

# SAS Bulletin

## Society for Archaeological Sciences

Volume 17

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### SAS News

#### Annual SAS Business Meeting

April 22, 1994

Disneyland Hotel, Anaheim, California

The meeting, held in conjunction with the 59th Annual Meeting of the Society for American Archaeology, was convened at 4:30 pm. There were 24 SAS members in attendance.

#### Reports of the Officers

*Christine Prior, Secretary/Treasurer:* The total SAS membership for 1994 so far is 403 members. Broken down into categories: 263 Regular members, 69 Lifetime members, 31 Institutions, 19 Associate, and 21 Student members. The number of SAS members who have subscribed to the *Journal of Archaeological Science* so far for 1994 is 279. There are 119 SAS members from 1993 who have not yet renewed for 1994.

The income and expenditure summary from January 1, 1993 to December 31, 1993 was presented. The SAS began the year with an account balance of \$5874.87, took in \$23,392.73 as income, spent \$22,225.11, and ended the year with an account balance of \$7042.49. The proposed 1994 budget was proposed and described. It was moved to adopt the 1994 budget. The motion carried and the 1994 budget was adopted.

*Betsy Lawlor, Vice President for Membership Development:* The new SAS display was displayed in the Exhibits Hall. (The members broke into unanimous applause and praise for all of Betsy's hard work.) With a \$2000 grant from Academic Press and a small contribution from the Preservation Science and Technology Unit at the University of California-Riverside, a traveling display was purchased from the Nomadic Display company. Betsy hired a graphics artist to design a new SAS logo and typeface, and commissioned a poster and new membership brochures—all in matching colors, coordinated with the fabric of the display frame, even with the new logo printed by the Nomadic company on the header panel of the display. All

SAS members were invited to take posters and brochures with them, and to display and distribute them.

*Steven Shackley, Vice President for Intersociety Relations:* The Geological Society of America has established a connection with SAS. Jim Burton is liaison. Shackley is the SAS liaison with the International Association for Obsidian Studies. People need to send Shackley addresses of journals, newsletters, etc., so he can send them news of the SAS, announcements of meetings, and so on.

*R.E. Taylor, General Secretary:* The Center for Preservation Technology at Northwest Louisiana State University at Natchitoches, Louisiana, has been established. Archaeology is well-represented on the Board of Directors, who will be electing an Executive Director soon.

#### In This Issue

SAS Meeting Minutes

SAS and SOPA

Archaeometallurgy News

GIS

Conference Reviews

*Archaeometry Symposium*

*Phytolith Analysis*

*Mediterranean Archaeology*

*Environmental Archaeology*

*Wetlands*

Announcements

Book Reviews

*Skeletons & Teeth*

*Animals*

*Piles of Shells*

*Carbon Isotopes*

Meetings Calendar

## SAS News

Concerning the *SAS Advances in Archaeology & Museum Sciences* series, one royalty payment of \$780.49 for the phytolith book was received in May 1993. The SAS paid \$468.00 to *Radiocarbon* as repayment of our debt incurred in the production of the book. SAS still owes *Radiocarbon* \$268.00. We expect another royalty payment from Plenum Press in May 1994. There are three more books in the works. One has only one chapter waiting to be completed. Also, the plan for a series of volumes replacing Brothwell and Higgs is still going.

### New Business

The Executive Board reappointed the current SAS Vice Presidents and Standing Committees for another term.

Concerning long-term planning, Erv Garrison noted a potential conference at the University of Georgia at Athens. The first proposal for *Archaeometry 2000* was rejected, but Garrison was invited/encouraged to resubmit the proposal, which he did. The new idea is to hold the conference in Spring 1995 with SAS as the co-sponsor; new title: *Archaeological Science in the 21st Century*. Approval and funding is pending.

Irv Rovner (SOPA Board member) suggested that, in addressing the relationship between SAS and SOPA, we make a list of scientific expertise and services offered by SAS members. A suggestion was made that we compile a directory of such SAS members to distribute to SOPA members. Listing in the directory would be *voluntary*. He has some indications that SOPA is receptive to the idea. The SAS Executive Board has established a committee to work out the details of the directory. SAS members should look for more details in the *SAS Bulletin*.

Pat Martin (Vice President/president elect) pointed out how few SAS members are also members of SOPA. He has proposed the idea to SOPA of an "associate membership", so SOPA information would be disseminated but associates would not have to pay the high membership fees.

Rob Tykot reminded SAS members of the conference in October 1994, *Science and Archaeology: A Multidisciplinary Approach to Studying the Past*, to be held at Harvard University. The conference is on track and will take place, but they are still waiting for some funding. Tykot brought up the idea of having an SAS-sponsored workshop on the second day of the conference.

It was agreed in the Executive Board meeting that starting next year, the President will present a formal "State of the SAS" report at the annual meeting. Also beginning next year, the Vice Presidents and Chairs of standing committees will present written reports of their activities and accomplishments.

The next election of SAS officers will be in 1995. The executive board is also the nominating committee.

Members are encouraged to provide names of potential candidates soon.

The new editors of *Geoarchaeology*, Ofer Bar-Yosef and Paul Goldberg, reminded everyone that SAS members get a discount on subscriptions to *Geoarchaeology*.

The meeting was adjourned at 5:15 pm.

Respectfully submitted by Christine Prior, SAS Secretary/Treasurer □

### SOPA and SAS

In the 1993 SOPA (the Society of Professional Archaeologists) elections, the two candidates put forth for the SAS representative to the SOPA board were not selected in accordance with SOPA by-laws. The SAS President, Erv Garrison, in consultation with the SAS executive board, protested the election to Bill Lees, SOPA Secretary-Treasurer. Dr. Lees, with concurrence from the SOPA board, agreed to invalidate the election of the SAS representative. A second slate of candidates for the SAS representative was presented to the SOPA membership in a special election in March. SAS presented two candidates, Erv Garrison and Irwin Rovner, who qualified under the SOPA by-laws. In a close vote, Rovner won the election and will serve as the SAS representative to the SOPA board beginning in April 1994. Congratulations are extended to him and to those in SAS and SOPA who moved quickly to rectify the earlier election situation. □

### News of Archaeometallurgy

A symposium on the subject of Gilded Metal Surfaces has been announced for the summer of 1995. It will be held at the Johns Hopkins University in Baltimore for two and a half days, most probably in July, although the dates are not yet set. The symposium will cover historical, technical, aesthetic and conservation issues of gilded metal surfaces and imitation gilding on archaeological and ethnographic objects, historical and decorative art objects, furniture, sculpture, functional objects, outdoor sculpture and monuments, and architectural elements. The symposium is organized and sponsored by the Objects Specialty Group of the American Institute for Conservation, the National Association of Corrosion Engineers, the Association for Preservation Technology, and the National Institute for Conservation. For further information write Terry Drayman-Weisser, Walters Art Gallery, 600 N. Charles Street, Baltimore MD 21201, USA.

Plans are already being made to hold the next meeting of the Comité pour la Siderurgie Ancienne of the International Union of Pre-and Protohistoric Sciences in Norberg, Sweden, in 1995. This was the site of the meeting, on Medieval Iron in Society, in 1985. A report of the 1985 meeting by Robert B. Gordon and Terry S. Reynolds was published in *Technology and Culture* 27 (1986) 110-117. The site of Lapphyttan, with its early blast furnace, was then recently excavated but since has been extensively reconstructed.

I have the sad duty to report that Elisabeth Tylecote, the widow of Ronald F. Tylecote, passed away in 1993. She was very much a support to her husband's efforts in founding and editing the journal of the Historical Metallurgy Society and in his many books on archaeo-metallurgy. He freely acknowledged that she made a substantial contribution to this work; he once told me that on going back to his notes that he often found them to be in Lis's hand. We will miss her.

If you have any archaeometallurgical news to contribute or announcements to make, please contact

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

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## News of GIS

### Conversion Of State Historic Preservation Office Databases To GIS

Largely during the last two decades, a vast body of electronic information pertaining to the nation's cultural resources has been accumulated. This information—on may hundreds of thousands of cultural resource sites, properties, and surveys—is vital to the preservation of our heritage and history. Of course, it is also vital that these data be accessible to those who make use of it. Research directed toward determining the best way to insure timely and maximally efficient use of these data has recently been begun by Ebert & Associates, Inc.

Each state, by federal mandate, maintains a database of cultural resource properties and sites, usually in the office of the State Historic Preservation Officer (SHPO). Actually, in most states the situation isn't so simple: there are often multiple cultural resources databases, sometimes at various locations throughout a state. Some databases are divided along prehistoric/historic lines. Nearly all states have their own coding forms and conventions; where forms such as IMACS are used across state boundaries, they are often coded in different ways. Some SHPO databases in western states contain records of hundreds of thousands of sites, while some other states tally only a few thousand. Many government agencies with land management responsibility

also maintain "parallel" databases which contain some of the same sites as the SHPO files, often in slightly different form.

The technical means by which states manage their SHPO databases vary, too. Nearly all states employ computer database management systems (DBMS) to some extent. Computerized or "automated" DBMS range from various sorts of geographic information systems in a few states, through lists of sites and locations used as indexes to paper maps and site files.

The major use of SHPO databases is to keep track of cultural resources eligible for nomination to the National Register of Historical Places which may be affected by land disturbance and development activities falling under CFR Sections 36 and 800, the National Environmental Policy Act of 1976, or state and local regulations. Private archaeological contractors and state, federal and local governments consult SHPO databases prior to determination of impacts; after surveys are carried out, they add additional cultural sites to the SHPO files.

Research focusing on managing SHPO databases within a GIS framework was recently begun at Ebert & Associates, Inc. with the support of the National Science Foundation. This research is funded as Phase I of a Small Business Innovation Research (SBIR) project (National Science Foundation Grant No. III-9360278, entitled "A Study of the Feasibility of Developing Generally Applicable Methods and Techniques for Conversion of Existing State Cultural Resource Databases to Geographic Information Systems"). Under the SBIR program, government agencies assist research by small businesses into innovative new technologies or uses of new technologies which are determined to benefit national goals as well as promising to open or expand private sector markets.

Geographic information systems (GIS) have become a familiar topic in cultural resource management and archaeological circles in the last few years. A GIS is, in an inclusive sense, a facility for preparing, presenting, and interpreting facts that pertain to the surface of the earth. More specifically, a GIS comprises software and hardware that facilitate the compilation, management, and accessing of a database through the linkage of spatial and non-spatial characteristics of the entities in it. SHPO cultural resource management databases contain the locations of site and properties, and of surveys and other activities by which sites and properties are found, as well as a wide range of non-spatial characteristics of each of these entities.

A number of recent questionnaires and surveys undertaken by federal agencies and others indicate that most SHPO offices hold conversion of their database to a GIS framework as a major goal. Such conversion is not simple, however, and requires design and planning by archaeologists experienced in both cultural resource data collection and analysis, and GIS and other digital mapping and database management techniques.

GIS (continued on p. 11)

## Conference Reports

### 29th International Symposium on Archaeometry

May 9-14, 1994, Ankara, Turkey

The opening, reception, program papers, and close were held at the auditorium of the headquarters building for the Scientific and Technical Research Council of Turkey (TUBITAK). Poster sessions were in the entry and registration areas of the auditorium. The organizing committee provided phone and fax services at the meeting site. Trips to sites such as Pergamun and Hattusas were arranged on site as well. A second reception was held at the Museum of Anatolian Civilizations and a gala Turkish-style dinner, complete with belly dancer, completed the supra-meeting activities.

Monday, May 9th, papers were on "Ancient Technology and Provenance of Non-Metals," in three sessions. The morning session papers covered: provenance of Late Neolithic/Early Bronze Age obsidian; stone monument identification using spectroscopy; and stable isotope evaluation of Proconnesian marble. The afternoon sessions had 11 papers. The first afternoon session was structured around ceramic analysis with papers covering Mycenaean, Troy, Terra Sigillata (Turkey), and Minoan wares. The last afternoon session dealt with later period ceramic and glass analyses with a very interesting closing paper on cobalt pigments in 18th century glasses in French Canada.

