, using osteology and art history to examine the difference between taxonomic and cultural categorizations. Papers may also address methods for the use of specialist data or their incorporation into larger syntheses.

This conference is interdisciplinary. Submissions from departments of anthropology, archaeology, art history, classical studies, earth sciences, history, and related disciplines are welcome. Papers will be organized thematically into sessions on the basis of the abstracts selected.

Abstracts of 500 or fewer words should be submitted to the addresses below by post or e-mail on or before Friday, May 1. Please include your name, college/university and departmental affiliation, address, telephone number, and e-mail address.

This conference is sponsored by the Archaeology Graduate Student Association and the Department of Archaeology at Boston University. There is no registration fee. Contact: Graduate Student Conference Committee '98, Boston University (Karin Dunwoody, Susan Allen, Britt Hartenberger), Department of Archaeology, Boston University, 675 Commonwealth Ave., Boston, MA 02215. E-mail: allens@bu.edu; web: <http://www.bu.edu/ARCHAEOLOGY/www/events/events.html>

Meetings Calendar

Susan Mulholland, Associate Editor

* = new listings; + = new information for previous listings

1998

- * Feb. 21-22. 9th Annual Dept. of Anthropology Workshop in Archaeometry. New York State University, Buffalo, New York, USA. Ezra Zubrow, Dept. Anthropology, State University of New York, Buffalo, NY, USA; tel: 716-645-2511; email: archaeometry@hotmail.com; web: <http://wings.buffalo.edu/anthropology/argg.html>.
- * Feb. 27-March 1. The Transition from Prehistory to History in the Southwest. Albuquerque, New Mexico, USA. Deni Seymour, 2301 Yale Blvd. SE, Suite B2, Albuquerque, NM 87106, USA; tel: 505-246-2606; email: djlsmas@ail.com.
- * Feb. 28-March 1. 26th Annual Midwest Conference on Andean and Amazonian Archaeology, Anthropology, and Ethnohistory. University of Illinois, Urbana-Champaign, Illinois, USA. Helaine Silverman, Dept. of Anthropology, Univ. of Illinois, Urbana, IL 61801, USA; email: helaine@uiuc.edu.
- * March 1-6. 1998 Pittsburgh Conference. New Orleans, Louisiana, USA. PITTCON '98, Dept. CFP, 300 Penn Center Blvd., Pittsburgh, PA 15235-5503, USA; tel: 412-825-3220; fax 412-825-3224; email pittconinfo@pittcon.org. Symposium: Archaeology and Art - Diverse Applications of Analytical Chemistry.
- * March 5-7. Texas Academy of the Sciences, Annual Meeting. University of Texas, Tyler, Texas, USA. Special Symposium: Frontiers in Archaeometry. Jeff Leach, Centro de Investigaciones Arqueologicas, 130 N. Stevens, Suite E., El Paso, TX 79905, USA; tel: 915-533- 7977; email: jleach1532@aol.com; web: www.uttyl.edu/~cosc/tas/
- * March 6-7. 21st Midwest Mesoamerican Meeting. Michigan State University, East Lansing, Michigan, USA. Helen Pollard, Dept. of Anthropology, Michigan State University, 354 Baker Hall, East Lansing, MI 48824, USA; tel: 517-353-3135; fax: 517-432-5935; email: helen.pollard@ssc.msu.edu.
- * March 13-14. The Caddo Conference. Arkadelphia, Arkansas, USA. Meeks Etchieson, US Forest Service, PO Box 1270, Hot Springs, AR 71902, USA; tel: 501-321-5252; fax: 501-321-5382.
- * March 14-18. Earth's Changing Land: GCTE-LUCC Open Science Conferenc on Global Change. Barcelona, Spain. Sue Julson, tel 612-624-4238; email: julso001@tc.umn.edu.
- + March 24-28. 26th Annual meeting, Computer Applications and Quantitative Methods in Archaeology. Barcelona, Spain. J.A. Barcelo, Quantitative Archaeology Lab, Dpt. of Prehistory, Universitat Autònoma de Barcelona, Barcelona, Spain; email: ilphd@blues.uab.es; web: <http://blues.uab.es/~ilphd/caa98.html>.
- March 25-29. 63rd Annual Meeting of the Society for American Archaeology. Seattle, Washington. J.Driver, Program Chair, Dept. of Archaeology, Simon Fraser

