SAS Bulletin

Society for Archaeological Sciences

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SAS Annual Meeting

The Annual Meeting of the Society for Archaeological Sciences will take place during the 59th Annual Meeting of the Society for American Archaeology, to be held at the Disneyland Hotel, Anaheim, California, April 20-24, 1994. The SAS Business Meeting will be on Friday, April 22 at 4:30 pm. The location will be announced in the Final Program.

Other events at the SAA Meeting will be of interest to SAS members. These include the following:

Events

GIS in Archaeology Workshop. Offered by the University of Nevada, Reno, this course will focus on basic principles and practical applications of Geographic Information Systems (GIS) for use in archaeological research and management. Instructor: W. Frederick Limp; $250 fee; 4/18–4/19, 8:30 am–5:00 pm.

Paleoanthropology Society Annual Meeting. 4/19–4/20, 8:30 am.

GIS Training Workshop. This day-long computer workshop will introduce the fundamental concepts and capabilities of GIS through direct hands-on experience. Instructor: Kenneth L. Kvamme; $95 fee; 4/20, 9:00 am.

International Association for Obsidian Studies Annual Meeting. 4/20, 1:30 pm.

Adobe and Stone Conservation Tour at the Getty Conservation Institute. 4/20, 2:00 pm.

International Association for Obsidian Studies Workshop on Field and Laboratory Reporting Standards in Obsidian Geochemistry. 4/20, 3:30 pm.

Symposia of interest

Human Evolution: Interaction of Biology and Behavior. 4/20, evening.

Method and Theory in Phytolith Analysis (sponsored by Society for Phytolith Research). 4/21, afternoon.

The Archaeology of Global Change (Plenary symposium). 4/21, evening.

The Archaeology of the Pleistocene-Holocene Transition in Africa, the Near East & Europe (INQUA). 4/22, morning.

Prehistoric Human Impacts on the Environment: A Global Perspective. 4/22, morning.

The Archaeology of the Pleistocene-Holocene Transition in Asia, Australia, and the Americas (INQUA). 4/22, morning

Bone Chemistry and Human Diet–Recent Advances, Recent Retreats (Fryxell Symposium). 4/22, afternoon.

Bioarchaeology of the Chinchorro People. 4/23, afternoon

Great Basin Bioarchaeology: Desert Wetlands Adaptations. 4/23, afternoon.

General Sessions of interest

Information Management and Remote Sensing. 4/22, afternoon. □

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Compiled by Jodie Dalton (address on back page) □

IAOS Annual Meeting, and Workshop on Field and Laboratory Standards in Obsidian Geochemistry

This year the International Assocation for Obsidian Studies annual meeting will be held in conjunction with the SAA Annual Meeting in Anaheim, California. The business meeting will run from 1:00 pm until 2:30 pm on Wednesday, April 20. Afterwards, IAOS will be sponsoring a workshop and discussion on field and lab standards in obsidian geochemistry. The timing of the allied annual meetings and the workshop is very good since many obsidian researchers from Oceania and the Mediterranean will be in attendance, as well as a great number from the Americas. Everyone is invited to attend the meetings and the following discussion and workshop. Following is an abstract of the workshop submitted to SAA:

> Geochemical analyses of obsidian and volcanic glass in archaeology has become very much a part of archaeological theory and method in many parts of the world. While the technology of chemical analysis has improved markedly (INAA, XRF, PIXE-PIGME), and the data generated has proliferated, there has been virtually no attempt to coordinate reporting standards. In this workshop, a number of researchers active in the field of obsidian geochemistry and interested parties from SAA and IAOS will discuss these problems and prospects for the decades to come, formulating provisional reporting standards for the collection and analysis of obsidian source standards and artifacts. The basic list of topics to be discussed will include: the petrology of silicic glasses; field methods in the collection of source standards; instrumental techniques; elements of interest; data presentation; and inter-laboratory cooperation and data sharing. Any interested party is invited to participate, and the results will be published in the IAOS Newsletter and possibly other venues.

Contributed by Steven Shackley (address on back page) □

News Of Archaeometallurgy

The Dartmoor Tinworking Research Group is planning to celebrate the 500th anniversary of the tinners' Great Court next September. For further details write Philip Newman, Dartmoor Tinworking Research Group, 2 Kiln Orchard, Newton Abbot, Devon TQ12 1PJ, England.

The first major study on *The Celtic Sword*, by Radomir Pleiner with contributions by B.G. Scott, was published in March 1993 by Oxford University Press. They conclude that the technological level of these swords was higher than suggested by ancient authorities and that they exhibit extensive development in forging and carburization. The book (ISBN 0 19 8134118) has 216 pages and 36 plates and is available in hardcover for £55 from Oxford University Press, Saxon Way West, Corby, Northants NN18 9ES, United Kingdom, telephone 0536-741-519, fax 0536-746-337, or for US $95 plus $1.50 for shipping and handling, from Order Processing Department, Oxford University Press Distribution and Information Systems, 2001 Evans Road, North Carolina 27513, USA, telephone 919-667-0977, fax 919-677-1303. Access, Visa, American Express, and Diner's Club are accepted.

The *SME Handbook*, 2nd edition contains a short history of mining by Willard Lacy and his son John C. Lacy. The *Handbook* is available from the Society of Mining, Metallurgy, and Exploration, Inc., Publication Sales, IJSM, P.O. Box 625002, Littleton, Colorado 80162-5002, USA.

Sara Wright has translated E.N. Chernykh's *Ancient Metallurgy in the USSR: The Early Metal Age* for the New Studies in Archaeology series, published in 1992 by Cambridge University Press. It is a detailed review of metal assemblages, with typology and distribution, for which there is little information elsewhere in English. Though

Archaeometallurgy (continued on p. 8)

Geophysics News

Press Release: New Ground-Penetrating Radar Introduced

GeoRadar Inc. has introduced an improved ground penetrating radar based on stepped-FM technology. Ground penetrating radar has many applications in archaeology, including mapping buried walls and foundations; measuring soil depths; detecting tunnels and cavities; delineating burial sites; and locating artifacts.

The stepped-FM design appears to offer several advantages over the pulsed radar systems now commercially available. Because the antennas have a narrow cone of illumination, images created by the system resemble the actual object rather than the broad hyperbolas characteristic of pulse systems. Closely-spaced objects appear as distinct targets which can be resolved in the image. The stepped-FM system requires a minimum of controls and adjustments, so a non-technical user can operate the system and interpret the results as well.

The system was developed and refined over several years in a government laboratory funded by the U.S. Department of Energy. The technology is being licensed to GeoRadar Inc. as part of a U.S. Government initiative to encourage transfer of defense technology to private industry. GeoRadar is producing a commercial version of the system, with enhancements in its imaging, plotting, and processing capability. While stepped-FM systems require substantially more processing capability than pulse systems, digital signal processing technology has become inexpensive and reliable with the advent of modern DSP integrated circuits.

GeoRadar Inc.'s ground-penetrating radar system

For more information, contact: Doug Crice, President, GeoRadar, Inc., 19623 Via Escuela Drive, Saratoga, CA 95070 USA; tel: 408-867-3792; fax; 408-867-4900. □

GPR '94: 5th International Conference On Ground Penetrating Radar

June 12-16, 1994, Kitchener, Ontario, Canada

Ground penetrating radar (GPR) is increasingly becoming an accepted tool for a wide range of non-invasive mapping applications. This conference will bring together GPR experts and users, and continues a series of biannual meetings that focus on GPR technology and applications.

Topics: GPR theory and modeling; equipment developments; data processing and display techniques; survey design and methodology; environmental applications; detection of subsurface contaminants; geotechnical applications; ice, permafrost and glacier studies; pavement and bridge deck evaluation; radar stratigraphy for geological exploration; mining and tunneling applications.

Time will be made available for informal discussions and to view poster papers. One-half day of the conference will be allotted to demonstrations of applications.

For more information, contact: GPR '94, Waterloo Centre for Groundwater Research, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada; tel: 519-885-1211; fax: 519-725-8720. □

New Journal: *Archaeological Prospection*

A new journal has been initiated called *Archaeological Prospection*. The journal seeks articles on all aspects of the geophysical prospection of archaeological sites. The editors are soliciting review papers, details of important work in progress, small case reports and results of studies which do not warrant a full paper. For more information write to the editors, either Professor Mark Pollard or Dr. Arnold Aspinall, Department of Archaeological Sciences, University of Bradford, West Yorkshire, BD7 1DP, United Kingdom; tel 44-274-383531; fax 44-274-385190.

Contributed by John Weymouth, Department of Physics, University of Nebraska, Lincoln, NE 68588, USA; tel: 402-472-2775; e-mail weymouth@unlinfo.unl.edu. □

Conference Reports

Science for Life? The COPUS/SERC Conference For Scientists and the Media

The extravaganza known as the Annual Meeting of the British Association for the Advancement of Science, held at Keele University, in September 1993, provided the venue for the COPUS/SERC conference "Research Horizons - Science for Life." This one-day conference was organized by the Committee on the Public Understanding of Science (COPUS) and the Science and Engineering Research Council (SERC), on the theme of scientists communicating their work to the general public.

"... all aspects of archaeological research, including science-based archaeology, should look to the potential public audience as a method of spreading the message about the joys of research and learning."