Tuesday, May 10th, morning, afternoon and poster sessions were on prospection. All papers were well illustrated. The morning papers ranged from methodological to applications. Becker's paper on picotesla sensitivity opens up an interesting use of high-sensitivity magnetometers in survey. Herbich and Missiewicz reported on the use of resistivity in ascertaining vertical sections through a monastic site. Papamarinopoulos and Papioannou gave an update of the use of archaeogeophysical techniques in concert with the building of the Athens subway. Afternoon papers included GPR (ground penetrating radar), tensor resistivity, automatic gradiometer interpretation, and balloon photography. The last session of the day covered the "Dating of Organic and Inorganic Materials." The five papers ranged, in subject, from AMS-radiocarbon, magnetic, ESR (electron spin resonance) to OSL (optically-stimulated luminescence) and IRSL (infrared stimulated luminescence). These latter two papers creatively explored these TL relatives for the age determination of archaeosediments. The poster session was populated with a wide variety of papers, most of which were of high graphic quality. The only drawback to so many fine posters was the space set aside for their display. One had to maneuver carefully through the crowded gallery to

see a poster of interest, much less to discuss its content with the author(s).

Wednesday, May 11, was the theme session: "Science in Anatolian Archaeology." One can only marvel at the maturation of archaeometry as an endeavor when one considers the breadth and depth of papers in this session. Most of the presenters had their start or present affiliation with METU (Middle East Technical University), Ankara. The quality of the papers was high and a tribute to our Turkish colleagues. The only criticism, and it is minor, was the graphics in one paper listing a bibliography for archaeometric studies in Turkey running on for several overheads!

Thursday, May 12, had three sessions and the second poster session. The organizing theme in two of the morning and afternoon sessions was "The Study of Human and Animal Bones, Organic Materials and Residues." ESR made its appearance, again, this time as a detection technique of thermal activity relative to bones. Organic residues on archaeological materials were the topic of three papers. Dental and blood group studies were covered in two papers, and two isotopic papers dealt with Holocene variation in tree rings and skeletal materials. Geoarchaeology was the topic of the last session of the day with five papers. Geophysical prospection had a "refugee" from the Tuesday session with Papamarinopoulos et al. reporting on the geophysical re-location of the Canal of Xerxes. The poster session benefited from the previous one, with many of the posters moved into the hall/atrium area outside the auditorium. This move alleviated much of the crowding experienced in the first poster session.

Friday, May 13, brought the symposium to a close. Three sessions covered "Ancient Technology and Provenance of Metals," while the closing session dealt with "Mathematical Methods and Data Management." The archaeometallurgy papers represented the largest single topical set of papers in the conference and were of high quality and interest. This fact is a tribute to the dynamism of this field of archaeometry. I will not go into detail of any papers for fear of slighting any because of my own biases (and fatigue—it was the last day!). Please read the proceedings to be published on these papers as well as the others prepared for this fine conference. The final session of the day and conference provided the most "fireworks." Lead isotope studies seem to a hotbed of scholarly debate and even polemic (cf. *Archaeometry*, vol. 35, 1993).

Closing note: The author, your current President, carried the new SAS pop-up exhibit, together with posters and brochures, to Ankara and back to his base in Athens, Georgia. He only lost one piece of the exhibit to customs! The organizers of the Symposium graciously provided room for the SAS exhibit and almost all the literature—Plenum publication fliers, brochures and posters—was

taken by conference participants. I hope to see many new members come from this initiative on the part of SAS.

*Submitted by Erv Garrison (address on back page)*



## Method & Theory in Phytolith Analysis

Society for American Archaeology  
April 20-24, 1994, Anaheim, California

The Society for Phytolith Research sponsored a symposium entitled "Method and Theory in Phytolith Analysis" at the 1994 Society for American Archaeology Conference, April 20-24, 1994, Anaheim, California (at the Disneyland Hotel). Elizabeth J. Lawlor was the symposium organizer and chair. The symposium was a success, with no cancellations and attendance of 30 to 50 at any one time. It was especially nice to see the session highlighted in large, bold print on the cover of the SAA Bulletin previewing the meeting!

The session focused on the challenges of phytolith identification and interpretation. Two papers provided syntheses of current phytolith analysis. Deborah M. Pearsall (University of Missouri-Columbia), Dolores R. Piperno (Smithsonian Tropical Research Institute), and Robert A. Benfer, Jr. (University of Missouri-Columbia) presented an overview on "Identifying Crops through Phytolith Analysis." They noted that methods for establishing identification criteria for crops vary among crops (use of diagnostic shapes and sizes; evaluation of assemblages; multivariate techniques) and among researchers (multiple identification methods for maize, rice), and summarized the crops currently identifiable to certain taxonomic levels in certain regions. Later, Susan C. Mulholland (University of Minnesota-Duluth) discussed "The Status of Method and Theory in Phytolith Analysis" as reliant on the degree of the researcher's interdisciplinary training, which should include botany, anthropology, and geomorphology.

Two papers focused on particular techniques. Terry Ball, Michael Standing, and Wilford M. Hess (Brigham Young University) reported on "3-D Microscopy and Image Analysis of Phytoliths." Using a videotape and stereoscopic slides for which the audience donned 3-D glasses, Ball et al. evaluated the potential of using laser confocal microscopy and computer-assisted image processing to create and manipulate 3-D images of individual phytoliths to aid in typology and morphometrics. Zhijun Zhao and Deborah M. Pearsall (University of Missouri-Columbia) discussed "Using Multivariate Analysis Techniques to Search for Diagnostic Phytoliths," using *Oryza* and *Setaria* as examples to illustrate how species-level diagnostics can be identified using discriminant analysis and other multivariate analysis techniques.

Two papers focused on applications in particular environmental settings. Marsha Baenziger (University of Missouri-Columbia) and Tom Dillehay (University of Kentucky) discussed "Methods for Identifying Opal Phytoliths: Monte Verde, a Case Study of Panicoids." Preliminary findings from the 13,000 BP levels indicated that a warm-season panicoid grass predominates at the site but not in the surrounding area, so was brought to the site by the occupants. Lisa Kealhofer (Smithsonian TRI) reported on "Phytoliths and the Paleoecology of Central Thailand," where sediment sequences document 8000 years of environmental change and human impact; however, intensive human disruption begins in the third millennium BP.

Two papers focused on phytolith assemblage formation processes. Alix Powers-Jones (Cambridge University) called her paper "Phytoliths: A Process-driven Approach?" and explored the examination and identification of phytolith suites (such as those found in dung, peat, and turf) rather than individual phytoliths, illustrated with an application to analyses of prehistoric sites in the Outer Hebrides of Scotland. Elizabeth J. Lawlor (University of California-Riverside) discussed "Site-formation Processes Affecting Phytolith Deposits in the Mojave Desert," including such processes as wind and the tracking of ash on feet, as demonstrated by an experimental field study comparing soil samples from modern food-preparation areas to samples from control areas.

Phytolith residues were considered by two papers. Hope Jahren (University of California-Berkeley), N. Toth (University of Indiana), K. Shick (University of Indiana), and J. D. Clark and R. G. Amundson (University of California-Berkeley) presented "Phytolith and Other Residue on Stone Tool Surfaces: Experimental Results from Bamboo and Bone Processing." Experimentally manufactured chert tools used on bamboo exhibited bundles of hair-like bamboo phytoliths, which were distinguishable from phosphate-based bone residues by SEM/EDAX elemental analysis. Robert Thompson (University of Minnesota-Minneapolis) and Susan C. Mulholland (University of Minnesota-Duluth) reported that "Opal Phytolith Analysis Provides a Method for Tracing the Use of Pottery Vessels to Prepare Corn." A phytolith assemblage representing corn cob fragments and chaff incorporated into food cooked in pottery was recognized at the Shea site and confirmed on food residues from Peru.

Finally, two papers focused on underused applications of phytolith analysis: identification of fibers and of medicinal herbs. Judith Zurita-Noguera and Emily McClung de Tapia (UNAM) reported the "Identification of Carbonized and Mineralized Agave Fiber Remains from Terremote-Tlaltenco, Teotihuacan and Tlaltelolco." Phytolith extractions of modern specimens revealed silicified structures that can be considered diagnostic of Agave fibers; in applications to prehistoric specimens, it was possible to identify which specimens were Agave fibers and which corresponded to other plant families on the basis of diagnostic phytoliths. Susan Pennington (University of

## Conference Reports

Minnesota-Minneapolis) titled her paper, "Towards the Routine Integration of Phytoliths into Paleoethnobotanical Research," and discussed integrating phytoliths, both silica and calcium based, with macrobotanical and pollen data in preliminary research into magical and medicinal plants of the medieval period.

Complete abstracts will be published in the *Phytolitharien Newsletter*. Plans are underway for phytolith symposia at the 1995 meeting of the International Society of Palynology in Houston and at the 1995 SAA meeting in Minneapolis. For more information, please contact Page C. Twiss, President, Society for Phytolith Research, Department of Geology, Kansas State University, Manhattan, KS 66506, USA, or (for the SAA symposium) Susan Pennington, Department of Anthropology, University of Minnesota, Minneapolis, MN 55403, USA.

*Contributed by Elizabeth J. Lawlor (address on back page)* □

### Problem-Solving in Mediterranean Archaeology

Archaeological Institute of America Meeting  
Dec. 30, 1993, Washington, DC

Scientific data were presented in 11 of 26 colloquia at this year's annual meeting, continuing the long history of collaboration between classical archaeologists and archaeometrists. The particular purpose of the colloquium reviewed here was to examine the relationship between archaeology and archaeological science through the presentation of research efforts which truly integrate scientific methods with archaeological fieldwork, art historical analysis, and interpretation of ancient texts (*SAS Bulletin* 16(2):21, 1993). The emphasis was thus on the incorporation of scientific methods and data into archaeological research design and interpretation.

The first paper, by Sarah Vaughan (American School of Classical Studies, Athens), focused on marble-tempered ceramics from the Early Bronze Age Aegean. Petrographic and SEM analysis of the pottery, and stable isotope analysis of the marble temper, were used to reconstruct production technology. Cross-craft exchange between potters and sculptors was suggested to explain the presence of both marble and vein calcite (associated with marble formations) temper in these ceramics, the calcite of course unsuitable for carving the well-known Cycladic figurines.

James Blackman and Robert Henrickson (Smithsonian Institution) also studied ancient ceramic technology, in this

case from Gordion in Turkey. Using neutron activation, x-ray diffraction, and differential thermal analysis, they characterized Late Bronze Age and Phrygian period pottery, and both modern and ancient clays. The authors conclude that the LBA ceramics were made from local clays and perhaps were centrally produced. The Phrygian wares on the other hand were primarily made of non-local clay. This technological shift was then interpreted in light of the cultural, economic, and political breaks known between the LBA and the Phrygian period.

Geoffrey Purcell (State University of New York-Albany), in a more theoretically oriented paper, examined the complementary nature of typological and analytical data in the reconstruction of Late Roman ceramic economy in the Middle Danube region. Typological variable such as vessel form and decoration can be used alone to answer questions about style, chronology, and function, whereas clay chemistry and mineralogy are more informative about raw material procurement and the technology of production. These two categories of data are both necessary and interdependent, however, for studying ceramic exchange and understanding extinct economic systems.

Bernard Knapp (Macquarie University) emphasized the lack of critical examination of archaeological and analytical results and their cultural interpretation in the case of Bronze Age Cyprus. He compiled the analytical data from 1534 pottery samples and 282 metal or ore samples, produced from at least eight different laboratories, and used principal components analysis to statistically assess how well these data sets can arbitrate among alternative cultural hypotheses regarding the organization of production and its relationship to the socio-political and demographic shifts which occurred after 1700 BC.

The final paper, by this writer, Nikolaas van der Merwe (Harvard University), and John Herrmann (Museum of Fine Arts, Boston), demonstrated how the combination of stable carbon and oxygen isotopes analysis, x-ray diffraction, and art historical interpretation determined the likely raw material source for 86% of the 145 classical marble sculptures examined. Significantly, the techniques used are minimally destructive and also inexpensive, so that large numbers of sculptures may be examined. The authors suggest that strontium, lead, and neodymium isotopes should unambiguously differentiate all possible sources, while still requiring only a small powdered sample, but that the construction of the quarry database would be quite expensive.