- University, Burnaby, British Columbia, V5A 1S6, Canada; tel 604-291-4182; fax 604-291-5666; email: driver@sfu.ca.
- * April 1-4. 67th Annual Meeting of the American Association of Physical Anthropologists. Salt Lake Hilton, Salt Lake City, Utah, USA. Clark Larsen, Research Laboratories of Anthropology, Alumni Bldg., CB#3120, University of North Carolina, Chapel Hill, NC 27599- 3120, USA; tel: 919-962-3844; email: cslarsen@email.unc.edu.
 - * April 2-4. 75th Annual Central States Anthropological Society Meeting. Kansas City, Missouri, USA. Harriet Ottenheimer, SASW/Anthropology, Waters Hall, Kansas State University, Manhattan, KS 66506, USA; tel: 785-485-2703; fax: 785-532-6978; email: mahafan@ksu.edu.
 - * April 5-7. Perspectives in Amino Acid and Protein Geochemistry. Washington, DC, USA. Glenn Goodfriend, Geophysical Laboratory, Carnegie Institution of Washinton, 5251 Broad Brand Road, NW, Washington, DA 20015-1305, USA; tel: 202-686-2410, ext. 4432; fax: 202- 686-2419; email: goodfriend@gl.ciw.edu.
 - * April 6-10. 3rd International Symposium on C14 and Archaeology. Lyon, France. Preprints and abstracts available on the web: www.univ-lyon1.fr/~carbon14/congres.htm. Secretariat, Centre de Datation par le Radiocarbone, Université Claude-Bernard Lyon 1, Bât. 217-43 Boulevard du 11 Novembre, 69622 Villeurbanne, France. Tel 33-4-72448257; fax 33-4-72431317; e-mail cdrc14@cismsun.univ-lyon1.fr
 - * April 8-11. Society for California Archaeology Annual Meeting. Hyatt Islandia Hotel, San Diego, California, USA. Michael Sampson, California State Parks, 8885 Rio San Diego Dr., Suite 270, San Diego, CA 92108, USA; tel: 619-220-5323; email: msampson@parks.ca.gov. NOTE: GPS/GIS symposium-Integration of the Global Positioning System and Geographic Information Systems in Archaeological Inquiry. Jeff Hamilton, NCRM, PO Box 509, Redwood Valley, CA 95470, USA; tel: 707-485-7211, ext. 12; fax: 707-485-8962; email: hamilton@ncrm.com.
 - * April 20-22. Applications of Stable Isotope Techniques to Ecological Studies. Saskatoon, Saskatchewan, Canada. Keith Hobson, Canadian Wildlife Service, 115 Perimeter Road, Saskatoon, SK S7N 0X4, Canada; tel: 306-975-4102; fax: 306-975-4089; email: Keith.Hobson@EC.GC.CA; web: <http://ecsask65.innovplace.saskatoon.sk.ca/isotope/>
 - April 27-May 1. International Symposium on Archaeometry. Hungarian National Museum, Budapest, Hungary. Katalin T. Biro, Hungarian National Museum, Dept. of Information, H- 1450 Budapest Pf. 124, Hungary; tel/fax: 36-1-2101/338; email: h5852tbi@ella.hu; <http://origo.hmn.hu/ametry>.
 - * May 1-3. 82nd Annual Meeting of the New York State Archaeological Association. Bonnie Castle Resort Hotel, Alexandria Bay, New York, USA. Theme: St. Lawrence River archaeology. Tim Abel, Program Chair, PO Box 81, Philadelphia, NW 13673, USA; tel: 315- 642-0202; email: abeltj@northnet.org.
 - * May 7-10. 33rd International Congress on Medieval Studies. Western Michigan University, Kalamazoo, Michigan, USA. The Medieval Institute, Western Michigan University, 1201 Oliver St., Kalamazoo, MI 4900803801, USA; tel: 616-387-8745; fax: 616-387-8750; email: mdvl_congres@wmich.edu; web: <http://www.wmich.edu/medieval/> Session: From Paradis to Vegetable Patches-Interdisciplinary Approaches to Monastic Gardens. Susan Pennington, Dept. Anthropology, Univ. of Minnesota, 215 Ford hall, 224 Church St. SE, Minneapolis, MN 55455, USA; tel: 612-625-3095; fax: 612-625-3095; email: penn0010@gold.tc.umn.edu.
 - * May 16. 1998 Historical Metallurgy Society Annual General Meeting, and Spring Meeting: Archaeology and Science. Several workshops on metallurgy. Contact: J.G. McDonnell, Department of Archaeological Sciences, University of Bradford, Bradford, West Yorkshire BD7 1DP, UK.
 - * May 21-24. 23rd Colloque International pour l'étude de l'âge du Fer. Dolors Codina, Museu d'Arqueologia de Catalunya-Girona, Pedret 95, 17007-GIRONA, Spain; tel: 34-72-2046-37; fax: 34-72-21-04-54.
 - * May 25-June 5. NATO Advanced Study Institute: Numerical Modeling of the Global Atmosphere. Dr. Philip Mote, NWSA, PO Box 3027, Bellevue, WA 98009, USA; web: <http://www.nwsa.com/ASI>.
 - * June 2-6. Canadian Association of Geographers Annual Conference. Ottawa, Ontario, Canada. Special session: Impacts of Global Climate Change in Southwest Yukon. Peter Johnson; email: peter@aix1.uottawa.ca.
 - * June 11-15. 5th Meeting, Association for the Study of Marble and Other Stones in Antiquity. Museum of Fine Arts, Boston, Massachusetts, USA. ASMOSIA, Dept. of Fine Arts, 465 Huntington Ave., Boston, MA 02115, USA; tel: 617-369-3259; fax: 617-369-3276; email: p.russell@mfa.org; web: <http://www.oberlin.edu/~scarrier/ASMOSIA/Intro.html>.
 - * June 14-18. Chapman Conference: Mechanisms of Millennial-Scal Global Climate Change. Cliff Lodge, Snowbird, Utah, USA. AGU Meetings Dept., Millennial-Scal Global Climate Conference, 2000 Florida Ave. NW, Washington, DC 20009, USA; tel: 202-462-6900; fax: 202-328-0566; email: meetinginfo@kosmos.agu.org.
 - * June 20-24. Joint Meetings: Society for the Study of Evolution, Society of Systematic Biologists, and American Society of Naturalists. University of British Columbia, Vancouver, British Columbia, Canada. Daphne Fairbairn, Dept. of Biology, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Quebec H3G 1M8, Canada; email: fairbrn@vax2.concordia.ca; web: <http://www.zoology.ubc.ca/~schluter/meeting98.html>
 - * June 28-July 4. Dual Congress: International Association for the Study of Human Palaeontology and International Association of Human Biologists. Johannesburg and Pretoria, South Africa. Dept. of Anatomical Sciences, University of the Witwatersrand, Medical School, 7 York Road, Parktown, Johannesburg 2193, South Africa; tel: 27-11-647-2054/2526; fax: 27- 11-643-4318; email: 055dc98@chiron.wits.ac.za; web: <http://sunsite.wits.ac.za/conferen/dual98/home.html>.
 - * July 2-5. International Small Islands Studies Association, ISLANDS V. Mauritius. Topic: Small Islands in the Third