Archaeology as a whole is a very public-friendly subject and much more accessible than some other science topics addressed at this meeting, for example chaos theory of particle physics. As such, all aspects of archaeological research, including science-based archaeology, should look to the potential public audience as a method of spreading the message about the joys of research and learning. We should learn to cultivate the public's interest in our research field. A high profile which stimulates public interest and public support may help to encourage project funding, something for which science-based archaeology is continuously searching.

The overwhelming conclusion was that for a general audience, scientists must learn to put their "punch line" up at the top, rather than lay out introduction, aims, methodology, results, and finally, the conclusions. For many of us this means a complete about-face in our approach to writing, but a valuable lesson to learn if we are to move away from the "ivory tower" image of the researcher, and to communicate with the rest of the (non-academic) world.

Designed to demonstrate the scope and variety of subjects funded by SERC, the conference consisted of two half-days of prepared lectures covering a number of diverse and erudite subjects and pitched at a level to amuse and entertain the non-specialist audience. In addition, the lectures provided Wendy Barnaby, journalist and Chair of the Association of British Science Writers, with the source material. Barnaby's role was to comment on presentation of research to a mixed or non-specialist audience.

Of most interest at this conference were comments by Barnaby and the lively discussions that followed, involving academic and other media representatives. In her critiques of these talks, Barnaby stressed many important points that are of significance both to the researchers preparing verbal presentations, and those aiming at press releases or articles. Summarized in Table 1, Barnaby commented on significant differences in writing styles between journals and newspapers. There are, however, some ideas that can be applied equally to both outlets, such as simple language and brevity.

Common to both writing styles is the necessity to consider and address the target audience. A paper prepared for a learned journal, with a small but knowledgeable readership, is very different from a piece written for a newspaper. The latter has a larger audience but its background knowledge of the subject is small or absent. The astonished conference participants heard the revelation that broad-sheet newspapers such as *The London Times* or *The Independent* write their articles for an audience with a reading age of 12 years! Less surprising was the disclosure that the reading age for tabloids such as *The Sun* newspaper was a mere 7 years. In practical terms the primary aim of the low reading ages is to enforce the use

Table 1. Comparison between writing styles for learned journals and popular newspapers.

Criterion	Scientific journals	Newspapers
Consideration of the target audience	Yes	Yes
Consideration of editorial restraints	Not necessarily	Yes
Headline to inform and intrigue	Not necessarily	Yes
Simple language	Not necessarily	Yes
Technical words	Yes	No
Personal pronouns	No	Yes
Direct quotations	Yes	Yes
Relation of research to reader	No	Yes
Placement of results and conclusions	End	Beginning

of simple language. Of course, it does not necessarily mean that only simple ideas can be conveyed.

The very formalized framework of learned journals usually precludes the use of personal pronouns ("we" and "I"), stressing instead the use of the third person, and a restrained and rigorous, if not sometimes downright stodgy language structure. This formalized language would be singularly inappropriate for newspaper readers. Personal pronouns help to associate the work with an individual or group of individuals, in the same way that direct quotations are popular. Lack of jargon in articles or talks aimed at a general, non-specialist audience is a prerequisite to a successful "story." The use of jargon, while uniting the knowledgeable few, excludes the majority.

Information about story selection within newspapers was particularly enlightening. A press release from a research institution or company has to catch the eye of the science writer (rather than the somewhat larger mouth of the rubbish bin), and gain approval from the sub-editor. A title that informs and intrigues is necessary to encourage first the journalists, and then the reading public, to stop, read, and investigate. The same is true, incidentally, for titles of conference papers or general talks.

Barnaby stressed the importance of giving the punch line right at the start. A primary position for the "payoff," or research conclusions, is imperative for journalists and those who desire a wider audience for their research. Furthermore, the sub-editor, even if approving of the subject matter, could still cause chaos with a piece written in the traditional style, placing the results and conclusions at the end. If the paper is shortened, the end is likely to be chopped off, removing any results and conclusions located there. More important than this practical constraint, however, is the desire to interest and captivate the audience so that they will "stay with" the item, reading or listening to the details behind the headline results and conclusions.

Having attracted the reader with interesting headlines and earth-shattering results, a written piece requires brevity and conciseness, so that the reader doesn't lose interest in the middle. Equally, the recipient of this news wants to know "So, what? How does this relate to me?" Placing the significance of research conclusions in a personal framework is very seductive to the audience.

One final point that came out of the discussion is that science should be fun! At a time in Britain when fewer children are studying science subjects after the age (14+) when their compulsory science education ceases, the interesting and exciting aspects of science require emphasis. Fewer children studying science leads to fewer university science students and fewer research scientists in academia and industry. Besides, science *is* fun as well as functional.

The consensus from those delegates to whom I had the opportunity to talk was that the conference had successfully raised many important points and started everyone thinking about a wider (non-specialist) audience. Many delegates, including myself, felt that we would have preferred more time to discuss the subject with colleagues from other disciplines and with media representatives. Another suggestion was the creation of a regular forum or course, where budding (and not so budding) research scientists can learn about communication skills. Too often we communicate only with other interested specialists in our field and forget that there is a wider audience outside. In these days of budgetary restraints, the wider the appeal of a subject, the more likely it is to receive and / or maintain funding.

Contributed by Dr. Alix H. Powers-Jones, SERC Post-doctoral Research Fellow, Department of Archaeology, University of Cambridge, Downing Street Cambridge, CB2 3DZ, England □

Analytical Methods in Archaeology
Geological Society of America Annual Meeting, Boston, Oct. 27, 1993

The annual symposium of the Archaeological Division of the GSA has, for the last few years, emphasized conceptual themes such as scale in archaeological geology. This year, for a change, the focus was on techniques, and how advances in scientific methodology have aided in the interpretation of archaeological sites. Many of the techniques discussed were familiar to geologists and geochemists in attendance: the emphasis of this symposium was on methods that had grown out of the earth sciences, rather than more arcane but trendy topics such as replication of fossil DNA.

Although an entire symposium could have been devoted to techniques of dating alone, the number of papers on this topic was limited to leave room for other topics. The leadoff paper (inadvertently scheduled for the morning divisional session) was by this writer, on Uranium-series dating. I emphasized the increase in precision of mass spectrometric dating, and possible high-precision dating using tooth enamel. The afternoon session continued the theme of age determination at archaeological sites, starting with luminescence methods. Steve Forman (Ohio State) reviewed the more familiar method of thermoluminescence, showing how it could be used on detrital sediments, while Dorothy Godfrey- Smith (Dalhousie University) introduced the audience to the newer but potentially more versatile method of optical dating, in which the luminescence in one wavelength is excited by shining a light at another wavelength. Both methods measure trapped electrons produced by surrounding radioactivity, a principle which was also invoked for ESR (electron spin resonance) dating of tooth enamel, as reviewed by Jack Rink (McMaster University). The advantage of using a ubiquitous material such as tooth enamel was discussed, as were the problems of estimating

the internal and external radiation dose rates, which is critical to establishment of the ESR age.

The last word in ^{14}C dating was presented by Tom Stafford (INSTAAR), who has been perfecting procedures for extraction of chemically pure components from fossil bones. He showed the importance of comparing results from a variety of materials at a site, including possible contaminants. Paleomagnetism was discussed in two papers. Rob Sternberg discussed the problems of archaeomagnetic dating, by showing the risks and potential of fitting data to master curves, while Ken Verosub (University of California, Davis) focused on the problems inherent in magnetic measurements of baked clays, particularly paleointensity estimates. Finally, the discussion of dating methods was rounded out by Ofer Bar-Yosef (Harvard University), who discussed the influence of new dating results on interpretation of the last phases of hominid evolutionary history, from the vantage point of some key Israeli cave sites. He also noted the use of FTIR (Fourier transform infrared) analyses of cave sediments to interpret diagenesis of bones.

Two papers focused on techniques for reading past climate from materials at sites. Thure Cerling (University of Utah) summarized the use of studies of stable carbon isotopes as indicators of climate shift in Asia and Africa, and possible links between these abrupt climate shifts and pulses in primate evolution. Shifts from C3 to C4 biomes are recorded both in soil carbonates and in tooth enamel. Another paper by Paul Goldberg reviewed the use of soil micromorphology as an interpreter of past conditions, taking the audience through a vast range of sites and textures.

Another aspect of analytical methodology in archaeology covered in the symposium was the characterization of materials found at sites. Two papers were presented on analysis of ceramics. Patricia Capone (Harvard University) gave a general review of petrographic studies of ancient ceramics, after which Maria Massucci (Drew University) focused on the use of trace element analyses of ceramics and possible source materials as methods of tracing the source and movement of ceramics in ancient times. Ken Verosub had, in his presentation, also discussed use of magnetic measurements as clues to technology of ceramic production.

Organic materials in archaeological contexts are being analyzed by ever more complex methods. Barbara Sherriff (University of Manitoba) described the use of nuclear magnetic resonance for sourcing of archaeological materials such as amber. NMR (nuclear magnetic resonance) spectra of residues found in the interior of ceramics were shown to give clues to the nature of foods that had been cooked in the vessels. Pat Julig (Laurentian University) reviewed the various biochemical tests that have been applied to residues found on the cutting edges of stone tools. Blood groups and other animal-derived residues can be recognized by immunological tests and other techniques. Nik van der Merwe (Harvard) discussed the isotopic analysis of human bone collagen and the inferences about paleodiet that can be drawn from these studies, including the identification of marine vs. terrestrial food sources, and the use of maize by native Americans.