Elizabeth Lyding Will (Amherst College) and Ron Hancock (University of Toronto) then put the contributions into the perspective of a classical archaeologist and an archaeometrist, respectively. Both discussants praised the integrative nature of all the papers, and called for greater interdisciplinary communication and collaboration in all

phases of archaeological research and interpretation. Abstracts of the papers delivered at the conference have since been published in the *American Journal of Archaeology* 98(2), 1994.

*Reviewed by Robert H. Tykot (address on back page)*

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## The Association for Environmental Archaeology Spring Conference March 28, 1994, The Museum of London

The A.E.A. Spring conference is an annual one-day event in which both well established names and newer researchers are able to give short presentations on their own particular lines of study. As such it is an ideal platform to present developing work in front of a small audience prior to its publication or completion. The conference is therefore often used by researchers as an opportunity for discussion, welcoming suggestions, and obtaining constructive criticism of ongoing projects. In this review, I have highlighted some papers of general interest.

Although the conference had no set theme, similar recommendations, approaches and conclusions were often reached by separate speakers. In particular, two papers—on pathological abnormalities in humans (Tony Waldron, St. Mary's Hospital, Paddington) and in sheep (Kathleen Clark, University of Southampton)—both challenged the application of aetiological studies in modern populations to palaeozoological work. Tony Waldron criticised studies in which inferences of occupation have been made upon individuals based upon the relative amounts of osteoarthritis observed in various joints. He argued that such studies were often too simplistic in their approach and disregarded the complex multiple causes often accumulating in the single observed effect on the bone. He suggested a wider strategy in which research upon osteoarthritis was applied to comparisons of populations rather than interpretations of individual skeletal remains. Kathleen Clark likewise criticised many interpretations of bone diseases observed in individual animals and recommended the use of multi-causation models and the application of such studies to whole populations rather than individual beasts.

Two papers dealt with research projects on oyster middens from the South of England. Elizabeth Sommerville (University of Sussex) used equations adopted from ornithology, which have been designed to test the accuracy of an individual taking measurements of zoological material. In a very honest presentation of her own length and breadth measurements of oyster shells from a Roman Villa in south-east England, she highlighted the discrepancies which one person can make, taking the same measurements. There is thus a clear need for caution when

comparing any archaeological data compiled by many different authors.

Jessica Winder's (free-lance, c/o Museum of London) study compared archaeological oyster middens with modern populations. She looked for infestations of micro-organisms or evidence for predatory behavior by hole-boring gastropods. The results indicated that in certain cases the oysters could be provenienced to likely locations upon the coastline. One critique was the assumption that the modern coastline provides a good analogy for past ecological marine communities. The argument could perhaps be strengthened by a study of the physiological and physical requirements of the micro-organisms involved.

Two topics stood out as having wide implications for future archaeological work the world over. Francis McLaren (Institute of Archaeology, University College London) has identified ancient wheats to species level using infra-red analysis to produce lipid profiles for archaeological charred material. These were matched against profiles obtained from modern reference material. Her results for Danebury, an Iron Age hillfort in the south of England, identified the free-threshing wheat *Triticum carthlicum*, an outcome which is at odds with conventional identification techniques and current opinions on the types of wheat thought to be utilized in prehistoric Britain. In spite of this, further development of the technique could provide a useful tool to identify problematic grains and chaff.

Another paper is perhaps very widely applicable to the study of archaeological demographies. Geraldine Barber (University of Bristol) has used a well established observation from the medical profession to push the possible maximum age assessment for any individual from the current ceiling of forty-five years to an estimated actual age of death. The number of pitted features termed arachnoid granulations, which are finger-like alveolar projections in the internal side of the cranial plates, increase with age. The modern comparison is as yet still limited to British populations, so it is unclear to what extent this phenomenon may be modified in a larger genetic pool. So far the ancient skulls aged have largely agreed with the results obtained using conventional techniques and include individuals who appear to have lived into their eighties.

Lastly was a presentation by James Rackham (free-lance, c/o Museum of London), exploring the seasonal slaughter of domestic animals. He used Medieval records of autumn fairs and investigated the longevity of such events using the skeletal remains of sheep, cattle and pigs from earlier pre-Medieval sites. Aging based on tooth eruption seemed to indicate high proportions of individuals aged to 18 and 36 months, which were presented as possibly representing animals killed during the autumn months of the year. Such a study highlights the importance of a seasonal cycle in the lives of populations with an agricultural subsistence.

The subject of seasonality forms the main theme of the Autumn A.E.A. conference at the University of Amsterdam,



## Conference Reports

from 21-24 September at the Institute for Pre- and Proto-historic Archaeology, and should provide further interesting examples of the links between environmentally influenced seasonal events and other activities observed in the archaeological record.

The address of the Association for Environmental Archaeology is: c/o Environmental Archaeology Unit, University of York, Heslington, York, YO1 5DD, UK.

Enquiries concerning membership of the AEA can be sent to: Membership Secretary, Association for Environmental Archaeology, c/o University Museum, Parks Road, Oxford OX1 3PW, UK.

*Contributed by Chris Stevens, McDonald Institute for Archaeological Research, University of Cambridge, 62 Sidney Street, Cambridge, CB2 3JW, United Kingdom* □

### **Wetlands: Nature Conservation and Archaeology.**

**April 11-14, 1994, Bristol, UK**

This long awaited and well attended wetlands conference was organized by Dr. Margaret Matthews of Gifford and Partners, with sponsorship from a range of august national and regional bodies. Of the 150 people in attendance, I was immediately struck by the overwhelming number of representatives from the various water and nature conservation authorities, probably outnumbering the archaeologists present.

The conference proceedings began with the keynote address by Dr. Francis Pryor of Fenland Archaeological Trust, standing in at the last moment for Dr. Oliver Rackham. In this fairly personal account, Dr. Pryor stressed that the archaeology of wetlands is not the answer to every archaeologist's wildest dreams. Wetlands archaeology is not just better preserved dry land archaeology. These regions are, by their very character of formation, different contexts probably presenting different aspects of the archaeological record, and certainly requiring different methodological approaches. Moreover, wetlands archaeology cannot be divorced from their dry land surroundings. This point is of particular importance, and is all too easy to forget when presented with the potential for 'fantastic' archaeology buried within wetlands. Finally, experience at the late Bronze Age site of Flag Fen, Peterborough, has shown that the water authorities and archaeologists can work together for mutual benefit. It must never be forgotten, however, that the archaeology in a former wetland is a diminishing resources, whatever the management practices involved.

The following two days contained an intensive set of sessions covering a whole range of topics, followed by a field trip to the Somerset Levels and Moors. Discussions included the management and protection of wetland ecosystems, the rehabilitation of wetlands, archaeological and conservation work in coastal, lowland and upland wetlands, and the functions and values of wetlands. The final afternoon session was designed to bring all these issues together by considering the priorities for wetland management and conservation.

Perhaps the most dynamic and lively presentation of all was the last paper given by Professor Patrick Denny on the priorities for nature conservation. He recognized and set out much of what was at the heart of the conference. Conflicts and potential conflicts between the cultural, natural and amenity conservation lobbies are complicated still further by commercial, moral, and aesthetic arguments. Prof. Denny described how an understanding of the main functions and values of different types of wetlands may provide a basis for conservation criteria. Their contribution on global, national and local levels can be identified, but are often impossible to evaluate. Knowledge of wetlands is necessary in order to rank them in terms of importance, and therefore in terms of priority for attention. Only then can management strategies be devised which take into account all sectors of society. Assessment of priorities and strategies arising from them are likely to be extremely difficult.

What had struck me throughout the proceedings was that the archaeological fraternity needs to dispel some myths. First of all, the conservation authorities have the distinct impression that archaeologists do not know what is actually present in wetlands. This is simply not the case: a vast amount is known and published. Even though there are still many unknowns in the archaeological record of wetlands, we as a profession have more than enough knowledge to make a case for what can be expected within various wetland areas. Obviously the archaeological profession is not making its experience and expertise available to those who need our guidance in formulating wetlands management schemes.

Secondly, it would appear that some archaeologists advising the various conservation bodies do not have sufficient or relevant experience and interest to be able to contribute the most useful and valuable information. The conservationists also seemed unaware of the large numbers of projects being commissioned by English Heritage to evaluate the importance of the archaeological record in wetland contexts. We archaeologists must make a much better attempt to bring our work and its implications to the attention of our natural allies in conservation.

**Wetlands (continued on p. 11)**



## Announcements

### Fryxell Award Request for Nominations, 1995

The Fryxell Committee bestows special recognition of interdisciplinary excellence by a distinguished scientist, who need not be an archaeologist, but whose research has contributed significantly to American archaeology. The award was made possible through the generosity of the family of Dr. Roald Fryxell, a geologist whose promising career in geoarchaeological research was ended by his premature death.

The award cycles through five categories: Earth Sciences, Physical Sciences, General, Zoological Sciences and Botanical Sciences. It consists of an engraved medal, a certificate, an award citation read by the President of the Society for American Archaeology at the annual business meeting, and announcements published in *American Antiquity* and the *SAA Bulletin*. In addition, a Fryxell Symposium is organized for the SAA meetings. The symposium topic follows the same cycle as the award category itself.

The award category for 1995, General Sciences, is for researchers who have made outstanding contributions to the integration of interdisciplinary research in archaeology, although they themselves may not have done research in a specific interdisciplinary subfield.

Nominations should describe the nature, scope and significance of the nominee's contributions to American archaeology. A recent curriculum vitae should be included for each nominee. Nominations for the award can be sent to the current Fryxell Committee Chair: Dr. Pat Watson, Department of Anthropology, Washington University, St. Louis, MO, 63130, USA. The deadline for nominations is September 2, 1994.

### Jobs

#### *Executive Director, Desert Research Institute*

The Quaternary Sciences Center of the Desert Research Institute is seeking an Executive Director of internationally recognized distinction in the Quaternary Sciences with proven administrative and personnel management skills. The candidate must have 1) Ph.D., 2) a proven ability to obtain significant research grants and contracts in the field of Quaternary Studies, and 3) a record of noteworthy, peer-reviewed publications in national and international journals or forums. In addition, the candidate must have demonstrated 1) creativity in identification of research issues and an ability to pursue research avenues that enhance academic prestige, as well as financial standing, 2) an ability to manage and guide research programs to timely completion, 3) administrative and personnel management skills that maintain high morale, and 4) an

aptitude for problem-solving. The Executive Director promotes the needs of the Quaternary Sciences Center and its personnel, and interacts with sponsors to further the strategic goals of the Quaternary Center and the Desert Research Institute. Salary is state-funded ranging from \$90,000 to \$110,000 (commensurate with applicant's qualifications). Position will be in either Reno or Las Vegas, Nevada. Review of applications begins 15 August 1994 and continues until position is filled. Submit a letter of interest describing how your qualifications meet the position requirements, a vita, and a list of five references to: Recruitment Office, Desert Research Institute, University and Community College System of Nevada, P.O. Box 19040, Las Vegas, NV 89132-0040, USA. The Desert Research Institute is an Affirmative Action/Equal Employment Opportunity Employer and employs only U.S. citizens and persons authorized to work in the U.S.