- Millennium-Problems and Prospects of Island Living. Web: <http://www.arts.unsw.edu.au/Centres/SouthPacific/ISISA.html>.
- July 26-Aug. 2. The 21st Century: The Century of Anthropology. 14th Congress of the International Union of Anthropology and Ethnological Sciences. The College of William and Mary, Williamsburg, Virginia, USA. Tomoko Hamada, 14th ICAES Executive Secretary, Dept. of Anthropology, college of William and Mary, Williamsburg, VA 23187-8795, USA; tel: 804- 221-1055, fax: 804-221-1066; email thamad@mail.wm.edu.
- * Aug. 20-26. 9th International Conference on Geochronology, Cosmochronology, and Isotope Geology. Beijing, China. Secretariat of ICOG-9, Chinese Academy of Geological Sciences, Baiwanzhuang Road 26, Beijing 100037, China; tel: 0086-10-68311545; fax: 0086-10- 68311545; email: liudunyi@public.bta.net.cn.
- Aug. 23-29. 8th International Congress, International Council for Archaeozoology. University of Victoria, Victoria, British Columbia, Canada. Rebecca Wigen, rjwigen@uvvm.uvic.ca or Quentin Mackie, qxm@uvic.ca. Tourism Victoria, 812 Wharf St., Victoria, B.C. Canada, V8w 1T3; tel: 250-382-6539; web: <http://travel.bc.ca=09>; web: <http://home.sprynet.com/sprynet/fdirrigl/metting.htm>.
- Symposium: High Resolution Faunas at the Pleistocene/Holocene Boundary. Jon Driver, Dept. of Archaeology, Simon Fraser University, Burnaby, BC V5A 1S6, Canada; email: driver@sfu.ca.
- Aug. 27-28. Second International Meeting on Phytolith Research. Aix en Provence, France. 2nd IMPR, J.D. Meunier, CEREGE, Europole Mediterranee de l'Arbois-BP 80, 13545 Aix en Provence Cecex 04, France; tel: 33-0-4-42-97-15-26; fax: 33-0-4-42-97-15-40; email: phytomeeting@cerège.fr; web: <http://www.cerège.fr>.
- * Sept. 5-7. 15th Biennial Meeting of the American Quaternary Association. Puerto Vallarta, Mexico. Socorro Lozano Garcia, Instituto de Geologia, Universidad Nacional Autonoma de Mexico, Ciudad Universitaria, Apartado Postal 70-296, 04510, Mexico City, Mexico; fax: 52-5-550-6644.
- * Oct. 4-10. V Congreso de la Asociacion Latino-americana de Antropologia Biologica y VI Simposio de Antropologia Fisica "Luis Montane." Universidad de La Habana, Cuba. Antonio J. Martinez Fuentes, Secretario Asociacion Latino-americana de Antropologia Biologica, Museo Antropologico Montane, Facultad de Biologia, Universidad de La Habana Calle 25 #455, entre J e I, Vedado Ciudad Habana 10400, Cuba; tel: 53-7-32-9000/79-3488; fax: 53-7-32-1321/33- 5774; email: montane@comuh.uh.cu.
- * Oct. 14-17. 56th Annual Meeting of the Plains Anthropological Conference. Radisson Inn, Bismarck, North Dakota, USA. Fern Swenson, State Historical Society of North Dakota, 612 E. Blvd. Ave., Bismarck, ND 58505, USA; tel: 701-328-3675; email: ccmail.fswenson@ranch.state.nd.us.
- Oct. 26-29. Geological Society of America, Annual Meeting. Toronto, Ontario, Canada. GSA Meetings Department, tel: 1-800-472-1988 or 303-447-2020, ext. 133; email: meetings@geosociety.org; <http://www.geosociety.org>
- * Oct. 31. 4th Annual Conference, Graduate Students Association, Archaeology Dept., Boston University. Boston University, Boston, Massachusetts, USA. Topic: Animal, Vegetable, Mineral: Using Specialist Studies in Archaeology. GSA Conference 1998, Dept. of Archaeology, Boston University, 675 Commonwealth Ave., Boston, MA 02215, USA; tel: 617- 353-3415; fax: 617-353-6800; email: dunwoody@bu.edu.
- Nov. Inter-Congress Meeting of Commission 4, Union Internationale des Sciences Prehistoriques et Protohistoriques. Arizona, USA. Keith Kintigh, Dept. Anthropology, Arizona State University, Tempe, AZ 85287-2402, USA; tel: 602-965-6900; fax: 602-965-7671.
- * Nov. 2-8. IV Jornadas de Arqueologia de la Patagonia. Rio Gallegos, Argentina. IV Jornadas de Arqueologia de la Patagonia, INALP, 3 de Febrero 1370 (1426), Buenos Aires, Argentina; tel: 54-1-783-6554; fax: 54-2-783-3371; email: rafa@bibapl.edu.ar.
- Nov. 7-11. 2nd International Climate and History Conference. Climatic Research Unit, Norwich, United Kingdom. Trevor D. Davies, Climatic Research Unit, University of East Anglia, Norwich NR4 7TJ, United Kingdom; tel: 44-1603-592721; fax: 44-1603-507784.