The symposium was rounded out by a talk on sourcing of marbles by Norman Herz (University of Georgia); a wide range of analytical techniques including Sr and stable C and O isotopes have been used to determine the sources of marbles used by artists of antiquity. He showed that the most precise answers seem to be given by combinations of three or more methods, but even then some ambiguity may remain.

The symposium was well-attended for most of its duration, and seemed to draw interest from far outside the usual archaeogeological crowd. It is hoped that a similar program could be run every few years to update progress in research methods in this field. For some listeners, this was the first time to hear about certain of the techniques (e.g., ESR dating or NMR characterization of organic residues). No publication is planned for the proceedings of this symposium.

Reviewed by Henry P. Schwarcz, Department of Geology, McMaster University, Hamilton, Ontario, L8S 4M1, Canada □

Midwest Archaeological Conference

Increasingly, at regional and other non-specialized archaeological meetings one sees a greater proportion of papers of direct interest to the wide interpretive range of archaeological science. The recent Midwestern Archaeological Conference held in Milwaukee (October 22-24, 1993) was no exception in this regard. Relevant papers included the following. Joseph Alan Artz reported on stratified prehistoric sites in loess-mantled uplands of Iowa as evidence for slope evolution and pedogenesis during the Holocene. James G. Foradas discussed the implications of chert sourcing using ICP (inductively coupled plasma) Spectrometry and conversion to common mineral constituents as an aid to sourcing and distinguishing macroscopically similar materials. Stephen C. Lensink reanalyzed previously collected radiocarbon dates and concluded that the temporal span for Mill Creek sites from northwestern Iowa is more attenuated than formerly thought, and these are therefore coterminous with the major Mississippian centers in the American Bottom region of Illinois indicating a possible increased trade relationship between the two areas. As a result of his intensive survey of rockshelters in a confined area of southwestern Wisconsin, David Lowe recognized variations in site size, use, and distribution as they pertain to the local geology.

Tom Pleger examined functional aspects of copper implement technology from a multi-component site in northeast Wisconsin. In comparing soil probes from possible effigy mounds in eastern Wisconsin with adjacent nonmound contexts, Gail M. Saler identified an efficient method for distinguishing mounds and historic disturbances. Robert F. Sasso and William G. Gartner discussed ongoing documentary, pedologic, archaeobotanical, and archaeological research on prehistoric agricultural features in Wisconsin and their differential use. Finally, Keith A. Sverdrup and David F. Overstreet reported on a resistivity survey of a pauper cemetery in Milwaukee and concluded that close interval measurement can effectively be employed to differentiate individual burials.

Contributed by William I. Woods, Department of Geography, School of Social Sciences, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026-1452 □

Archaeometallurgy **(continued from p. 3)**

analyses and metallographic studies are not presented, these are discussed. It is available in hardcover (ISBN 0 521 25257 1) for US $90 from Cambridge University Press at 40 West 20th Street, New York City 10011, telephone 1-800-872-7423, or £60 from the Press at The Edinborough Building, Cambridge CB2 2RU, England. Visa, Mastercard and American Express are accepted.

Dr. K. Alslihan Yener has been appointed Assistant Professor in the Near Eastern Languages and Cultures Department of the University of Chicago. After she returns from her excavations at Göltepe, Turkey by 1 September she can be reached at the Oriental Institute, 1155 East 58th Street, Chicago IL 60637, USA, telephone 312-702-9514.

Furnace, Fire, and Forge, A Professional Conference Addressing Issues of Iron in Archaeology and History, has been announced as a part of the *Smelt 1994 Project*. The conference will take place from Thursday, May 26 to Sunday, May 29. Most of the sessions will be held on the Twin Cities Campus of the University of Minnesota in Minneapolis. The conference fee is US $100 which includes transportation, the receptions and two lunches. There is a reduced rate for accompanying persons. The proposed schedule for *Smelt 1994* begins in April with construction of the furnace. It is proposed to build a replica of a traditional shaft furnace of ca. 0.3-0.4 m diameter, a smaller furnace than the 1.0 m furnace of Burgundland style that was built and operated during *Smelt 1991*, and to begin smelting around the clock from May 17 through May 22 and again from May 29 through June 3. If you are interested in volunteering to help with *Smelt 1994*, or want to participate in the conference, write to Dr. Carl Blair, Coordinator *Smelt 1994*, Interdisciplinary Archaeological Studies, 215 Ford Hall, 224 Church Street SE, Minneapolis, MN 55455, USA, telephone 612-825-1062.

The third and final volume of the proceedings of the seminar on *Bloomery Ironmaking During 2000 Years* held by the Comité pour la Sidérugie Annciene of the International Union of Pre- and Protohistoric Sciences at Budalen in 1991 has just been published. It can be ordered from Budalseminaret, N-7034 Trondheim, Norway. Checks should be made out to Budalseminaret c/o A. Espelund. Volume 3 is NOK 180 including postage; the other two volumes are NOK 150 each; or a total of NOK 420 for all three volumes ordered at one time.

News has reached us that Albert France-Lanord, whose atlas *Ancient Metals, Structure and Characteristics Technical Cards* (ICCROM, Rome, 1980) is well known to many of us, passed away on January 19, 1993. He was an engineer as well as an archaeologist, curator and conservator. As an expert in the conservation of archaeological metal objects he taught at the International Conservation Center in Rome for many years, receiving the ICCROM award in 1988.

If you have any archaeometallurgical news to contribute, please write or call

Martha Goodway, MRC 534, Smithsonian Institution, Washington DC 20560 USA; tel 301-238-3733; fax 301-238-3709. □

Announcements

Publication

Work has begun on *The Encyclopedia of Prehistoric Archaeology* edited by Robert Wenke, Wilma Wetterstrom, and Rita Wright and published by Garland Publishing, Inc. of New York City. Scheduled to be published in 1997, the book will consist of alphabetically arranged entries focusing on cultural and social evolution of anatomically modern humans in both the Old and New Worlds. It will provide an introduction to theoretical issued, methodological problems, scientific techniques, archaeological concepts, and specific culture areas and sites that form the basis for current interpretation of the archaeological record.

Inquiries should be addressed to Dr. Wilma Wetterstrom, Botanical Museum of Harvard University, 26 Oxford Street, Cambridge, MA 02138; or Professor Robert Wenke, Department of Anthropology, DH-05, University of Washington, Seattle, WA 98195, USA; or Professor Rita Wright, Department of Anthropology, New York University, 25 Waverly Place, New York, NY 10003, USA.

Announcements (continued on p. 19)

National Center for Preservation Technology and Training

In 1986, the U.S. Office of Technology Assessment issued a report entitled "Technologies for Prehistoric and Historic Preservation," based on a series of workshops held in 1985 and 1986. One of its core recommendations was to call for the creation of a Federal Center for Preservation Technology.

Now, as a result of initiatives from a number of different quarters—and many readers of this discussion group may have been involved in these initiatives—this new Center is actively moving forward.

As a result of the passage of P.L. 102-575 (Title IV) in 1992, the National Center for Preservation Technology & Training is established at Northwestern State University (NSU) in Natchitoches, Louisiana. Several preliminary reports have been, and are being, prepared to determine the focus of the Center without duplicating the work of other National Park Service units or other organizations already working in the field.

Five functions have been identified for the Center:

1) To develop and distribute preservation and conservation skills and technologies for the identification, evaluation, treatments, monitoring, and interpretation of prehistoric and cultural resources;

2) To develop and facilitate training for Federal, State, tribal, and local cultural resource professionals, cultural resource managers, technicians, and others working in the preservation field;

3) To apply technology benefits from research by other agencies and institutions to the preservation field;

4) To facilitate the transfer of preservation technology among Federal agencies, State, tribal, and local governments, universities, national and international organizations, and the private sector; and

5) To cooperate with related international organizations including, but not limited to, the International Council on Monuments and Sites, the International Center for the Study of Preservation and Restoration of Cultural Property, the International Institute for Conservation, and the International Council on Museums.

The acting director of the Center has requested one of the participating institutions, the U.S. Committee of the International Council on Monuments and Sites (US/ICOMOS) for its recommendations concerning national and international databases and other types of information resources that the Center might make available. The ICOMOS report will also propose an information management structure, and some suggestions for developing new databases for the preservation community. It is our intention that the Center should be able to provide technical and financial assistance to organizations for this purpose.

We have identified already a wide range of internet resources, especially gopher and web servers, and discussion groups. However, we would be very glad to have the comments of this list on how the goals of the Center might best be met; and how the Center could best serve your institution or discipline.

For instance:

- the Center should certainly run gopher and web servers, making available information about individual NPS parks and sites, as well as making fully available the National Register and other national inventories;

- the Center could offer to provide an archive for all relevant Internet/Bitnet discussion groups, adding a wais search engine to query all archives simultaneously;

- the Center could facilitate (technically and/or financially) the linking of State Historic Preservation Offices to the Internet, together with the relevant databases that those offices operate;

- the Center could actively participate in the development and use of Open GIS to allow geographic applications to query data sets in many different computer environments;

- the Center could work actively with kindred organizations in both the U.S. and abroad to develop a global network of shared resources.

The list of possible activities is vast, and one of the challenges will be to prioritize its tasks.

We encourage interested readers to submit ideas and other suggestions—as well as cautions—for inclusion in the Center's work program, which will be prepared over the next several months.