#### *Computer support person, Department of Anthropology, University of Georgia*

Computer support person with a strong background in human geography or anthropology to manage a GIS lab within a Department of Anthropology. Lab consists now of a networked cluster of 10 machines. Familiarity with GRASS, ATLAS-GIS, IDRISI and pc-NFS preferred. Specific duties include: 1) lab hardware/software maintenance—support the day-to-day computer operation of the department and the lab. Perform necessary routine maintenance required of SUN, IBM-PC and MACINTOSH platforms. Network administration, liaison to building network administrator. 2) build expertise—promote use of the lab through direct means such as teaching short courses and indirect means such as supervising graduate students working in the lab/department on hardware/software maintenance and upgrade. 3) research involvement—build the lab into personal research activities and offer expertise in drafting proposals to other members of the department. Closing date for applications is August 1, 1994. Write to: Dr. Robert E. Rhoades, Professor and Head, Department of Anthropology, University of Georgia, Athens, GA 30602-1619, USA. University of Georgia is an Equal Opportunity Employer. *From the ARCH-L listserver.*

### Geological Society of America Meeting Oct. 24-27, 1994, Seattle, Washington

#### *Short Course - Geology in Cultural Resource Management*

A day-long short course entitled "Geology in Cultural Resource Management" will be offered on Sunday, October 23 in conjunction with the Annual Meeting of the Geological Society of America. The course is being taught by Art Bettis (Iowa Department of Natural Resources-Geological Survey) and Ed Hajic (Illinois State Museum),

and will focus on geologic issues that need to be addressed during the survey, testing, and mitigation phases of cultural resource studies. Several topics will be addressed: the role of geologists in CRM from perspectives of both archaeologist and geologist, general research questions, methodologies utilized during various investigative phases and their effectiveness, issues of scale, the balancing of fiscal and temporal constraints, and communication among archaeologists and geologists. Detailed course notes will be provided to registrants. You may register for the course only, and need not be a GSA member to attend. For further information and registration information contact: Edna Collis, Continuing Education Coordinator, GSA Headquarters P.O. Box 9140, Boulder, CO 80301, USA; tel: 303-447-2020; or Art Bettis IDNR-GSB, 109 Trowbridge Hall, Iowa City, IA 52242, USA; tel: 319-335-1578; e-mail: abettis@gsbth-po.igsb.uiowa.edu. Registration deadline is September 16 and course attendance is limited.

#### *Symposium - Use of Archaeology for Dating Geologic Events.*

Invited papers only. Tuesday, Oct. 25, afternoon. Sponsored by the Archaeological Geology Division. Organized by Margaret J. Guccione, University of Arkansas.

#### *Theme Session - Volcanic Hazards and Disasters in Human Antiquity*

Numerous volcanic eruptions have influenced our environment, from the destruction of our immediate surroundings to climate change. Volcanism also has been a major factor in the preservation of our paleoenvironment, from simple tools to cities and landscapes. We are organizing a theme session, sponsored by the Archaeological Geology and Volcanology Divisions, for the 1994 Annual Meeting of the Geological Society of America on "Volcanic Hazards and Disasters in Human Antiquity". This GSA session concerns volcanic hazards and disasters in the geologic and archaeologic record. We intend to assemble a program that will appeal to a broad cross-section of the geological sciences. Dr. Grant Heiken, Los Alamos National Labs, ESS-1 MS D462, Los Alamos, NM 87545, USA; tel: 505-667-8477; fax: 505-665-3285; e-mail: heiken@esslab.lanl.gov; Dr. Floyd W. McCoy, University of Hawaii, Windward Community College, Kaneohe, HI 96744, USA; tel: 808-235-7316, fax: 808/247-5362; e-mail: wccmop@uhccvx.uhcc.hawaii.edu. Between May 20 and August 15, please contact Grant Heiken.

#### *Theme Sessions*

Records of Glaciation and Climate Change Along the Leading Edge During the Last Glacial Maximum and the Pleistocene-Holocene Transition (20-8 ka). Sponsored by the Quaternary Geology/Geomorphology Division. Organized by Donald T. Rodbell, P. Thompson Davis, and Geoffrey O. Seltzer.

The Last Interglacial: Timing and Environment. Sponsored by the Quaternary Geology/Geomorphology Division. Organized by Gifford Miller.

Quaternary Dating Methods. Sponsored by the Quaternary Geology/Geomorphology and Stratigraphy Divisions. Organized by Milan Pavich.

#### *Field Trips*

Geoarchaeology of Sites on San Juan Island, Washington. Saturday, Oct. 22. Co-sponsored by Archaeological Geology Division. Leader - Julie K. Stein, Burke Museum DB-10, University of Washington, Seattle, WA 98195, USA; tel: 206-685-2282.

#### *Discipline Session*

General session(s) of contributed papers will also be sponsored by the Archaeological Geology Division.

For general information concerning the meeting, contact GSA Annual Meeting, The Geological Society of America, 3300 Penrose Place, P.O. Box 9140, Boulder, CO 80301, USA; e-mail: mball@geosociety.com.

## **Lithics**

### *Lithic Resource Studies - A Request from SAS-Net*

I am in the process of finishing up a sourcebook on lithic resource studies and would like to include an appendix listing of the various archaeometric facilities that deal with stone (chipped stone, groundstone, ceramics, etc.). Any facility that would like to be included can send me the following information: name and address of facility, director's name and phone # (and e-mail address), the instrumentation available, and the general area of interest and/or expertise. Please send to: Tim Church, 3358 Eastridge Pl., Las Cruces, NM 88005, USA; tel 915-568-4483; e-mail: Michel1767@aol.com.

### *Buffalo Museum of Science Lithic Laboratory*

The Holland Comparative Lithic Laboratory at the Buffalo Museum of Science has opened. The laboratory houses a comparative collection of over 3000 lithic materials known to have been used prehistorically throughout North America. Current research includes development of a master database of the collection, a directory of other lithic laboratories and collections, computerized mapping projects, ultraviolet fluorescence characterization, and a thesaurus of names which have been associated with each type of lithic material. Future plans include thermal alteration and full petrographic studies of all materials. The laboratory has been assembled through the efforts of John Holland over the last decade. Most of the samples have been personally collected at outcrops. The laboratory requests information regarding well provenienced samples from any individuals who have collections or access to lithic resources. Please contact: Mr. John D. Holland, Director of the Holland Comparative Lithic Laboratory, Buffalo Museum of Science, 1020 Humboldt Parkway, Buffalo, New York 14211; tel 716-896-5200 ext 292; fax 716-897-6723. From the ARCH-L listserver.

## Publications

### *Directory of Graduate Programs*

The eighth edition of the Directory of Graduate Programs in Archaeological Geology and Geoarchaeology was published in March 1994. Copies are available free to any student or faculty advisor from: Rip Rapp, Archaeometry Laboratory, Research Laboratory Building, University of Minnesota, Duluth, MN 55812-2496, USA; tel (218) 726-7629; fax (218) 726-6556; e-mail grapp@ua.d.umn.edu.

### *British Archaeological Yearbook*

This first in an annual series will be a compendium of information about British archaeology. It will include: a summary of British archaeology in 1994; information on archaeology in education; detailed listings of British archaeological organizations; details of significant dates and events concerned with British archaeology in 1994-95; a guide to information sources on various aspects of archaeology. Available for £18 from CBA, Bowes Morrell House, 111 Walmgate, York YO1 2UA, UK. □

### GIS (continued from p. 3)

Ebert & Associates, Inc. is an Albuquerque, New Mexico based firm which for more than a decade has specialized in the applications of digital mapping and other data collection and analysis techniques—including technically assisted field data collection design and implementation, remote sensing, photogrammetry, and GIS—to cultural resource management and archaeological research. The firm was founded in 1983 by James I. Ebert, who for ten years previously helped develop the National Park Service's Remote Sensing Division at the University of New Mexico. Ebert is principal investigator in the Phase I SBIR project. Dr. Eileen Camilli is project director, assisted by Eric Ingbar. Roger Werner, of ASI Inc. in Stockton, California is serving as a GIS consultant in the effort.

Phase I research will focus on determining in detail the range of data currently managed by SHPO cultural resource databases, the methods that are presently used for their management, and current and future needs that SHPO databases must fulfill, largely through surveys and interviews of SHPOs, SHPO database managers, and cultural resource data users and providers across the United States. In addition, alternative GIS approaches to such needs, and optimal methods for the conversion or translation of current databases into a GIS framework will be explored. Associated topics such as database standards, networking and other means of data dissemination, document imaging, and innovative means for funding database conversions will also be investigated.

A major underpinning of Ebert & Associates' approach to automation of SHPO databases is that it is crucial to

develop a generally applicable set of techniques by which data are converted or translated into, and managed and made available within, a GIS framework. *This is not to be construed to mean that data among states would be "standardized"*—the data collected in each state has of course evolved in response to their unique cultural resources and data needs. Data must, however, be enterable, manageable, and accessible in compatible form and using "standard" methods for several reasons.

At the database conversion stage, of course, the use of general translation and GIS methods—rather than the development of a wholly unique database management system for each state—should reduce design costs radically, something which appears to be extremely important at all SHPO offices. In addition, many current database users—notably federal managers with responsibilities which span several states—are seriously impeded given present incompatibilities in access and database structures among the states. Finally, consistency in database structure and access will open a vast national archive of cultural resource data to archaeological and historical researchers—a class of users that has been largely unable to make use of these data. And someday, linkages with GIS databases being compiled for non-archaeological purposes, which are being planned and constructed by hundreds of states, agencies, and other groups throughout the country, will enable archaeologists and cultural resource managers to use SHPO databases for purposes that couldn't have been imagined even a few years ago.

*Contributed by James I. Ebert, Associate Editor for Remote Sensing and GIS (address on back page)* □

### Wetlands (continued from p. 8)

On the other hand, nature conservationists should educate archaeologists in the relevant legislation as well as conservation techniques. It is apparent that some of the most successful conservation schemes are those where the least is currently known about the archaeology. This clearly shows that there must be much more co-ordination between nature conservation agencies and archaeologists, which would lead to mutual benefit. Such an approach would give us all greater influence, on a wider scale.

As ever, it would appear that a regular forum is needed to thrash out common approaches to a vast problem: how to preserve wetlands habitats and resources for the future, given all possible constraints imaginable. I am sure that everyone's hope at the conference was that this beginning in co-ordination can continue to grow and strengthen.

*Contributed by Dr. Charly French, Department of Archaeology, University of Cambridge, Downing Street, Cambridge CB2 3DZ, United Kingdom* □

## Book Reviews

**Reconstruction of Life from the Skeleton.** Mehmet Yasar Iscan and Kenneth A.R. Kennedy, (eds.). Alan R. Liss, Inc., New York, 1989. xv + 315 pp., index. \$59.95 (cloth).

**Skeletal Biology of Past Peoples: Research Methods.** Shelley R. Saunders and M. Anne Katzenberg (eds.). Wiley-Liss, New York, 1992. xvii + 265 pp., index. \$59.95 (cloth).

**Advances in Dental Anthropology.** Marc A. Kelley and Clark Spencer Larsen (eds.). Wiley-Liss, New York, 1991. xiv + 389 pp., index. \$99.95 (cloth).

*Reviewed by Joseph A. Ezzo, Statistical Research Inc.,  
P.O. Box 31865, Tucson, AZ 85751-1865, USA*

*Reconstructions of Life from the Skeleton* grew out of a symposium presented at the 1986 American Anthropological Association meeting. The volume consists of 15 papers that deal with various methods to determine age, sex, genetic affiliations, health status, and diets from skeletal data. After an introductory chapter by the editors, the papers fall into five categories of inquiry: age determination (Chapters 2-4), sex and genetic affiliation (Chapters 5-6), pathology (Chapter 7-11), dietary reconstruction (Chapters 12-14), and reconstruction of life histories (Chapter 15). Papers tend to focus on two topics: a critical review of pertinent literature, and an evaluation of current methods of investigation. In this sense they read almost as if the volume were intended as a textbook for an upper-level undergraduate or graduate-level course. This is not meant as a criticism; the papers are generally well-written and illustrated, and are focused in such a way that the authors are not required to cover huge amounts of ground in order to elucidate the major points.

The first part of the volume concerns age determinations, with a focus on subadults (Johnston and Zimmer, Chapter 2) and two methods of aging adults. The more traditional osteological approach is presented by Iscan and Loth (Chapter 3), while Stout discusses the use of cross-sections of bone tissue to apply histomorphometric principles to age. In each chapter the sites of analysis are discussed, followed by the methods of analysis. The paleopathology sections are the most extensive in the volume, covering recognition and implications of congenital abnormalities (Turkel, Chapter 7), skeletal markers that result from occupational stress or trauma (Kennedy, Chapter 8; and Merbs, Chapter 9), infectious

disease (Kelley, Chapter 10), and nutritional deficiency (Stuart-Macadam, Chapter 11). Keegan (Chapter 13), Aufderheide (Chapter 14), and Lukacs (Chapter 15) present thorough reviews of the potential for dietary reconstruction using stable isotopes, elemental analysis, and dental paleopathology, respectively. Saul and Saul (Chapter 15) round out the volume with a case study of reconstructing prehistoric life histories from skeletal data. As noted above, this volume should serve archaeologists and physical anthropologists who undertake skeletal analysis with a useful textbook for courses in such analysis.

