

SAS Bulletin

Society for Archaeological Sciences

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From the Editor

This is a critical time in the history of the SAS. Our membership numbers continue to grow, submissions to the *Bulletin* are healthy, the Society is actively engaged in influencing policy decisions that will impact the practice of archaeological science in the United States, we have a record number of non-North American members, and the monograph series with Plenum is up and running. The single most prominent additional step for Society growth, the item most commonly mentioned in discussions of the Board and members, is the publication of a regular, SAS-sponsored journal. This is regularly seen as a mark of a mature organization. The question that has most often arisen in this context is the necessity and/or desirability of another journal in this rather limited interest area. With *Archaeometry* and *The Journal of Archaeological Science* already being published, is there room for another journal in the field?

Recent developments have opened an opportunity to work around this problem. Academic Press is entertaining the possibility of an affiliation between SAS and JAS. Under one of two possible arrangements, our Society would be formally affiliated, with members receiving a very substantial discount on the subscription price. This would not entail a change in the SAS organization, nor a change in the *Bulletin*. Rather, the Board sees it as an opportunity to expand the benefits of membership.

The matter was discussed at both Board and Membership meetings in Las Vegas. It was decided that a poll of the members was necessary to provide guidance to the Board, and you will all be receiving an advisory ballot to express your opinions. Please act quickly on this matter so that we can make an informed judgement.

I've just learned that the deteriorating political situation in Colombia has necessitated a change of venue for the World Archaeological Congress 2. The meeting will go on as scheduled, but will be held in the 16th century town of Barquisimeto, Venezuela. The organizers have arranged free transport from Bogota for those participants who cannot change their travel plans. The Venezuelan officials have promised to provide automatic visa approvals for visitors who have already arranged Colombian visas. The organizers will circulate final arrangements soon.

Readers can look forward to several interesting items in upcoming issues of the *Bulletin*. We have several book reviews ready for publication, including reviews of *Fishes*, by Wheeler and Jones, *The Beginning of the Use of Metals and Alloys*, edited by Robert Maddin, *Current Scientific Techniques in Archaeology*, by Parks, *Photography in Archaeology and Conservation*, by Dorrell, and *Greek and Cypriot Pottery*, by Jones. If there are additional titles you wish to see reviewed, please contact Pru Rice, our Review Editor. This is particularly desirable if you are an author who wishes to have your work reviewed in the *Bulletin*. We do not receive titles automatically from publishers, so you must take it on yourself to notify us of your work.

You can also expect to see additional Laboratory Profiles in coming issues. The promised articles do not always materialize, but I'm counting on two very interesting items in the near future.

In This Issue

Announcements	2-4
Meeting Review	
Archaeometry in Heidelberg	4-5
Laboratory Profile	
Laboratory for Archaeological Chemistry, University of Wisconsin-Madison	6-9
Geoarchaeology News	10-11
Meetings Calendar	12-15

Announcements

Modern Tools in Archaeometry A SAC Symposium

Gothenburg, Sweden

May 23-25, 1991

The first symposium organized by SAC in cooperation with the SIMS Laboratory will be held in Gothenburg, at the Chalmers University of Technology. The symposium is supported by the Nordic Culture Foundation.

The theme of the symposium is the application of modern technical devices and methods in archaeometry. Proceedings will be published in *Archaeology and Natural Science*.

Interested persons should contact the organizer:

Dr. Peter M. Fischer, SAC Chairman, Department of Physics, Chalmers University of Technology, S-412 96 Gothenburg, Sweden. Telephone +46 - (0)31 - 72 34 31, 49 40 58. FAX +46 - (0)31 - 72 34 36, 49 40 58. EARN:F8BUE@SECTHF51.

Fourth Australian Archaeometry Conference

The Australian National University,
Canberra, January 29 - February 1, 1991

(Note Revised Dates)

The program will be aimed at highlighting recent developments in Australia and overseas which are opening new approaches to prehistory and palaeosciences. Conference topics will include applications to archaeology of biological techniques and microscopic remains, DNA studies, chronology, provenance studies, materials analysis, computer applications and authenticity studies.