Readers may respond either to the writer, at the address given below, to the Arch-L listserver if the subject merits discussion, or to the acting director of the Center, E. Blaine Cliver, Chief, Preservation Assistance Division, National Park Service, e-mail: ecliver@cap.gwu.edu.

From the listserver Arch-L, contributed by Peter Stott, Heritage Conservation, US ICOMOS / ICOMOS Canada; e-mail: pstott@jade.tufts.edu □

Book Reviews

A History of Metallurgy, 2nd Edition.
Ronald F. Tylecote. Institute of Materials, London, 1992, 205 pp., 8 appendices, 1 index. £35.00 (hardbound).

Reviewed by Robert M. Ehrenreich, National Materials Advisory Board, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418, USA

The 1992 edition of *A History of Metallurgy* is a revised version of Tylecote's 1976 publication. As Tylecote states in the Preface, the main additions are the inclusion of more recent references on prehistoric metallurgy in the first five chapters and the revision of the sections on the Roman Period and the Industrial Revolution. The objective of this volume is to provide archaeologists, metallurgists, and technological historians with a one-volume introduction to the history of metallurgy from the earliest use of native metals to the current sophisticated state of materials science (p. xi). Each of the chapters concerns metalworking in a specific technological period: Neolithic, Early Copper, Early Bronze, Full Bronze, Early Iron, Roman Iron, Migration and Medieval, Post-Medieval, Industrial Revolution, and Recent. The volume also contains eight appendices: a glossary of metallurgical terms; a review of the units of measurement; a table of elements; a world chronology of the metal ages excluding China; a metallurgical chronology for China; a list of the journals consulted; a list of the volumes consulted; and a series of maps showing the locations of the sites discussed. The figures in the volume are predominantly tables of metallurgical analyses and illustrations of pyrotechnological structures. More diagrams of artifacts and micrographs of metallurgical structures would have been useful to augment the discussions of the artifact types and metallurgical techniques discovered. This edition succeeds in providing a comprehensive chronicle of the global evolution of metalworking. Tylecote develops a chronology that is useful for historians of technology and metallurgists interested in the origins of their field. Over half of the volume is dedicated to the historic period: 112 pages on the most recent 1600 years versus only 75 pages on the first 6000 years. This may seem reasonable to some technological historians since a tremendous amount of information is covered in the volume and little technological development is believed to have occurred during the earlier period, but the technological historical bias reduces the volume's appeal to archaeologists. This volume will be of greatest use to archaeologists as a reference resource. Archaeologists should initially refer to the edition to gain an overview of the field and to learn what metallurgical research was performed in their area through the late 1980s. They should then examine the cited sources to ensure the accurate incorporation of the contextual data. Archaeometallurgists could increase the relevance of their work to mainstream archaeology by incorporating the following archaeological considerations into their research paradigms.

"Archaeometallurgical research cannot be fully incorporated into archaeology as long as it remains a subdiscipline of the history of technology. If the field is ever to achieve its full potential, archaeometallurgists must broaden their links to archaeology and assimilate anthropological method and theory."

1. *Functional Context*

Archaeologists require explicit information on an artifact's function before any analyses can be incorporated into archaeological theory. Historians of technology tend to view artifacts simply as sources of samples for the construction of chronologies. The object's date and regional location assume primary importance and little attempt is made to understand the archaeological context from which the artifact was recovered. The functional context of an artifact is important because it reveals the artifact's purpose and expected mode of fabrication. Childs (1991a) has shown that ritual axes were of poorer quality than functional axes in some parts of Africa because physical attributes were of little consequence for ceremonial purposes. Thus, the artifact's functional context (e.g., burial, votive, settlement, or stray find) is critical to the understanding of the artifact's purpose and potential mode of fabrication.

2. *Material Status*

Recognition of the status or value of metals within societies is crucial to the development of valid archaeological theories and cultural comparisons. The importance of material status tends to be underestimated by historians of technology. For example, the meteoric-iron artifacts listed in Table 2 range from 3500 B.C. for beads from Gerzeh, through 1340 B.C. for a dagger from Tutankhamen's tomb, to a recent Inuit knife. This manner of compiling data implies that meteoric iron was of equivalent significance to each culture, which is not true. Meteoric iron was a rare, highly valued material in Egypt, as shown

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by the presence of the elaborate dagger in a pharaoh's tomb. For the Inuit, however, the large quantities of meteoric iron in the Cape York region of northwest Greenland were exploited as a natural resource (Wayman 1988). The Inuit had an epi-metallurgical societal structure (i.e. a culture possessing all aspects of a metal-based society but lacking the capability of smelting) based on the distribution and manufacture of large quantities of meteoric iron for basic tools (McCartney 1991). Thus, meteoric iron was present in both cultures, but the status of the material was very different—a point that is obscured when limited quantities of data drawn from broad geographical regions and various time periods are correlated out of context.

3. Craft Specialization

Archaeologists use the level of craft specialization attained by a society as an indicator of the sophistication of the culture, the societal significance of the craft, the complexity of the industry, and the status of the specialists. The identification of craft specialization is a complex process based on a range of societal and technological factors (Ehrenreich 1991b). Historians of technology tend to rely solely on technological factors to discern the level of craft specialization attained. Tylecote (p. 20) concludes from the lack of sherds discovered in European Iron Age slag heaps that metalworkers were economically poor individuals during this period. Thus, he assumes the level of craft specialization and the status of metalworkers solely on the absence of domestic waste in technological remains. This lack of debris could be attributed to ritualism, however. African archaeological and ethnographic evidence has shown that iron smelting was closely coupled with ritual to assure the success of iron manufacture (Childs 1991b). Smelting sites were situated far from domestic centers to protect them from presumed harmful forces, and cleansed before the commencement of iron production. Such protection of sites could account for a lack of domestic debris found in slag heaps. Thus, craft specialization cannot simply be assumed for any prehistoric society that was able to produce and work metals.

4. Culture Contact

The identification of cultural interactions is essential for understanding the development of prehistoric societies. Archaeometallurgical studies have provided evidence of culture contact, but the process is not always straightforward. The development of technologies by neighboring societies is usually taken by historians of technology as evidence of interaction. This has led to the fervent belief among many archaeometallurgists in diffusionism (e.g. the diffusion of metallurgy from a single, central location in the Near East) as opposed to independent discovery and parallel development. During the first half of this century, archaeologists steadfastly maintained that all "advanced" prehistoric culture diffused from the Near East. A watershed was reached in the 1950s with the advent of radiocarbon dating, which showed that the European cultures were as old as the Near Eastern societies. This methodological innovation helped foster the rise of New Archaeology with an emphasis on anthropological approaches to prehistory—a change that archaeometallurgists should heed. The fact that a society develops a metallurgical technique is not sufficient proof of culture contact or technological diffusion. A solid archaeological basis for the determination of culture contact must first be established before technological exchange can be studied.

5. Technological Transitions

Analytical studies of artifacts are required by archaeologists to help understand why ancient societies changed technologies. Historians of technology tend to minimize the importance of technological transitions. In simplest terms, technological histories are constructed by interpolating between the time when the technology was nonexistent and the present. As such, the reasons for the transitions are superfluous because they are part of an inevitable evolution. The only statement concerning the bronze-to-iron transition was that it was a slow process (Tylecote p. 47). The bronze-to-iron technological transition was actually extremely complex (Ehrenreich 1990). Bronze had a significant industrial organization, and analytical analyses have shown that iron was inferior to bronze on introduction. Thus, it is not immediately obvious why a society should have made the transition. More coordinated archaeological and archaeometallurgical research is required to understand why these transitions occurred within ancient societies.

6. Representative Samples

An extensive, representative set of analyses is required for the formulation of any valid hypothesis. Historians of technology tend to use limited numbers of artifacts, which reduces the credibility of their technological chronologies. For instance, Tylecote (p. 63) concludes from the examination of two large nails and four short nails out of the 900,000 recovered from the scuttled Roman fort of Inchtuthill in Scotland that: (1) larger nails were deliberately carburized while the shorter ones were not; and (2) low-phosphorus/low-nickel iron was typical of the Roman period. Is the sampling of six nails from one site a sufficient basis on which to formulate hypotheses on nail fabrication techniques and the types of iron commonly used? Recent

examination of approximately 1000 iron artifacts has shown that: (1) ironworking was a very segmented industry in the Pre-Roman and Roman Iron Ages; (2) carburization was not uniformly used during these periods; and (3) low-phosphorus/low-nickel iron rose in prevalence during the course of the British Iron Age as the Wealden ore sources were increasingly exploited (Ehrenreich 1991a).

7. Ethnographic Evidence

Many aspects of the archaeological record have been illuminated by ethnographic research. Modern ethnographic material, such as the study of African ironwork, tends to be ignored by historians of technology. Tylecote only briefly mentions African research three times in the volume and there is no map of Africa in Appendix 5. African iron smelting research has provided a wealth of information about the rituals involved in metalworking and the status of metals and metalworkers within society. For instance, Tylecote (p. 22) dismisses the presence of decoration on a European tuyere as irrelevant. Extensive ethnographic evidence has shown that the decoration of furnaces in Africa was an integral part of the ritual associated with the smelting process and cannot be ignored. Ethnographic results, therefore, can help highlight subtle features of importance in the archaeological record and enhance our understanding of the intangibles of prehistoric technologies, such as the rituals associated with metalworking.