The 12 papers in *Skeletal Biology of Past Peoples: Research Methods* are divided into four sections: morphological analyses, chemical analyses of hard tissues, prehistoric health and disease, and quantitative methods and population studies. According to the editors, the volume is designed "to show how technological advances can be used to learn more about past peoples and it is one of our goals to do this in a way that is instructive rather than intimidating to the reader" (xiii-xiv). In this they have succeeded most admirably. In general the volume consists of excellent review papers of research methods, with extensive bibliographies.

Saunders' discussion of analysis of subadult skeletons opens the volume impressively. Her section on growth-related studies is particularly well-integrated in reminding us of the importance of archaeological contexts and burial assemblages to these studies. Stout's chapter focuses on the various models of employing bone histomorphometry (quantitative histology) to estimate age at the time of death. He begins by discussing bone remodeling, which is the metabolic basis for cortical bone histomorphometry, pointing out the microscopic diagnostic markers that are the results of various processing in remodeling. Ruff explains how biomechanical information can be obtained from skeletal remains, and he follows this with several applications, such as changes in subsistence strategy, age-related bone loss, growth and development, and sexual dimorphism. Mayhall's treatment of dental morphology analysis focuses on methods that the author claims are "easily achievable and generally accepted" (p. 59). He discusses three topics: tooth size, tooth morphology, and periodontal disease, noting that the topics are not mutually exclusive. Sandford's "A Reconsideration of Trace Element Analysis in Prehistoric Bone," despite its title, does not appear to be a reconsideration as much as a general review. Katzenberg succinctly considers the principles, methods, and applications of stable isotope analysis to archaeological skeletal material. Her final section, "Problems and New Directions," is outstanding, introducing exciting prospects such as the increased use of stable isotope analysis on bioapatite and the application of stable isotopes to hominid

fossils. Klepinger describes a series of studies that have attempted to identify various types of nutritional deficiency or excess in prehistoric diets, utilizing a combination of chemical and pathological analyses. Rothschild's chapter on detecting disease in archaeological bone focuses first on molecular, microscopic, and immunological techniques of analysis. Advances in DNA techniques comprise a significant portion of the chapter, although most of this section deals with descriptions of the techniques themselves, rather than their application to paleopathology. Skinner and Goodman discuss the methods of identifying

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*"...it is evident from this brief treatment that the subfield of skeletal analysis in archaeology and physical anthropology is a growing and vibrant area of research. New techniques are continually being introduced and integrated into research protocols."*

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and evaluating enamel defects and the anthropological questions that can be addressed by such data. Roth opens the final section of the book by presenting a succinct treatment of the basics of paleodemography, how it has grown as a subfield and how appropriate osteological measures have been utilized that allow for an integration of such data with traditional models in demography. Jackes follows this chapter with a more detailed discussion of paleodemographic techniques, their potential and shortcomings. Van Vark and Schaafsma conclude the volume with a discussion of the use of quantitative methods in skeletal analysis, providing a number of examples to illustrate the use of various statistical measures.

It was the hope of the editors that one of the functions of this volume would be to provide archaeologists and physical anthropologists with a framework to evaluate critically the literature in the subfields of inquiry contained within the volume. Given the ever-increasing specialization with the discipline, this is certainly needed. The volume would also succeed quite nicely as a text for a graduate-level course in prehistoric skeletal analysis.

*Advances in Dental Anthropology* contains 20 papers that admirably cover the broad field of dental studies in anthropology. The papers derive in large part from a 1988 symposium at the annual meeting of the American Association of Physical Anthropologists; according to the editors, the presented papers were substantially revised for this volume, and several others were added. Although not divided into sections, the volume covers two general topics and their anthropological implications: tooth morphology and formation (Chapters 3 through 8), and disease and tooth wear (Chapters 9 through 16). The remainder of the volume includes chapters on the history of dental research in anthropology (Chapter 2), dental

anomalies (Chapter 17), dental attrition (Chapter 18), dental microwear analysis (Chapter 19), and mutilation and modification of teeth (Chapter 20). Papers range from methodological descriptions (Turner et al., Chapter 3, is perhaps the best example) to focused case study (Lukacs and Hemphill's study of tooth size variation over several thousand years in prehistoric Baluchistan, Chapter 6, is a prime example). Although many of the papers are quite detailed, with long tables of numbers and multiple graphs, they are generally very well written, with clearly stated objectives and conclusions, and all are couched very centrally in eliciting the anthropological potential of the employed techniques and generated data bases.

Dahlberg's chapter on the history of dental anthropological research is a particularly enjoyable read, having been composed by a scholar who has been active in the field for over fifty years (virtually the entire existence of dental anthropology). Brace, Smith, and Hunt (Chapter 4) provide a superbly written piece on tooth size over time, integrating human evolutionary theory with dental data, and discussing the major cultural developments that have led to a progressive reduction in teeth. They further propose various evolutionary processes that have occurred as a result of these cultural development and selected for smaller teeth. Calcagno and Gibson (Chapter 5) cover similar ground, but focus their study on Australopithecines, and point out how their diets selected for both larger (molars, premolars) and smaller (incisors) teeth simultaneously. Like Brace et al., they propose evolutionary processes that would code for such traits. Unlike Brace et al., who favor mutation, Calcagno and Gibson offer natural selection as the primary agent.

Turning to the section on dental disease and tooth wear, Larsen, Shavit, and Griffin (Chapter 10) offer a detailed case study of dental caries incidence along the prehistoric and early historic Georgia Bight. They propose several possible explanations for the changes in the frequency and severity of caries through time, noting that the most prosaic explanation is the progressive increase in dietary maize. Kelly, Levesque, and Weidl (Chapter 11) compare frequency of dental disease among five prehistoric Chilean populations covering a period of approximately 4500 years. Using a series of quantitative measures to analyze caries and antemortem tooth loss frequency, they conclude that increases in starchy carbohydrates increase caries frequency, and that the degree of tooth wear correlates positively with antemortem tooth loss. Sledzik and Moore-Jensen (Chapter 12) provide an interesting study of the dental condition of American soldiers (unfortunately their data base is quite small) from three different wars (War of 1812, Civil, and French & Indian). Using historic documentation to reconstruct diets, they found that the factors influencing dental disease included diet, access to dentistry, and ethnicity. In a methodological paper, Hildebolt and Molnar (Chapter 13) discuss the complexities of identifying and analyzing periodontal disease in archaeological specimens.

## Book Reviews

While it is not possible to discuss all of the papers in this volume, suffice it to say that they provide results and discussions of a caliber with the one discussed herein. *Advances in Dental Anthropology* is aptly titled, and an outstanding overview of a very dynamic subfield.

To summarize, it is evident from this brief treatment that the subfield of skeletal analysis in archaeology and physical anthropology is a growing and vibrant area of research. New techniques are continually being introduced and integrated into research protocols. It would also appear that this subfield has reaped considerable success in obtaining funding for research. Given the current laws regarding reburial and scientific burial analysis, with institutions returning numerous Native American skeletal collections for reburial and existing collections becoming more difficult to study, one cannot help but wonder if the exemplary research presented in these three volumes is not describing the peak of activity, which will wane markedly even as this is being written. □

**Early Animal Domestication and its Cultural Context.** Pam J. Crabtree, Douglas Campana, & Kathleen Ryan (eds.). MASCA Research Papers in Science and Archaeology, Special Supplement to Volume 6. MASCA, Philadelphia, 1989.

### **Animal Use and Culture Change.**

Pam J. Crabtree and Kathleen Ryan (eds.). MASCA Research Papers in Science and Archaeology, Special Supplement to Volume 8. MASCA, Philadelphia, 1991.

*Reviewed by Genevieve LeMoine, Department of Archaeology, University of Calgary*

The study of animal bones from archaeological sites has come a long way since the days of 'laundry lists' of identified specimens appended to site reports. The two books reviewed here, both supplements to the MASCA *Research Papers in Science and Archaeology*, serve as good examples of just how far (even too far) archaeologists have taken the analysis of archaeological faunal remains. The prominent place given to culture in the titles of both books is an indication of the welcome change in emphasis in faunal analysis over the last few decades. Given the numbers of animal bones potentially recoverable from many archaeological sites, this can only be a good thing. Many of the papers in these volumes highlight problems that faunal analysts must still deal with, especially sample

size and control over the manner in which data is collected. The papers in both these volumes, while by and large maintaining a high standard of reporting of 'standard' data (identification of elements to lowest possible taxa, age and sex data where possible, MNIs and so on), make a conscious effort to go beyond biological/osteological data to recover information about the people responsible for the bones in an archaeological site in the first place.

In this they are following in the footsteps of Dexter Perkins, Jr. and Patricia Daly, pioneers in the field of faunal analysis, to the memory of whom *Early Animal Domestication and its Cultural Context* is dedicated. Papers in this volume were contributed by former students of Perkins and Daly, and their students. An obituary of Perkins by Ralph Solecki is also included. Identification of early animal domestication in the Middle East was the focus of much of Perkins' and Daly's research, so it is appropriate that this volume centers on that subject, although the research interests of the contributors have expanded beyond this area to range from India (Rissman) to Central Europe (Bogucki). Perkins and Daly also made significant contributions to the methods of faunal analysis, including consideration of taxonomic abundance, inter- and intra-assemblage variation and site formation (including their identification of the well known 'schlepp effect'), as well as more specialized methods, such as Perkins' attempts to identify domestication by examining the micro-structure of bone. Consideration of these factors have since become standard practice among faunal analysts.

The first paper, by Crabtree and Campana, serves to set the stage by outlining the many contributions of Perkins and Daly to the study of animal domestication, and faunal analysis in general. They also provide a useful summary of how their ideas have survived the intervening years, discussing both the criticisms they have been subject to and the influence they have had on more recent work. This serves as a useful introduction to the rest of the volume, especially for readers who may not have had much exposure to the study of animal domestication in all its intricacies.

The other seven papers in the volume deal with specific issues in the study of animal domestication. Four of them (Hesse, Meadows, Gilbert, and Stein) deal with matters of direct interest to Perkins and Daly, while the remaining three show the influence of Perkins and Daly, while working in areas removed from the latter's immediate interests (Anthony and Brown, Bogucki and Rissman). There are a number of common themes and approaches here, apart from the emphasis on domestic animals. Of these, perhaps the most important are the problems of small sample size and control over the sample(s). This is most evident in Hesse's paper, in which he tries to draw



conclusions from a portion of a sample of excavated bones from western Iran. The collection was divided (by Perkins) after excavation, with part remaining in Iran while the rest was shipped to the United States. Precisely how this division was made is unclear, but it seems that the bones left in Iran included all equid bones (an important part of other Paleolithic/epipaleolithic samples in the region) as well as all axial elements. Working with such a sample suggests that even tentative conclusions such as those Hesse tries to draw will be of dubious utility, verging on the positively misleading. While it is admittedly important to study such collections and to publish the data, particularly given the difficulty of acquiring more reliable data from the region, any attempt to draw conclusions from it seems doomed to failure.

There are two main avenues of research in the study of animal domestication, described by Crabtree and Campana (after Dyson 1953) as exclusivist and inclusivist. The former accepts as evidence of domestication morphological changes to the species under consideration, while the latter includes changes in exploitation pattern (as reflected by osteological remains—the death assemblages) thought to accompany domestication and likely to be identifiable before any morphological changes are evident. Most papers in this volume can be placed in one category or the other, although I doubt if any of the authors would claim to rely on one or the other exclusively. Two papers, by Meadows and Gilbert, are primarily concerned with morphological changes. Both relate directly to earlier work by Perkins. Meadows tackles the problem of Perkins' identification of sheep at the site of Aq Kupruk as domesticated on the basis of horn core morphology. Here the problem of sample size rears its head again, as Meadows (rightly) concludes that there is not enough data, either in the shape of archaeological horn cores, which are relatively fragile and so less often preserved than other elements, or on the morphology of the horn cores of the some 16 subspecies of two species of wild sheep possibly found prehistorically in the region, to decide one way or the other about the status of the Aq Kupruk sheep.