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- * Jan. 5-6. Recent Advances in Quaternary Biostratigraphy. Papers are invited for a discussion meeting on recent advances in Quaternary biostratigraphy, especially in the British Isles. Deadline for abstracts is October 15, 1998. Dr. Danielle Schreve, Dept. of Paleontology, Natural History Museum, London SW7 5BD UK. Tel 44-171-938-9258; fax 44-171-938-9277; email d.schreve@nhm.ac.uk.
- * Jan. 10-14. World Archaeology Congress 4. Cape Town, South Africa. Theme: Global Archaeology at the Turn of the Millennium. Carolyn Ackermann, WAC4, Congress Secretariat, PO Box 44503, Claremont 7735, South Africa; tel: 27-21-762-8600; fax: 27-21-762-8606; email: wac4@globalconf.co.za; web: <http://www.globalconf.co.za/wac4>.
- * May. 1999 International Rock Art Conference. Ripon College, Ripon, Wisconsin, USA. Deborah Morse-Kahn, Regional Research Consortium, Minneapolis MN, USA; tel: 612-925- 0749; email: deborah@pclink.com; web: <http://www.pclink.com/cbailey>
- Aug. 3-11. XV INQUA Congress 1999. Durban, South Africa. Theme: Environmental Background to Hominid Evolution in Africa. Mrs. E. Aucamp, PO Box 798, Silverton, Pretoria 0001, South Africa; fax: 27-12-8411221; email: eaucamp@geoscience.org.za; web: inqua.geoscience.org.za
- * Aug. 23-29. 8th International Congress of the International Council for Archaeozoology. University of Victoria, Victoria, British Columbia, Canada. ICAZ '98, Conference Management, Division of Continuing Studies, University of Victoria, PO Box 3030, Victoria, BC V8W 3N6, Canada; email: ICAZ@uvcs.uvic.ca; web: <http://www.uvcs.uvic.ca/conferce/archzool/>.

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The quarterly newsletter of the SAS contains short articles, laboratory profiles, SAS meeting summaries, recent publications and book reviews, and professional meeting announcements. The SAS Bulletin is automatic with SAS membership. Indeed, the Bruker instrument was found to have sufficient intra-instrument consistency for geochemical source determination. Fall 2009. SAS Bulletin. page 17. Figure 3. K-means cluster analysis centroids centered around El Chayal (upper left) and Ixtepeque (lower right).