A History of Metallurgy is a solid introduction to the field of archaeometallurgy and an exceptional summary of the development of metals use through time. Archaeometallurgy owes a great deal to Ronald Tylecote. With books such as this one and *Metallurgy in Archaeology* (1962), he inspired a generation of archaeometallurgists. The future of the field depends on a more anthropological approach, however. Archaeometallurgical research cannot be fully incorporated into archaeology as long as it remains a subdiscipline of the history of technology. If the field is ever to achieve its full potential, archaeometallurgists must broaden their links to archaeology and assimilate anthropological method and theory.

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1991b Metalworking in Iron Age Britain: hierarchy or heterarchy. In *Metals in Society: Theory Beyond Analysis*, edited by R.M. Ehrenreich, pp. 69-80. MASCA Research Papers in Science and Archaeology, vol. 8(2). MASCA, Philadelphia.
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Recent Trends in Archaeometallurgical Research. Peter D. Glumac (ed.). MASCA Research Papers in Science and Archaeology 8.1. MASCA, Philadelphia, 1991, 82 pp. $20.00 (paper).

Metals in Society: Theory beyond Analysis. Robert M. Ehrenreich (ed.). MASCA Research Papers in Science and Archaeology 8.2. MASCA, Philadelphia, 1991, 92 pp. $20.00 (paper).

Reviewed by A. Bernard Knapp, School of History, Philosophy and Politics, Macquarie University, Sydney, Australia

Every "scientist" and every archaeologist involved in archaeometallurgical research ought to own, read, and digest these two volumes: they offer a good sampling from the cutting edge of research by a new generation of scholars trained in both archaeology and science-based archaeology. In the past, archaeometallurgical research has tended to focus on early technologies and their history, ancient smelting techniques, or the structure and makeup of distinctive artifacts. In contrast, and in line with recent theoretical developments in archaeology overall, these papers call for an emphasis on social models and examining the influence of technology on society; on the organization of prehistoric industries; on refining the definition of, and

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developing further models of, craft specialization; and on determining the impact of metallurgical production, distribution, and consumption on social hierarchies and social change. Ehrenreich argues that archaeometallurgical work must be made relevant to archaeologists seeking to model socioeconomic relations, and further that "The aims of the scientific study of ancient metalwork should reflect the goals of the study of archaeological materials in general" (Part I, p. 55). As an archaeologist, reviewing these volumes almost exclusively from that perspective, I regard these aims and objectives not only as desirable, but critical for the future of science-based archaeology.

"Every 'scientist' and every archaeologist involved in archaeometallurgical research ought to own, read, and digest these two volumes: they offer a good sampling from the cutting edge of research by a new generation of scholars trained in both archaeology and science-based archaeology."

The papers in Part I (*Recent Trends*), edited by Peter Glumac, stem from the 1990 SAA meetings in Las Vegas; those in Part II (*Metals in Society*) stem from the 1991 SAA meetings in New Orleans. The case studies in Part I deal with Old World cultures and Iron Age Africa, those in part II chiefly with New World Cultures (plus one paper each on Britain's and Africa's Iron Age). Some authors–Childs, Ehrenreich, Geselowitz–have papers in both volumes; those by Childs and Ehrenreich (respectively on Iron Age sub-Saharan Africa and Iron Age Britain) are complementary rather than repetitive, and give some indication of the quality and depth of research involved. Many of the papers reveal mastery over a variety of languages (e.g. Glumac and Todd on southeast Europe), or over the archaeological literature of a specific culture area (e.g. Hoffman on Spain/west Mediterranean; Hall on Ireland; Leader on the Arctic). All papers demonstrate familiarity with the relevant archaeometallurgical literature. The papers by Childs and Geselowitz (both in Part I) provide excellent, theoretical discussions of technology and social relations (discussed further below); Ehrenreich's paper (Part II) contains an important critique on the issue of craft specialization.

In the main, these studies represent very recent work from a group of American scholars, most of whom have studied metallurgy and/or materials science as well as archaeology, and many of whom are presenting in succinct form at least partial results of their Ph.D. research (Glumac, Hoffman, Killick, Geselowitz, Hall, Leader). Some of the papers focus more on archaeology, material culture, or ethnohistory than on science (Hoffman, Childs, Ehrenreich, Hall, Leader, McCartney). From my perspective, this is–again–a welcome development.

Both volumes have editorial introductions that outline the themes and set the stage, as well as concluding papers that summarize–from varying perspectives–the content and significance of the individual case studies. Michael Wayman's overview (Part I) deals more with technical and metallurgical matters than with sociocultural issues; nonetheless it reiterates the call for archaeometallurgists to broaden their scope and orient their research toward better understanding of human behavior and society. Part II has three overviews, by Vincent Pigott, Tamara Stech, and Peter Wells. Pigott's critique is the most comprehensive, and evaluates three issues that characterize the papers: (1) the significance of metallurgical analysis; (2) the complexity of technology; and (3) resource and technological control. Stech's overview is most valuable for its Old World (specifically Mediterranean and Mesopotamian) perspective; and as she emphasizes (Volume II, p. 88):

> In all cases, the important point is that social meanings and the materials themselves conferred value, rather than the technological properties which the artifacts possessed.

In his assessment, Wells deftly treats two issues from an *anthropological*– as opposed to a science-based–perspective (Part II, p. 89): (1) the relation between the use of metals and cultural interaction, and (2) the meaning of metal objects in specific cultural contexts.

Given these thematic analyses, detailed discussions, and critical assessments, it would be redundant to attempt another summary or synthesis. I propose, therefore, to look briefly at an important theoretical concept which informs the discussion in several papers: the anthropology of technology, and its impact on social structure and social change.

At least two authors (Childs, Geselowitz) refer to a key paper by Lechtman and Steinberg, which maintained that technology, like technical knowledge, should not be separated from the total social context in which it is learned and used, and to which it is bound (1979:136). Technology, therefore, is integral to everyday life, and the products of technology must be reinserted into the socio-technic milieu whence they originated, and studied together with other domains into which social reality has been 'sliced' (Lemonnier 1986:180). The most urgent issue is to determine precisely under what conditions–technological or other–archaeologists may grasp some aspects of past social organizations or social representations (Lemonnier 1990:283). Studying the structure of technological activity has several advantages for archaeology: (1) the complexity

of such activity is recognized, and human actions or alternatives are considered; (2) diversity in human behavior is acknowledged conceptually, and the implications and outcomes of such diversity may be addressed; (3) because the 'task structure' of technological activity is intrinsically dynamic, archaeological materials may be conceptualized in other than static terms (Bleed 1991:20).

Lechtman and Steinberg ask (1979:137-139): to what extent do technologies have 'internal forces' (physical properties, matter, energy sources) that drive them or even permit them to develop, and to what extent does society determine the content and structure of technology? Their answer stems from a vision of technology as an 'institution' of culture, and their belief that technologies are cultural phenomena which may express social preoccupations by means of technological styles. A perspective that takes into account the interaction of differing technologies helps us to identify and understand task specialization, labor organization and social differentiation, settlement pattern shifts, transport, and exchange (Lechtman and Steinberg 1979:144). Sociocultural dynamics, in other words, can usefully be gauged by looking at the interactive role of several basic technologies.

Viewing technology as humanized nature forces one to recognize the complexities involved in linking technological forms to human culture (Pfaffenberger 1988:244). The interrelationship amongst society, technology, and environment affects the way in which meaning is communicated. The cognitive aspects of a cultural system serve as a link between material, behavior, and environment, and thus help to elucidate the social context of technology. The symbols associated with technology or technological change often serve as dominant cultural markers.

Bronze metallurgy in ancient Western Asia, for example, flourished in an era of urban nucleation and emergent social complexity, when elites would have had a strong cultural imperative to demonstrate their status in society. Whether as imported goods or exotic commodities, metals –and the technology implicit in metallurgical production and exchange–would at least partially have satisfied that imperative (Stech and Maddin 1988:173). 'Elite' technologies, frequently centered on metals, are often geared to produce status symbols that help to legitimize or maintain elite authority. By regulating certain technologies, furthermore, elites are often able to take control of the productive base of society. Renfrew argues that the products of early metallurgy had novel properties that enhanced their symbolic and prestige value (1986:146), rather than any decisively mechanical properties that established their utilitarian value. This viewpoint echoes that of Cyril Stanley Smith (1981:347), who maintained that the discovery of the materials, processes, and structures that comprise technology nearly always stem from aesthetic and cultural factors rather than from preconceived necessity.

For anthropologists, technology is a total social phenomenon, simultaneously material, social, and symbolic; the social construction of technology takes place when one set of meanings replaces another, and is expressed in the technical content of the artifact (Pfaffenberger 1988:236, 240). In other words, any behavior that is technological is at the same time political, social and symbolic. Technology must be incorporated within a broader view of behavior: it conveys messages that take an active part in creating, maintaining, and transforming social relationships (Gero 1989:92). Although the products of technology take material form, the essence of technology is social and cultural, and the complex 'routines' of technology must be learned in a social context (Gowlett 1990:88). In Marxist terms, the technical forces of production are deeply embedded in the social relations of production. Mauss (1947:7), perhaps, had already taken this notion to its logical extreme: material culture is the embodiment of social facts, and just as social life is intimately dependent on techniques, technology gains its meaning and definition from society.