Gilbert takes on the interesting problem of bone microstructure as a possible early indicator of domestication. This is a very thorough examination of the original work by Perkins, Daly and Drew, as well as that of their major critics in the decade following publication of their results (Drew et al. 1971). Gilbert goes on to present his own research into this problem, demonstrating that changes formerly attributed to domestication are actually a result of diagenetic factors. He pays less attention to Perkins, Daly, and Drew's suggestion that changes in the trabecular structure of long bones, thought to be a result of the "less stressful" life faced by domestic animals, are also important, but this seems to be the subject of ongoing research and will hopefully be reported on elsewhere.

A study less directly related to Perkins and Daly's work, but clearly inspired by them, is Anthony and Brown's use-wear analysis of bit wear on equid teeth, a different type

of culturally influenced change on bone. As with many of the papers in this volume, this is clearly a report of ongoing research. Nevertheless, Anthony and Brown present a convincing argument, based on a well thought out research strategy. Their work needs to be expanded, of course, and they particularly need to find better-preserved samples than those illustrated. The number of bubbles present in the casts of archaeological samples illustrated indicates that they need to improve their technique in this regard too. My own experience suggests that such a large number of artifacts in a cast is unnecessary. This small quibble aside, this is a fruitful line of inquiry. Expanding it to take in more, and better preserved, samples, and to include a consideration of rope or leather bits will provide an important tool for examining the origin and spread of the use of bits.

Stein takes an inclusivist approach, addressing the question of risk reduction among early farmers in the Near East by examining hunting and herd management strategies. That hunting continued to contribute to the diets of early farmers is hardly surprising. Wild fauna are commonly identified among domestic animals at eighth and seventh millennia sites. To explain this in the Taurus region, Stein argues that winter, when crops are newly planted and goats and sheep are giving birth, is a season of high risk, when farmers do not know how long their stored supplies may have to last. Many wild animals coincidentally spend winters in snow-free lowland areas like those occupied by farmers. They would be easily accessible to farmers, at a time when their own work load was relatively light, allowing time to be spent hunting. Although Stein does not mention it, such hunting may also have helped save tender new crops from the depredations of wild animals, thus reducing risk in other ways as well. Other risk reduction strategies, such as a diverse domestic resource base and conservative herd management strategies, were also practiced. Stein cites data from the site of Grilille (without the sampling problems seen in some other cases) in the Euphrates Valley to support his arguments, and support it they do. It would be nice, at some point, to see some data on season of death, for both domestic and wild species, but in the meantime the arguments presented here make sense.

Two other papers included here review the state of research in areas outside the Near and Middle East. The study of animal domestication away from this region is, to judge from the papers presented here, for various reasons somewhat less well developed. Bogucki begins his review of the use of domestic species in central Europe with a discussion of problems associated with many of the samples: collection bias, preservation bias and generally small sample size, as well as the difficulty of separating native wild species of pig and cattle from domestic species, and hence of identifying imported domesticates or local domestication. In what is basically a summary/synthesis of published research, much of it not available in English, he highlights a number of points: that pigs should be



## Book Reviews

considered separately from either wild or domestic species, since imported domestic pigs were probably allowed to roam the forest and so would likely have formed a single population with local wild species; that there were two paths to the exploitation of domestic species in northern Europe, first colonization of the loess belt by farmers, and then adoption of domestic plant and animal species by indigenous inhabitants of the North European Plain; and that it is this, the adoption of agriculture by inhabitants of the North European Plain, that is likely to be the most useful and interesting area for future research.

*"The study of animal bones from archaeological sites has come a long way since the days of 'laundry lists' of identified specimens appended to site reports. The two books reviewed here ... serve as good examples of just how far (even too far) archaeologists have taken the analysis of archaeological faunal remains."*

Rissman provides a similar review of research on animal domestication in India. He dismisses most published evidence for early domestication on the basis of questionable dates or mis-identifications (in the case of sheep and goat identified in an Upper Paleolithic context). Indeed, it seems that it is not until well-established villages are found, in the late fourth millennium B.C., that there is much sound evidence for domesticated species in India. On scant evidence, Rissman proposes a model for the introduction and spread of domestication in India which parallels the historic situation of hunters, herders, farmers and urbanites all exploiting their different niches simultaneously. He suggests that hunters and herders were important in supplying Harappan cities. With the Harappan collapse, these groups found themselves over-specialized, focused on supplying resources for which there was no longer a demand. By the second millennium B.C., they had settled in villages, practicing a generalized, diversified economy including both dry and irrigation farming, herding of cattle, sheep, goats and pigs. As Rissman admits, this is very much a "just so story," designed to account for the current evidence from India. It is an interesting one, deserving of more consideration, especially in that it takes into account the particularly "Indian" context.

Papers in the second volume under review here, *Animal Use and Culture Change*, are on the whole even more sensitive to the cultural context of the faunal remains under study than those in the first. They cover a wide range of topics and geographic areas, from Spanish Florida to modern Maasailand. The common theme among most of

the papers in this volume is conservatism of animal use over time, in the face of changing social and economic conditions. This comes out most clearly in the papers by Crabtree, McCormick, Reitz and Ryan et al. and rather less clearly in the papers by Redding and Karega-Munene. Armitage and Szuter do not directly address this issue.

Karega-Munene suggests that animal utilization at the site of Baba Jan Tepe in Iran remained constant from the Bronze Age through the Iron Age, despite social changes which saw a pattern of little animal husbandry with only a few owning livestock in the Bronze Age change to one of widespread ownership and increased on-site animal husbandry in the Iron Age. Unfortunately, this tentative conclusion is completely insupportable due to the poor quality of the data. While Karega-Munene is aware of these problems, which include poor control over collection techniques and possibly even selection of only identifiable (i.e. complete or near-complete elements) by the excavators, no control over context, and samples from different areas of the site of unknown size and probably of different function, he chooses to ignore them and assume a representative sample. This is completely unwarranted and renders his conclusions meaningless. On the whole he spends too much time explaining well-known analytical techniques, such as the principles of aging by epiphyseal fusion rate, to an audience which might be expected to be familiar with them already, and not enough time considering the problems of the data and the implications these have for drawing conclusions. Fortunately, Karega-Munene's is by far the weakest of the papers in this volume.

Continuity of animal resource utilization in the face of change is more convincingly demonstrated in the other five papers mentioned above. Crabtree uses aging and butchering data from the Late Roman site of Icklingham and the Early Anglo-Saxon site of West Stowe to show that after the collapse of the Roman economic system, standardized butchery practices associated with a market economy were no longer practiced, replaced by self-sufficient small-scale farming. Despite this major socio-economic change (as reflected in animal use), there may be continuity from Roman and even pre-Roman times to the Early Anglo-Saxon period in some animal husbandry practices. In particular, Crabtree uses data on cattle size to suggest that the people of West Stowe continued to use improved Roman breeds after the collapse. Although the data are not presented here (they are published elsewhere), Crabtree also suggests that animal husbandry practices at small-scale sites like West Stowe, where animals were raised and butchered for home consumption, show important continuities from pre-Roman times (albeit with improved breeds).

From Roman and Anglo-Saxon Britain, McCormick's

paper moves to Early Christian and Medieval Ireland to examine changes in animal use over time, and under different colonizing groups. The message here is again conservatism in animal exploitation, until change is forced from above. During the Early Christian Period, McCormick shows that the 10th-12th century occupation of coastal areas by Vikings had little impact on traditional animal husbandry, while the economic changes brought about by more widespread Anglo-Norman colonization in the Medieval period brought about profound changes. Of particular interest is the decline in importance of cattle in the Medieval period. Cattle were important both socially and economically in the Early Christian period and were used as currency in important transactions, such as payment of dowries, tribute and fines. Such use of cattle was legislated against in Medieval Ireland. Farmers forced to make payments, including taxes, in cash switched to an emphasis on sheep, as seen both in documentary and archaeological evidence. Cattle maintained their importance only in areas where the Anglo-Normans did not have influence. Here again we see conservatism in animal use over time whenever possible. Change comes about as a result of external influence.

Reitz documents a similar case of change in faunal exploitation under colonial influence, but in this case it is the colonizers who face a change in diet. In this well-presented paper (including the presentation of the raw data in an appendix), she demonstrates that Native American subsistence strategies changed little even among those living in close proximity to Spanish Missions in colonial Florida. The diet of the Spanish colonizers, on the other hand, changed considerably, as they were forced to rely upon the same wild resources exploited by the Native Americans rather than on more familiar domestic species. They did not compete directly with Native Americans, however, as they fished in deep water habitats rather than the shallow estuarine habitats exploited by the Native Americans. Reitz makes a good case for conservatism in diet wherever possible. The complaints about their diet in Florida attributed to the Spanish stand as testimony to the unwillingness of people to accept major changes in diet.

The paper by Ryan et al. moves us into modern times. It is an ethnoarchaeological study of cattle naming and lineages among Maasai. This is part of a larger study of traditional herding practices and represents their initial findings. While they are preliminary, the results are interesting and help build on the case for conservatism in animal use through times of culture change. In this, as in the Irish case, this conservatism extends beyond diet to the social realm. Maasai appear to have retained cattle naming practices which both reflect and preserve a record of human social relations, and contribute to good herd management strategies as well. Ryan et al. clearly have a lot more work to do in this area, but if this paper is any indication they have made a productive and interesting start.

Redding's paper does not directly address conservatism in animal resource utilization, although the model he develops could be taken as implying such a strategy. Briefly,

he suggests that pigs in Old Kingdom Egypt were an important household-level resource which by its nature was attractive because it was difficult for the state to exert control over. In the Middle Kingdom, with increasing grain agriculture—required to pay taxes to the state—pigs became less desirable because they competed directly with humans for cereal crops. He outlines how this model should/could be tested, although as of yet suitable data are not available. If the data he hopes to collect in the near future do turn out to support this model, it will be an interesting case of imposed change in one aspect of food production resulting in a (more or less) voluntary change in another realm, pig production.

The final two papers, by Armitage and Szuter, address the question of animal use and culture change even less directly. Armitage documents a case of a lesser quality, unimproved breed of sheep found in the faunal remains of an East Indiaman wreck. As such live animals on board were present to provide fresh meat to paying passengers, this poor quality breed, less hardy and with coarse flesh, among the improved breeds was at first considered unusual. Further study of the qualities of the particularly breed, especially its hardiness in cold, wet conditions and with a poor quality diet, showed that it was probably a good choice for on-board livestock, although it would not have been appreciated by upper-class passengers. Armitage considers its presence on the ship evidence of economy on the part of the captain, whose responsibility it was to provide for the passengers. While this is by no means the only possible explanation (the remains could be of a single individual, which may have been included among the "improved" varieties by an unscrupulous vendor for instance), it certainly is possible. This is an interesting piece of work, using contemporary sources for information about the qualities of different breeds, as well as for life aboard an East Indiaman, but it does little to address the theme of the volume.

Similarly, Szuter's paper, an interesting and well-presented comparison of butchering practices for home consumption and commercial sale at a historic trading post in the American Southwest, does not directly address the theme of culture change and animal use. Bones analyzed dated from the 1880s through the 1960s, and no differences in butchery practices were noted. Considering the magnitude of culture change in this period, it is surprising that no attempt is made to explain such conservatism. Perhaps when the documentary evidence associated with the trading post is examined this question will be addressed.

The diverse papers in these two volumes are indicative of the changes that have taken place in faunal analysis in the last few decades. Although some of the most interesting conclusions in these works are supported by documentary evidence rather than relying solely on osteological remains, this is by no means always true. In any case, the osteological evidence does more than merely support conclusions that could have been made using documents alone. While only

## Book Reviews

one or two papers in each volume will be of particular interest to a specialist, together they provide a good overview of where faunal analysis is today. Thankfully gone are the days when bones were left to speak for themselves in dry appendices. They are now commonly accepted as useful archaeological data which can inform not only upon economic practices, but on other facets of society as well.