The relationship between material culture, technology, and human behavior provides a focal point for recent archaeological and social theory. In the postprocessual 1990s, material culture is no longer regarded solely as a product that reflects social entities at some level, but rather as an active, constitutive element of social practice (Gero 1989:103-105). The prominence of the object and its patterns has been superseded by a view of all cultural production as the result of physical and cognitive processes that both constitute and are constituted by a social and historical framework (Conkey 1990:13).

Changes in technology affect the way that people house and feed themselves, and how they communicate. As such, technology is a fully human endeavor that acts upon both the practical and aesthetic needs of society. Technology, therefore, must be studied within its material, social, spatial, and politico-historical matrix, and it must be interpreted within a theoretical framework that explores the dynamic between objects, human behavior, and social structure.

Most papers in the two volumes under review undertake this task knowingly, seriously, and successfully. Geselowitz (Part I, p. 64) is concerned that little has changed since the publication of Lechtman and Steinberg's "seminal" paper, and that technology is still viewed as a "dynamic entity unto itself." Perhaps this remains true in general. In particular, however, *Recent Trends* and *Metals in Society* both demonstrate that the newest generation of (science-based) archaeologists is methodologically apt and theoretically aware. Through innovative and discriminating use of laboratory analyses, metallurgical data are no longer "...mired in some Victorian form of vulgar functionalism" (Glumac, Part I, p. 6), but rather are situated in a broader, human-science framework that makes them relevant for generating models in prehistoric–as well as historic–contexts, and for formulating social and behavioral

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interpretations associated with the technology and use of metals.

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Books Received

The following books have been received from the publishers:

Economy and Settlement in the Near East. Analyses of Ancient Sites and Materials, by Naomi F. Miller (ed.). 1990. MASCA Research Papers in Science and Archaeology, Supplement to Volume 7. 88 pp. $20.00 (paper).

River of Gold. Precolumbian Treasures from Sitio Conte, by Pamela Hearne and Robert J. Sharer (eds.). 1992. The University Museum, University of Pennsylvania, Philadelphia. xii + 132 pp., 72 color pls., 45 figs. $24.95 (cloth).

Housing Culture. Traditional Architecture in an English Landscape, by Matthew Johnson. 1993. Smithsonian Institution Press, Washington, D.C. xiv + 220 pp. $39.95 (cloth).

The Uses of Style in Archaeology, by Margaret Conkey and Christine Hastorf (eds.). 1993. Cambridge University Press, Cambridge. ix + 124 pp. $19.95 (paper). Hardcover first published in 1990.

The Phoenicians and the West. Politics, Colonies and Trade, by Maria Eugenia Aubet. 1993. Translated by Mary Turton. Cambridge University Press, Cambridge. xviii + 348 pp. $59.95 (cloth).

The Iron Age Community of Osteria dell'Osa. A Study of Socio-Political Development in Central Tyrrhenian Italy, by Anna Maria Bietti Sestieri. 1993. Cambridge University Press, Cambridge. xii + 271 pp. $69.95 (cloth).

Tikal Report No. 25, Part A. The Ceramics of Tikal: Vessels from the Burials, Caches and Problematical Deposits, by T. Patrick Culbert. 1993. The University Museum, University of Pennsylvania, Philadelphia. xi + 32 pp., 155 figs. $65.00 (cloth).

Quirigua Reports III: Archaeological Investigations in the Lower Motagua Valley, Izabal, Guatemala, by Edward Mark Shortman. 1993. The University Museum, University of Pennsylvania, Philadelphia. xii + 292 pp. $50.00 (cloth).

The Paleolithic Prehistory of the Zagros-Taurus, by Deborah I. Olszewski and Harold L. Dibble (eds.). 1993. The University Museum, University of Pennsylvania, Philadelphia. xiii + 237 pp. $50.00 (cloth). □

Forthcoming Book Reviews

Animal Use and Culture Change
Early Animal Domestication and its Cultural Context
Deciphering a Shell Midden
Reconstruction of Life from the Skeleton
Skeletal Biology of Past Peoples: Research Methods
Advances in Dental Anthropology
Carbon Isotope Techniques

Meetings Calendar

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New listings are marked by a *; new information for previous listings indicated by a +. More information on some meetings is given in previous bulletins as indicated, e.g., "15(1):2" for volume 15, number 1, page 2.

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March-April. Cultural Resource Management, 1993-94. Reno, Nevada. Cultural Resource Management, Division of Continuing Education/048, University of Nevada, Reno, NV 89557-0024, USA. Courses include: Geomorphology in Archaeological Analysis, April 5-9, $525, registration deadline 3/7/94; Geographic Information Systems in Archaeology, April 18-19, $250, registration deadline 3/21/94.

April 2-6. Association of American Geographers Annual Meeting. San Francisco. Association of American Geographers, 1710 16th Street NW, Washington DC 20009, USA; tel: 202-234-1450.

* April 4-7. 5th Global Warming Science and Policy International Conference and Exposition. San Francisco, California, USA. Sinyan Shen, The Global Warming International Center, PO Box 5275, Woodridge IL, 60517, USA; tel: 708-910-1151; fax: 708-910-1561.

April 4-11. William Robertson Smith Congress. Aberdeen. William Johnston, Department of Hebrew and Semitic Languages, University of Aberdeen, King's College, Old Aberdeen AB9 2UB, Scotland, UK.

* April 5-8. Mental Health, Race, and Culture in Europe. Bristol, Great Britain. Secretariat, Mental Health, Race and Culture Conference, Richmond Bridge House, 419 Richmond Road, Twickenham TW1 2EX, Great Britain; tel: 44-81-892-3637.

April 7-9. 2nd International Conference on Pedo-Archaeology. Columbia, South Carolina. A.C. Goodyear, SCIAA-USC, 1321 Pendleton Street, Columbia, SC 29208, USA; tel: 803-777-8172; fax: 803-254-1338.

April 8-9. Integrating Archaeological Demography: Multidisciplinary Approaches to Prehistoric Population. Carbondale, Illinois. Richard R. Paine, Center for Archaeological Investigations, Southern Illinois University, Carbondale, IL 62901, USA; tel: 618-549-4009; fax: 618-453-5037.

* April 10-24. Sciences and Materials of Cultural Heritage: The Stone of Monuments in Physical and Cultural Environments—Methodology and Deontology of Study. Ravello and Florence, Italy. Centre Universitaire Europeen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669-858101; fax: 857711.

April 11-13. International Conference, Wetland Archaeology and Nature Conservation. Bristol, UK. Margaret Cox, Somerset Levels & Moors Archaeologist, Department for the Environment, Somerset County Council, County Hall, Taunton TA1 4DY, UK; tel: 0823-255416; fax: 0823-334343.

April 11-15. Materials Research Society, Spring Meeting. San Francisco. Materials Research Society, 9800 McKnight Road, Pittsburgh, PA, USA; tel: 412-367-3012. Symposium: Materials Issues in Art and Archaeology IV.

April 13-18. 3rd International Conference, The Birth of Metallurgy. Sanmenxia City, China. Prof. T. Ko, Institute of Historical Metallurgy, University of Science and Technology, Beijing 100083, China; tel: 861-2019944; fax: 861-2017283.

* April 17-21. 6th International Symposium on Biological and Environmental Reference Materials. Kona, Hawaii, USA. Wayne Wolf, US Dept. of Agriculture, Nutrient Composition Lab, Beltsville, MD 20705, USA; tel: 301-504-8927; fax: 301-504-8314.

* April 18-22. 6th International Conference on Near-Infrared Spectroscopy. Lorne, Victoria, Australia. Pastoral and Veterinary Institute, Mt. Napier Road, Private Bag 105, Hamilton, Victoria 3300, Australia; tel: 61-55-730915; fax: 61-55-711523.

April 20-24. Society for American Archaeology 59th Annual Meeting. Anaheim, California. Society for American Archaeology, 1511 K Street NW, Washington, DC, USA; tel: 202-223-9774.

* April 21-24. Architectural Aspects in Medieval and Norman Europe: Analysis and Criteria of Intervention. Centre Universitaire Europeen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669-858101; fax: 857711.

* April 24-28. European Association of Science Editors, 5th General Assembly and Conference. Budapest, Hungary. EASE Secretariat, 49 Rossendale Way, London, NW1 0XB, UK; tel: 44-71-388-9668; fax: 44-71-383-3092.

April 25-29. European Geophysical Society, XIX General Assembly. Grenoble, France. EGS Office, Postfach 49, Max-Planck-Str. 1, 37189 Katlenburg-Lindau, Germany; tel: 49-5556-1440; fax: 49-5556-4709; e-mail: EGS@LINMPI.DNET.GWDG.DE. Symposia include: Geophysics and the ancient environment (S. Papamarinopoulos, convenor). Abstract deadline: 1 Jan. 1994.

* April 28-May 1. 12th Biennial Conference, Society of Africanist Archaeologists. Bloomington, Indiana, USA. Kathy Schick, SAfA 1994, Anthropology Department Student Bldg. 130, Indiana University, Bloomington, Indiana 47405, USA; tel: 812-855-7536 or 7568; fax: 812-855-7574; email: kaschick@indiana. edu.

* May 2-5. Iraqi Geological Congress. Baghdad. Union of Iraqi Geologists, Box 6244, Almansour, Baghdad, Iraq.

* May 3-8. Geophysical and Archaeological Chronology in the Upper Palaeolithic. Centre Universitaire Europeen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669; fax: 857711.

* May 4-8. 27th Annual Meeting, Canadian Archaeological Association. Edmonton. Jack Ives, Provincial Museum of Alberta, 12845 - 102 Avenue, Edmonton, Alberta, Canada T5N 0M6; tel: 403-453-9149; fax: 403-454-6629.

May 5-8. 1994 International Congress on Medieval Studies; symposium of Medieval Metal and Metallurgy. Kalamazoo, Michigan, USA. Dr. Alan Stahl, American Numismatic Society, Broadway at 155th Street, New York, NY 10032, USA; tel: 212-234-3130; fax: 212-234-3381.

* May 9-12. Geologic Remote Sensing, 10th Thematic Conference. San Antonio, Texas, USA. ERIM/ Thematic conferences, PO Box 134001, Ann Arbor MI 48113-4001, USA; tel: 313-994-1200, ext. 3234; fax: 313-994-5123; email: wallman @vaxb.erim.org.

May 9-14. Archaeometry 94: 29th International Symposium on Archaeometry. Ankara. Prof. Dr. Ay Melek Ozer, Middle East Technical University, Department of Physics, 06531, Ankara, Turkey; fax: 90-4-210-12-81. 16(3):15.

May 16-18. Geological Society of Canada, Annual Meeting. Waterloo, Ontario. Geological Association of Canada, Department of Earth Sciences, Memorial University of Newfoundland, St. John's Newfoundland, A1B 3X5 Canada. Sessions include: Techniques for reconstructing Quaternary paleoclimates.

* May 16-19. 24th Annual Symposium on Environmental Analytical Chemistry. Ottawa, M. Malaiyandi, CAEC, Chemistry Dept., Carleton University, 1255 Colonel By Drive, Ottawa Ontario, K1S 5B6, Canada; tel: 613-788-3841; fax: 613-788-3749.

* May 16-20. Joint Conference of the International Symposium on Microchemical Techniques and Deauville Conference 1994 Symposium on Analytical Sciences. Montreux, Switzerland. Nicko and CRI Associes, 7 Rue d'Argout, F-75002 Paris, France; tel: 33-1-42334766; fax: 33-1-40419241.

May 16-20. Materials Issues in Art and Archaeology IV. Cancun, Mexico. James R. Druzik, The Getty Conservation Institute, 4503 Glencoe Avenue, Marina del Rey, CA 90292, USA; tel: 310-822-2299; fax: 310-821-9409.

May 17-21. International Conference on Tree Rings, Environment, and Humanity: Relationships and Processes. Tucson, Arizona. International Conference on Tree Rings, Laboratory of Tree-Ring Research, Building 58, University of Arizona, Tucson, AZ 85721, USA; tel: 602-621-2191; fax: 602-621-8229. 16(3):15.

* May 22-24. The Archaeology of Israel: Constructing the Past/interpreting the Present. Bethlehem, Pennsylvania. Shirley Ratushny, Administrative Associate, Philip and Muriel Berman Center for Jewish Studies, 9 W. Packer Avenue, Lehigh University, Bethlehem, PA 19015-3082, USA; tel: 610-758-3352; fax: 610-758-4858; email: saro@ lehigh. edu. Includes session on: Modern techniques for laboratory analysis of archaeological objects – Overview and examples.

* May 23-27. Annual Spring Meeting of the American Geophysical Union. Baltimore, Maryland. American Geophysical Union, 2000 Florida Avenue NW, Washington DC 20009, USA; tel: 202-462-6900; fax: 202-328-0566; e-mail: sbell@ kosmos.agu.org. Includes session: Geophysics and Archaeology (convenor: R. Sternberg).

\+ May 24-29. 20th Annual Conference and Pre-Conference Training Workshop, International Institute for Conservation – Canadian Group. Toronto. Iona McCraith, IIC-CG Conference '94, Toronto Area conservation Group, P.O. Box 956, Station F, Toronto, Ontario M4Y 2N9, Canada; tel: 416-327-1521; fax: 416-327-1999.

* May 29-June 1. Glacial Cycles at High Latitudes. Fjaerland, Norway. Berit Barkley, Department of Geology, PO Box 1047 Blindern, 0316 Oslo, Norway; tel: 47-22-856691; fax: 47-22-854215.

* May 29–June 2. American Astronomical Society, 184th Meeting. Minneapolis, Minnesota, USA. AAS Executive Office, 1630 Connecticut Avenue, NW, Suite 200, Washington DC 20009, USA; tel: 202-328-2010; fax: 202-234-2560; e-mail: aas@blackhole.aas.org. Abstract deadline: 1 April.

May 30-June 4. International Rock Art Congress. Flagstaff, Arizona, USA. 1994 IRAC-ARARA, PO Box 65, San Miguel, CA 93451-0065, USA; tel: 805-467-3704; fax: 800-467-2532. Symposia tentatively planned include: Preservation and conservation; Advances in dating techniques; Archaeoastronomy.

* June 3-5. The System Man–Environment Between Past and Present. Centre Universitaire Europeen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669; fax: 39-0-89-857711.

June 5-11. Geochronology, Cosmochronology and Isotope Geology (ICOG-8). Berkeley, California. Garniss H. Curtis, Institute of Human Origins-Geochronology Center, 2453 Ridge Road, Berkeley, CA 94709, USA; tel: 415-845-4003; fax: 415-845-9453.

June 6-11. 22nd Annual Meeting, American Institute for Conservation of Historic and Artistic Works. Nashville, Tennessee. AIC, 1717 K Street, NW, Suite 301, Washington, DC 20006, USA; tel: 202-452-9545.

June 12-16. Fifth International Conference on Ground Penetrating Radar. Kitchener, Ontario. GPR '94, Waterloo Centre for Groundwater Research, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada; tel: 519-885-1211; fax: 519-725-8720.

* June 13-17. American Ethnological Society Annual Meeting. Santa Monica, California, USA. Karen Brodkin Sacks, Department of Anthropology, UCLA, Los Angeles, CA 90024, USA; email: sacks@anthropology.sscnet. ucla.edu.

June 19-22. American Quaternary Association (AMQUA), 13th Biennial Meeting. Minneapolis. Limnological Research Center - AMQUA, University of Minnesota, 310 Pillsbury Drive S.E., Minneapolis, MN 55455-0219, USA. Theme: Data and models in Quaternary research. Field trips include: Archaeological sites in southern and southwestern Minnesota.

June 19-24. American Nuclear Society Annual Meeting. Atlantic City, New Jersey. ANS, Meetings Department, 555 N. Kensington Avenue, La Grange Park, IL 60525; tel: 312-352-6611.

* June 24-27. 3rd European Association of Social Anthropologists Conference. Oslo. EASA, Department of Social Anthropology, PO Box 1091, Blindern, N-0317, Oslo, Norway.

* July 2-19. Summer School on Russian Traditional Culture. Moscow. Dr. Nadexhda Dubova, Institute of Ethnology and Anthropology, Russian Academy of Sciences, Leninsky pr., 32A, 117334 Moscow, Russia.

* July 4-9. Threatened Peoples and Environments in the Americas, 48th International Congress of Americanists. Stockholm. Institute of Latin American Studies, S-10691 Stockholm, Sweden.

July 5-9. 7th International Specialist Seminar on Thermoluminescence and Electron Spin Resonance Dating. Krems an der Donau, Austria. Norbert Vana, Atominstitut, Schuttelstrasse 115, A-1020 Vienna, Austria.

July 10-16. 15th International Congress of Soil Science. Acapulco, Guerrero, Mexico. Dr. Roberto Nulez, Colegio de Postgraduados, Centro de Edafología, Km. 34, Carretera México-Texcoco, Montecillo, C.P. 56230, México; tel: 52-595-557-1; fax: 52-595-4-57-23.

* July 11-18. Geological Indicators of Rapid Change, International Workshop. Corner Brook, Newfoundland, Canada. A.R. Berger, Chairman, Geo-Indicators Working Group, 528 Paradise Street, Victoria, BC V9A 5E2, Canada; 604-480-0480; fax: 604-480-0480.

* July 15-18. The Social and Cultural Origins of Language. Berkeley, California, USA. Bruce Richman, 2200 Oakdale Road, Cleveland Heights, Ohio 44118, USA.

Aug. 8-12. LSC 94 – Advances in Liquid Scintillation Spectrometry. Glasgow. LSC 94, c/o Dr. G.T. Cook, Scottish Universities Research and Reactor Centre, East Kilbridge G75 0QU, Scotland, UK; tel: 44-3552-23332; fax: 44-3552-29898. The aims of the conference are to promote and encourage the free exchange of information on liquid scintillation spectrometry and related scintillation techniques. Abstract deadline: Dec. 1993.

* Aug. 8-14. 5th Argentinean Sedimentological Meeting. San Miguel de Tucuman, Argentina. Gerardo Bossi, Presidente de la 5ta. Reunion Argentina de Sedimentologia, Laboratorio de Sedimentologia, Miguel Lillo 251 – Tucuman, Argentina; tel: 5481-239723; fax: 5481-311524.

Aug. 15-19. 15th International Radiocarbon Conference. Glasgow. The Secretariat c/o Mrs. M. Smith, Department of Statistics, University of Glasgow, Glasgow, G12 8QW, Scotland, UK; tel: 44-41-339-8855 x5024; fax: 44-41-330-5094; e-mail: Gata24@UK.AC.Glasgow.VME. 16(3):16.