These books are both nicely presented, and lack the all too common typographical and other editorial errors that seem to plague some publications. Not surprisingly, considering that these publications are supplements to a journal, they are not indexed, and the references cited are presented with each paper, rather than being gathered together at the end, which can be either good or bad, depending on your preference. These papers do not represent milestones in the development of faunal analysis, nor were they meant to. Rather, many of them are reports of current research and work in progress. As such, they are useful collections which will appeal both to faunal analysts and to the general archaeological public.

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1971 Prehistoric domestication of animals: effects on bone structure. *Science* 171:280-281.
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**Deciphering a Shell Midden.** Julie K. Stein (ed.). Academic Press, San Diego, 1992. xix + 375 pp., figs., tables, indexes. \$89.95 (cloth).

*Reviewed by William D. Middleton, Department of Anthropology, University of Wisconsin-Madison*

The archaeology of shell middens has been studied for over one hundred years, and there has amassed a respectable literature on the subject. A fairly casual perusal found over two hundred references. It is somewhat surprising, then, that *Deciphering a Shell Midden* is about the only book-length treatment of the mechanics of shell midden archaeology (see Trigger's 1986 compilation of original publications detailing the development of shell midden archaeology).

This volume contains 15 chapters including an introduction by Stein: "Shell midden boundaries in relation to past and present shoreline" (F.H. Whittaker and J.K. Stein); "Geophysical prospection of the shell midden" (R.A. Dalan, J.M. Musser and J.K. Stein); "Historic treatment of a prehistoric landscape" (B.H. Thomas and J.W. Thomson);

"Interpreting stratification of a shell midden" (J.K. Stein); "British Camp shell midden stratigraphy" (J.K. Stein, K.D. Kornbacher and J.L. Tyler); "Sediment analysis of the British Camp shell midden" (J.K. Stein); "Shell midden lithic technology: analysis of stone artifacts" (K.D. Kornbacher); "Lithic manufacturing at British Camp: evidence from size distributions and microartifacts" (M.E. Madsen); "An analysis of fire-cracked rocks: a sedimentological approach" (T.W. Latas); "Shell midden deposits and the archaeobotanical record: a case from the Northwest Coast" (M.A. Nelson); "Effects of recovery techniques and postdepositional environment on archaeological wood charcoal assemblages" (D.M. Greenlee); "Interpreting the grain size distributions of archaeological shell" (P.J. Ford); "Is bone safe in a shell midden?" (A.R. Linse); and "Burned archaeological bone" (P.T. McCutcheon).

Though it may be described as a site report, this edited collection does an excellent job of relating the specifics of a site (British Camp) to the generalities of shell midden archaeology. In fact, it has much to offer those who have no interest whatsoever in shell middens, but are simply concerned with the practice of excavation. The entire work can be taken as a case study for Dr. Stein's wider interest in the sedimentological study of archaeological deposits (Stein 1987). Specialists from a variety of fields present articles on their particular approach to the problem of deciphering the British Camp shell midden. The book also reflects recent changes in the manner in which shell middens, more properly called shell-bearing sites, are viewed (e.g. Claassen 1991). An effort is made to get beyond simply viewing the shell as food refuse, and to approach a broader understanding of the depositional factors and processes involved in the accumulation of shell and, ultimately, the human behavior responsible.

Nearly all of the chapters relate directly to the British Camp shell midden, but can be extended to other sites in terms of the methodologies they present. This is not, however, a handbook: actual techniques are not always presented in a how-to fashion (though they are generally described in a comprehensible manner). Specific techniques are well cited, however, so the archaeologist wishing to employ any of the approaches described may easily do so.

The single exception is chapter five, "Interpreting stratification of a shell midden," by Dr. Stein. This chapter is much more general than the others, and in many respects is the most important chapter of the book. In it, she calls for a reunification of archaeological and modern stratigraphic approaches; the other contributions can be seen then as applications of this approach. Dr. Stein finds that while modern stratigraphy has developed a systematic terminology, archaeology has held to an inexact, subjective system of description. She proposes that archaeology adopt the terminological standards of the *International Guide to*

*Stratigraphic Nomenclature* and *American Code of Stratigraphic Nomenclature*, rather than to devise its own terminological standard or to continue with the current state of confusion. She also proposes a "cubist" perspective (e.g. Thomas 1989): the presentation of multiple points of view of a single problem. Anyone interested in actual excavation should read this chapter.

Most of the other contributions are of a type: how a particular approach to the British Camp midden adds another perspective to its interpretation. Most are applicable to sites other than middens, and therefore of interest to any dirt archaeologist. Chapters three, six, and seven are the strongest in this regard.

There are very few flaws. Dr. Stein could have exercised a firmer editorial hand; by chapter nine we have heard enough about the differences between the light and dark layer. The repetition is tedious. Two of the contributions, though basically interesting (Madsen, chapter 9; Greenlee, chapter 12), seem to be laboring under the conception that rigorous quantification (e.g. normalizing artifact counts per liter and extrapolating to the larger population) can overcome the limitations of a very small sample size (necessary in this respect—microdebitage counts are extremely time consuming). The most serious flaw, although outweighed by the overall contribution of the book, is that there is very little relation of the data to larger anthropological problems. As previously stated, this is not a handbook, and is essentially a site report. The data collected should be related to a problem other than simply sorting out the depositional relationship between one layer and another. Virtuoso analytical technique is without merit if totally divorced from the problems of archaeology—this work comes as close as is comfortable to this extreme.

The bottom line on *Deciphering a Shell Midden* is that it is a very interesting and useful book. The dirt archaeologist can benefit from reading at least chapters three, five, six, and seven. The entire book wouldn't hurt. Anyone practicing midden archaeology should buy it. The flaws are minor in that they do not detract from the book's overall usefulness and interest.

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1989 *Columbian Consequences*, volume 1. Smithsonian Institution Press, Washington D.C.
- Trigger, Bruce  
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**Carbon Isotope Techniques.** David C. Coleman and Brian Fry (eds.). *Isotopic Techniques in Plant, Soil and Aquatic Biology Series*. Academic Press, San Diego, 1991. xii + 274 pages, index, references. \$39.95 (paper).

*Reviewed by Julia Lee-Thorp, Department of Archaeology, University of Cape Town*

As a practical guide to carbon isotope approaches and techniques, this edited volume indeed fills a gap in the available literature. The editors have collated a comprehensive survey of carbon isotope techniques in biological and soil sciences, relating to the carbon isotopes  $^{14}\text{C}$ ,  $^{13}\text{C}$  and  $^{11}\text{C}$ . The range thus encompasses radioactive, tracer and natural abundance techniques. It will serve best as a handbook or set of guidelines for the use of carbon isotope tools in the ecological sciences. The book is aimed primarily at researchers in the biological sciences, not surprisingly since this is the first volume in a series called *Isotopic Techniques in Plant, Soil and Aquatic Biology*. These fields are admirably covered, but it does rather mean that even quite well-known applications in other disciplines, for example, archaeology, are neglected.

*Carbon Isotope Techniques* consists of three sections comprising chapters on  $^{14}\text{C}$ ,  $^{13}\text{C}$  and  $^{11}\text{C}$  respectively. There are fifteen chapters in all, mostly devoted to  $^{14}\text{C}$  and  $^{13}\text{C}$ , and only one describes applications relating to the lesser known synthetic radioactive  $^{11}\text{C}$ . The first two sections each have an introductory chapter, followed by chapters dealing with a different aspect or application, each of which has been contributed by a different researcher with experience in that particular topic. The contributors are drawn from fields related to isotopic ecology, for example, botany, soil and agricultural science.

The first and longest section deals with carbon-14. This radioactive isotope is often used as a tracer in terrestrial and aquatic biological systems. Several such applications are described here, most of which involve  $^{14}\text{C}$  enrichment and high-level counting. The introductory chapter briefly outlines the principles and includes warnings about the dangers of handling radioactive material, and suggestions for proper disposal of waste. As noted by F.R. Warembourg and J. Kummerow in Chapter 2, the application of  $^{14}\text{C}$  dilution and tracer kinetics has greatly improved understanding of the dynamic nature of organisms and ecosystems. They go on to outline the methodology of  $^{14}\text{C}$  tracers to plant sciences, principally relating to photosynthesis and translocation studies in terrestrial ecosystems. This is an excellent "how-to" chapter, with outlines for research design, details of equipment and procedures, and painstaking explanations of calculations for experiments. These are all placed within the context of three examples: pattern of carbon distribution within the plant; respiration in the root system; and a field study of

carbon gain, distribution and fate in a terrestrial ecosystem. In the next chapter a related application to examine carbon and energy flow in plant-microbe symbiotic relationships is described. Again detailed outlines are given of procedures, equipment and calculations. Two chapters further (Chapter 5), there is a description of a similar application, but in this case to plant-microbe-soil relationships.

Many applications described have an "aquatic" equivalent, although  $^{14}\text{C}$  studies are less often used to study carbon flow because of the difficulties imposed by the environment. Photosynthesis and translocation studies in the aquatic environment are described in Chapter 4. The setup of experiments is very similar in production and translocation studies, but there are differences in the delivery of the isotope and processing of samples. There are two further chapters in this section describing applications to environmental toxicology, one terrestrial, the other aquatic, where the aim is mainly to trace the degradation of herbicides.

The two last chapters of the  $^{14}\text{C}$  section, both written by K.M. Goh, describe low-level counting applications. The chapter on radiocarbon dating is of most direct interest to archaeologists. It gives an exhaustive description of requirements, sample choice, preparation, sources of error, correction factors, calculations, reporting and interpretation, all explained in a straightforward style. The sections on suitability of materials lay out clearly the advantages and disadvantages of various kinds of sample material, such as wood, charcoal and so on. My one quibble here is that bone is given rather cursory treatment, in spite of its paramount importance for direct dating of human skeletal material or food refuse. A considerable amount of research has been done recently on purification techniques, little of which is reflected here. Those described are standard but perhaps a little out of date. More thorough treatment is given to other materials, for example peats and charcoals, but perhaps this merely reflects the writer's own concerns, since he is based in a soil science department. Nevertheless, this chapter should serve as a very useful practical guide to radiocarbon users (including archaeologists) and to students. It could even be used as a practical handout for the latter.

The study of the dynamics of soil organic matter is given as an example of the use of bomb carbon as a low-level tracer. The technique employs the spike in  $^{14}\text{C}$  production in 1961 and 1962 as a result of intensive nuclear weapon testing before the test-ban treaty was introduced. Many other imaginative applications have been attempted which are not mentioned here. These include, for instance, its use to estimate bone turnover in humans and in horses, and to establish the antiquity or modernity of restricted materials such as ivory.

The next major section, on carbon-13, deals mainly with natural abundance approaches, although there is one chapter on enrichment-tracer techniques. The introductory chapter, written by Thomas Boutton, describes the instrumentation, background, sample preparation techniques

and interpretation. There is a welcome emphasis on the importance of standards, and the techniques for producing  $\text{CO}_2$  gas from both organics and carbonates are thoroughly described in a relatively jargon-free manner. Descriptions of sample preparation techniques are unfortunately repeated again in some of the following chapters, which leads to a certain amount of (unavoidable) repetition. The next chapter reviews natural abundances of  $^{13}\text{C}/^{12}\text{C}$  in the atmospheric, terrestrial, marine and freshwater environments. The review essentially lays out the rationale for using natural abundance techniques to study the flow of carbon and energy through various biological and physical systems in nature. The following chapter by James Ehleringer outlines the questions in plant studies which may be addressed using natural abundance techniques. It contains a useful summary of the notation used in plant studies, where more emphasis is placed on the discrimination or fractionation by the leaf ( $\Delta$ ), as well as the mechanisms of isotope variation. Detailed procedures and protocols follow, depending on the questions addressed which include photosynthetic pathway, intercellular  $\text{CO}_2$  and various nutrient fractions. This is an invaluable chapter for botanists.