Aug. 21-26. 14th International Sedimentological Congress. Recife, Brazil. 14th International Sedimentological Congress, Caixa Postal 7801 Cidaded Universitaria, 50739 Recife PE Brazil; tel: 081-271-82-40.

Aug. 23-27. Xth Congress of the International Federation of the Societies of Classical Studies. Quebec City. X Congres de la FIEC, Cabinet du Doyen, Faculte des Lettres, Universite Laval, Quebec City, Quebec G1K 7P4, Canada.

* Sept. 5-9. Arctic Margins, International Meeting. Magadan, Russia. Kirill Simakov, North East Scientific Centre, 16 Portovaya St., Magadan, 685000, Russia; tel: USA 907-474-7219, Russia 7-41-3-223-0953.

* Sept. 11-15. 1st International Airborne Remote Sensing Conference and Exhibition: Applications, Technology, and Science. Strasbourg, France. Robert Rogers, ERIM, Box 13001, Ann Arbor, MI 48113-4001, USA; tel: 313-994-1200, ext. 3234; fax: 313-994-5123.

Sept. 22-24. Symposium: Application of Scientific Methods for Investigating Coins and Coinage. London. Miss K. Havercroft, Department of Conservation, The British Museum, London WC1B 3DG, UK; tel: 071-323-8223.

* Sept. 22-24. Towns in the Upper Middle Age in the Western Mediterranean Sea (IV-IX centuries). Centre Universitaire Europeen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669; fax: 39-0-89-857711.

* Sept. 26-30. 12th Australian Geological Convention. Perth, Australia. Secretary, 12AGC, PO Box 119, Cannington, WA 6107, Australia; tel: 61-9-351-7968; fax: 61-9-351-3153.

October. Cities on the Sea Symposium. Nicosia. Stuart Swiny, Director, CAARI, 11 Andreas Demitriou, Nicosia 136, Cyprus; fax: 357-2-461-147.

* Oct. 3-7. 2nd International Congress for Study of Modified States of Consciousness. Theme: Ethnocognition, Shamanism, Plants and Cultural Context. Lerida, Spain. Institut de Prospectiva Antropologica, Av. Gran Via de Les Corts Catalanes, 457, 4rt, 08015 Barcelona, Spain.

Oct. 4-6. The Art of the Greek Goldsmith. London. Dr. Jack Ogden, Cambridge Centre for Precious Metal Research, PO Box 391, Cambridge CB5 8XE, UK; fax: 0223-565182.

Oct. 4-7. Annual Meeting German Geological Society. Heidelberg, Prof. Th. Bechstadt, Geologisches-Paläontologisches Institut, Ruprecht-Karls-Universität, Im Neuenheimer Feld 234, D-6900 Heidelberg, Germany; tel: 0-62-21-56-55-31.

* Oct. 11-15. International Conference on Archaeological Heritage Management. Montreal. CAHM Montreal 1994, Madam Rita Rachele Dandavino, SHDU - Ville de Montreal, 303 rue Notre-Dame est, 5e etage, Montreal, Quebec, Canada H3Y 3Y8.

Oct. 14-16. Science and Archaeology: A Multi-Disciplinary Approach to Studying the Past; sponsored by the SAS. Cambridge. Robert H. Tykot, Archaeometry Laboratories, Harvard University, Cambridge, MA 02138, USA; tel: 617-496-8991; fax: 617-495-8925; e-mail: Tykot@HUSC4.Harvard.Edu. 16(2):21.

Oct. 24-27. Geological Society of America, Annual Meeting. Seattle, Washington. Geological Society of America, 3300 Penrose Place, Boulder, CO 80301, USA; tel: 303-447-2020.

Nov. International Symposium: The Pleistocene/Holocene Boundary and Human Occupations in South America. Mendoza, Argentina. Marcelo Zarate, International Symposium on the Pleistocene/Holocene Boundary, Centro de Geología de Costas y del Cuarternario – UNMP, Casilla de

Correo 722 – Correo Central, 7600 Mar del Plata, Argentina.

Nov. 3-5. Imaging the Past: Electronic Imaging and Computer Graphics in Museums and Archaeology. London. Dr. Peter Main, Department of Scientific Research, The British Museum, Great Russell Street, London WC1B 3DG, UK; tel: 44-71-323-8959; fax: 44-71-323-8276; e-mail: EZBMPLM@UK.AC.ULCC. Electonic imaging and computer-assisted graphics are increasingly important in museum and archaeological work, in areas as diverse as education, gallery display, scientific examination, excavation and fieldwork. To provide a forum for workers in these fields to share experience and expertise, the British Museum is hosting a conference.

* Nov. 10-13. American Society for Ethnohistory Annual Meeting. Tempe, Arizona. Peter Iverson, Department of History, Arizona State University, Tempe, AZ 85287-2501, USA; tel: 602-965-5778; fax: 602-965-0310.

Nov. 12-14. Symposium, Wooden Artifacts Group. Williamsburg, Virginia, USA. Valerie Dorge, The Getty Conservation Institute, 4503 Glencoe Avenue, Marina Del Rey, CA 90292, USA; tel: 310-822-2299; fax: 310-821-9409.

* Nov. 13-18. Soil Science Society of America, Annual Meeting. Seattle, Washington, USA. Soil Science Society of America, 667 S. Segoe Road, Madison, WI 53711, USA; tel: 608-367-4373.

* Nov. 28-Dec. 2. Materials Research Society, Fall Meeting. Boston, Massachusetts, USA. Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237, USA; tel: 412-267-3003; fax: 412-367-4373.

Nov. 30-Dec. 2. American Anthropological Association, Annual Meeting. Atlanta, Georgia, USA. American Anthropological Association, 1703 New Hampshire Avenue NW, Washington DC 20009, USA; tel: 202-232-8800.

Dec. 4-11. Third World Archaeology Congress. New Delhi, Shri M.C. Joshi, Director General, Archaeological Survey of India, Janpath, New Delhi 110011, India; tel: 91-11-3014821; fax: 91-11-3019821.

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* Jan. 4-7. Joint Mathematics Annual Meetings. San Francisco, California, USA. H. Daly, American Mathematical Society, PO Box 6887, Providence, RI 02940, USA.

* Jan. 4-8. Annual Conference on Historical and Underwater Archaeology, Society for Historical Archaeology. Washington, DC, USA. Henry Miller, Historic St. Mary's City, PO Box 39, St. Mary's City, MD 20686, USA; tel: 301-862-0974; fax: 301-862-0968.

March 15-19. Association of American Geographers, Annual Meeting. Chicago, Illinois. Association of American Geographers, 1710 16th Street, NW, Washington, DC, USA; tel: 202-234-1450.

* March 26-30. 8th Conference on the Scientific Use of Statistical Software. Heidelberg, Germany. SoftStat '95, ZUMA, Postfach 12 21 55, 68072 Mannheim Germany; tel: 49-621-1246-174; fax: 49-621-1246-100; e-mail: softstat@zuma-mannheim.de. Abstract deadline: 1 Aug. 1995.

April 2-7. Archaeological Chemistry Symposium, American Chemical Society National Meeting; sponsored by the Subdivision of Archaeological Chemistry, Division of the History of Chemistry, ACS. Anaheim, California. Mary Virginia Orna, Department of Chemistry, College of New Rochelle, New Rochelle, NY 10805, USA; tel: 914-654-5302; fax: 914-654-5387. Major areas of interest: bone dating; artifact dating; archaeology of genetic material; peopling of the New World. Abstract deadline: 15 June 1994.

* April 3-7. Geological Society of South Africa Centennial Geocongress. Johannesburg, South Africa. Congress Secretariat, Centennial Geocongress, PO Box 36815, Menlo Par, 0102, South Africa; tel and fax: 27-12-47-3398.

* April 17-21. Materials Research Society, Spring Meeting. San Francisco, California, USA. Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237, USA; tel: 412-367-3003; fax: 412-367-4373.

* May 17-19. Geological Association of Canada–Mineralogical Association of Canada Joint Annual Meeting. Victoria, British Columbia, Canada. Chris Barnes, General Chair, SEOS, University of Victoria, PO Box 1700, Victoria, BC V8W 2Y2, Canada; fax: 604-721-6200.

Nov. 6-9. Geological Society of America, Annual Meeting. New Orleans, Louisiana. Vanessa George, Geological Society of American, 3300 Penrose Place, Boulder, CO 80301, USA; tel: 303-447-2020; fax: 303-447-1133.

* Nov. 15-19. American Anthropological Association, Annual Meeting. Washington, DC, USA. American Anthropological Association 4350 North Fairfax Drive, Suite 240, Arlington, VA 22203, USA; tel: 703-528-1902. □

Anouncements (continued from p. 8)

Grants

Applied Science in Archaeology Grants are open to all archaeologists, archaeological scientists and archaeological conservators resident in the UK. The grants are designed to provide support for non site-specific research proposals which involve the application of established scientific techniques, whether through provision of services of an identified specialist, or through access to certain existing SBAC-supported facilities, for radiocarbon dating, lead isotope analysis or electron microscopy. This fund is not intended as an adjunct to site-specific post-excavation costs. Amounts available are up to £5,000 in any one year. Applications, on the Applied Science in Archaeology form, should be submitted by 31 December and applicants will be notified of the outcome in March. Further details may be obtained from The British Academy, 20-21 Cornwall Terrace, London NW1 5QP, United Kingdom; tel 071-487-5966. □

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