Studies of diet and trophic relationships in whole ecosystems are described by Juanita Gearing. Although her depiction of the advantages and limitations of natural abundance techniques in ecosystem studies is on the whole sound, one of the prime advantages for using this approach in whole ecosystem studies is not stressed—the capability for integration over time (as opposed to "snapshot" views). Sources of intra- and extra-organism variability which may affect research design and results are discussed in detail. The procedures section is satisfactory and thorough. In general three kinds of problem can be addressed—carbon source, trophic relationships and turnover rates. As an isotopic archaeologist, I found the examples a little limited, especially since there is little mention of ecosystem studies using skeletal material.

Metabolic studies in humans and animals using  $^{13}\text{C}$ -enriched substrates forms the only contribution on  $^{13}\text{C}$  enrichment techniques. At present most such studies are in the medical field, where ethical considerations preclude the use of radioactive tracers, but there is a growing application to animal metabolic studies. This chapter focuses on the quantification of the fate of dietary nutrients, and the methodology required. A detailed protocol for the design and execution of such a study is given, including the details of equipment for collection of breath  $\text{CO}_2$ . This chapter gives a very comprehensive and thorough description of all aspects of the methodology.

The final chapter is of rather specialised interest; it describes the application of  $^{11}\text{C}$  to trace the transport of carbon in plants. Other examples touched on more briefly include plant responses to temperature, water status, stress and atmospheric pollutants. Unlike  $^{14}\text{C}$ , which decays slowly by  $\beta^-$  emission,  $^{11}\text{C}$  has a short half-life (about 20 minutes), and decays by  $\beta^+$  followed by  $\gamma$  emission. This

allows the study of rapid reactions such as photosynthesis and the unique advantage of repeated analyses of the same organism, usually a plant. The disadvantage is that the isotope must be produced in a cyclotron and used immediately, and sophisticated instrumentation, large computers and specialist technical staff are required. Thus application at present is limited to a few specialist laboratories.

I found all the chapters in this volume to cover their fields admirably. Much useful, extremely detailed advice is given which should provide a solid basis for scientists wanting to exploit carbon isotope approaches for the first time. It will save them a great deal of time and effort. Even for researchers more experienced in the field it provides many useful tips and background, although some of the

material is not as up-to-date as it could be. There are a few neglected areas. For instance, there is little on the marine environment, yet for instance natural abundance of  $^{13}\text{C}/^{12}\text{C}$  is a widely used tool for studying marine productivity, migrations, pelagic foodwebs and so on. A drawback for "palaeo"-scientists is that there is a lack of discussion of questions relating to dietary and palaeoenvironmental reconstructions, although the general principles and methodology apply directly. These minor omissions impose some limits on the wider usage of the handbook.

*Carbon Isotope Techniques* achieves what it sets out to do—provide a handbook for senior students and new (or even experienced) practitioners in biology. Every light-isotope laboratory should have one. □

## Meetings Calendar

*Susan Mulholland, Archaeometry Laboratory, University of Minnesota-Duluth, 10 University Drive, Duluth MN 55812, USA; e-mail: smulholl@ua.d.umn.edu; tel: 218-726-7957; fax: 218-726-6556*

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.

### 1994

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 Kilbride G75 0QU, Scotland, UK; tel: 44-3552-23332; fax: 44-3552-29898. 17(1):18.

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 Ciudad Universitaria, 50739 Recife PE Brazil; tel: 55-81-271-82-40.

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.

\* Aug. 26-29. Mapping and Remote Sensing Tools for the 21st Century; sponsored by the American Society for Photogrammetry and Remote Sensing. Washington, DC. ASPRS, Department DP, 5410 Grosvenor Lane, Suite 210, Bethesda, MD 20814-2160, USA; tel: 301-493-0290; fax: 301-493-0208; e-mail: e7g4hem@toe.towson.edu.

\* Aug. 29-Sept. 3. 10th European Meeting of the Palaeopathology Association. Göttingen. Prof. Dr. Michael Schultz, Zentrum Anatomie, Kreuzberggring 36, D-37075 Göttingen, Germany; tel: 49-551-39-7028. fax: 49-551-39-7995.

\* Aug. 30-Sept. 8. International Rock Art Congress. Pinerolo-Torino, Italy. Robert G. Bednarik, Australian Rock Art Research Association, PO Box 216, Caulfield South, Vic 3162, Australia.

\* Sept. 5-9. British Association for the Advancement of Science. Loughborough. British Association, Fortress House, 23 Savile Row, Lon-

don W1X 1AB, UK; 44-71-494-3326.

\* 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. 21-23. Landscape Conservation: Conference on the Cultural Environment. Edinburgh. Landscape Conservation Studio Ltd, 10, Raeburn Street, Edinburgh, EH4 1HY, Scotland; tel: 44-31-332-7410.

\* Sept. 21-24. Association for Environmental Archaeology Annual Conference. Netherlands. Henk van Haaster, Department of Environmental Archaeology, Institute for Pre- and Protohistoric Archaeology, University of Amsterdam, Nieuwe Prinsengracht 130, 1018 VZ Amsterdam, Netherlands; tel.: 31-20-525-5172. Theme: Seasonality. Suggested sessions include seasonality of crops and livestock, growth patterns, periodicity, food conservation and storage, and seasonality of archaeological deposits. Emphasis will be laid on agrarian and urban economies.

\* Sept. 22-24. Textile Society of America, 4th Biennial Symposium. Los Angeles, California, USA. Louise W. Mackie, Textile Department,



- Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, M5S 2C6, Canada; tel: 416-586-8055; fax: 416-586-5863.
- 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: 44-71-323-8223.
- Sept. 22-24. Towns in the Upper Middle Age in the Western Mediterranean Sea (IV-IX cent.). Centre Universitaire Européen pour les Biens Culturels, Villa Rufolo - I 84010, Ravello, Italy; tel: 39-0-89-857669; fax: 857711.
- \* Sept. 23-25. The Historical Metallurgy Society Ltd. Annual Conference. Swansea, Wales. Mr. Peter Hutchison, The Historical Metallurgy Society Ltd., 22 Easterfield Drive, Southgate, Swansea, SA3 2DB, UK; tel: 44-792-233223.
- \* Sept. 23-25. 3rd Archaeology and Gender Conference: Prehistory of the Americas. Boone, North Carolina. Cheryl Claassen, Department of Anthropology, Appalachian State University, Boone, NC 28608, USA; email: claassencp@appstate.
- 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.
- \* Sept. 26-Oct. 1. International Council for Archaeozoology, Seventh Congress. Konstanz, Germany. Dr. M. Kokabi, Archäologische Denkmalpflege, Arbeitsstelle Hemmenhofen, Landesdenkmalamt Baden-Württemberg, Fischersteig 9, D-78343 Gaienhofen-Hemmenhofen, Germany; tel: 49-7735-3001; fax: 49-7735-1650.
- \* Sept. 26-Oct. 1. Quaternary Events: Consequences on Environment and Human Beings. Stax. Symposium TAAG Secretariat, Department of Geology, Ecole Nationale d'Ingenieurs de Stax, PO Box W, 3038 Stax, Tunisia; tel: 216-4-274-088; fax: 216-4-175-595.
- 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 Antropológica, 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: 44-223-565182.
- 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: 49-62-21-56-55-31.
- Oct. 11-15. International Conference on Archaeological Heritage Management. Montreal. CAHM Montreal 1994, as 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: Towards an Interdisciplinary 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. See this issue.
- \* Oct. 18-20. Restoration 94. Amsterdam. Mrs. N. Duisenberg, RAI, Europaplein, NL-1078 GZ Amsterdam, The Netherlands; tel: 31-20-549-1212.
- 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 Cuaternario - 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. 17(1):19.
- 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. Includes symposium on isotopic and elemental analyses of bone, organized by Robert H. Tykot (address on back page).
- + Dec. 4-11. 3rd 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; e-mail (contact Vanessa Balloqui, University of Southampton, UK): ness@soton.ac.uk. Themes include: Indian Archaeology; Concepts of Time (sub-theme: How Science-based Dating has Affected the Understanding of the Past); Language, Anthropology and Archaeology (sub-themes: Archaeology/Biology and the Origins of Language; Implications of Human



Genetics for Language Grouping; Dating Language Spread and Change; Proto-Lexicons and the Origins of Agriculture); The Neogene and the Quaternary (sub-themes: Environment and Chronology; Human Evolution); Change in Agrarian Systems (sub-theme: Evidence Demonstrating Agricultural Change). There are specialised symposia, including: The Indus Civilisation; Recent Advances in Archaeological Field and Laboratory Techniques; Maritime Archaeology.

1995

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. 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 17-19. Sardinian Stratigraphy and Mediterranean Chronology. Medford, Massachusetts. Prof. Miriam S. Balmuth, Department of Classics & Archaeology, Tufts University, Medford, MA 02155, USA; tel: 617-627-3216; MBalmuth@Pearl.Tufts.edu.

March 26-30. 8th Conference on the Scientific Use of Statistical Software. Heidelberg, Germany. SoftStat '95, ZUMA, Postfach 1221 55, D-68072 Mannheim, Germany; tel: 49-621-1246-174; fax: 49-621-1246-100; e-mail: softstat@zuma-mannheim.de.

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. 17(1):19.

April 3-7. Geological Society of South Africa Centennial Geocongress. Johannesburg, South Africa. Congress Secretariat, Centennial Geocongress, PO Box 36815, Menlo Park, 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. Chris Barnes, General Chair, SEOS, University of Victoria, PO Box 1700, Victoria, BC V8W 2Y2, Canada; fax: 604-721-6200.

\* July 3-5. Archaeological Science Conference; held in co-operation with the Council for British

Archaeology Archaeological Science Committee. Liverpool. The Science Conference Organisation, Department of Archaeology, 14 Abercromby Square, University of Liverpool, PO Box 147, Liverpool, L69 3 BX, UK. Abstract deadline: November 1994. Papers invited on all aspects of the applications of science within archaeology.

\* July 11-18. International Workgroup for Palaeoethnobotany, 10th Symposium. Innsbruck. Dr. Klaus Oegg, Institut für Botanik der Leopold-Franzens-Universität Innsbruck, Sternwartestrasse 14, A-6020, Innsbruck, Austria.

\* Sept. 8-14. 13th Congress of the International Union of Prehistoric and Protohistoric Sciences. Forlì. Alla Segreteria del XII Congresso U.Z.S.P.P., Casa Saffi, Via S. Marchesa 12, I-47100 Forlì, Italy.

\* Oct. 9-11. ASMOSIA IV Conference. Bordeaux, France. Université de Bordeaux III - CNRS, Maison de L'Archeologie, Applied Physics Lab, CRIAA, F-33405 Talence Cedex, France; tel: 33-56-84-51-60; fax: 33-56-84-51-57.

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

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

## Science and Archaeology: Towards an Interdisciplinary Approach to Studying the Past

Oct. 14-16, 1994, Harvard University, Cambridge, Massachusetts, USA

This international conference, co-sponsored by the Society for Archaeological Sciences, the Archaeological Institute of America (Boston Society), and Harvard University, will focus on the need for increased communication and integration of research efforts by archaeologists, art historians, classicists, archaeometrists, physical scientists and others in their reconstruction of past societies.

The oral papers will therefore emphasize the nature of

interdisciplinary/multidisciplinary research, rather than detailing the results of a particular analytical technique or research project. Posters, however, can be on any aspect dealing with archaeological science, and anyone interested in presenting a poster should contact the organizers by September 1, 1994.

Sessions on: Archaeological Science in the US and other Countries; Interdisciplinary Research and the Role of Archaeological Scientists; Case Studies in Interdisciplinary Field Research; Interdisciplinary Artifact Studies—Stones and Bones; Interdisciplinary Artifact Studies—Ceramics and Metals; Panel Workshop.

Organized by Robert H. Tykot (address on back page) and Geoffrey D. Purcell □

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### Deadlines for Submissions:

No. 1 November 15    No. 2 February 15  
No. 3 May 15        No. 4 August 15

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