The organizing committee would be pleased to accept suggestions, papers, or indications of interest as soon as possible. For further details on abstracts, registration and accommodation contact the organizers at:

Archaeometry Conference, Prehistory Department, RSPacS, The Australian National University, GPO Box 4, Canberra ACT 2601, Australia. FAX: 062 571893; BITNET: THL410@CSC.ANU.OZ.

Pacific Coast Regional Meeting, American Ceramic Society

Seattle Sheraton Hotel

October 25 - 27, 1990

Two sessions in this meeting are of potential interest to archaeologists and conservators; they are available at the special registration fee of \$15, payable at the conference registration desk on the day of the session. This special registration fee does not include any of the conference meals but it does provide admission to the conference exhibits.

Session N

Ceramic Lecture Series

1:45 PM Thursday, October 25

Organizer: Thomas G. Stoebe, University of Washington, Seattle, WA

Ancient Ceramic Technology

W. David Kingery, University of Arizona, Tucson, AZ

Session Q

Ancient Ceramics

2:30 PM Thursday, October 25

Organizer: Jerry Podany, J. Paul Getty Museum, Malibu, CA

Technology of Ancient Glazing

Pamela Van Diver, Smithsonian Institution, Washington, DC

Repair and Restoration of Ceramic Vessels in Ancient Times

Maya Elston, J. Paul Getty Museum, Malibu, CA

Approaches to the Conservation and Restoration of Greek and Roman Ceramics

Jerry Podany, J. Paul Getty Museum, Malibu, CA

Recent Analytical Studies of Celadon Wares

Richard Newman, Boston University, Boston, MA

Variation in Ancient Greek Sinter Glazes

John Twilley, Los Angeles County Museum of Art, Los Angeles, CA

Low Temperature Firing Processes

W. David Kingery, University of Arizona, Tucson, AZ

Announcements

Seminar on the Use of Enzymes in Conservation

MIT, October 27 - 28, 1990

The properties and chemistry of enzyme systems relevant to conservation problems and the practical procedures involving enzyme-based methods for removing animal and starch adhesives, stains, and other materials and discolorations which can adversely effect the structural integrity and/or appearance of artistic, historic, and archeological objects will be addressed in "Enzyme Treatments: The Science and Its Applications in Conserving Artistic and Historic Works," an intensive seminar to be held at the Massachusetts Institute of Technology in Cambridge, Massachusetts, on October 27-28, 1990. This two-day seminar, sponsored by *Technology and Conservation Magazine* and the MIT Museum, is designed for conservators; museum, historical society, and art gallery directors and curators; archivists; preservation librarians; conservation scientists; and other responsible for the care and protection of works of art on paper, documents and maps, photographs, paintings, textiles, ceramics, ethnographic artifacts, furniture, and similar properties. (Registrants are NOT required to have a chemistry background.) Registration fee is \$250/person (\$290/person after September 10). Registration fee includes a comprehensive enzyme bibliography and other seminar materials, two luncheons, and a reception.

The seminar will provide a broad overview of the basic chemistry and working properties of enzymes and proteins useful in conservation procedures and will describe how to select the appropriate system for specific needs, including what protein engineering/non-aqueous treatments are available when an enzyme does not work. In addition to the potentials of enzyme-based procedures, the pitfalls and hazards of using these methods will be explored. Results of several long-term experimental studies involving the evaluation of 11 amylases and 8 proteases vis-a-vis different types of papers also will be covered. Case histories will be detailed, with attention given to how an appropriate treatment program can be achieved on a realistic budget—from preparation of the enzyme poultices/immersion solutions, to monitoring and control of treatment progress, and through to removal/denaturation of residues from substrates. One session of the seminar will include demonstrations and discussions of commercial products and health and safety considerations.

The lecturers for the seminar are recognized authorities in the fields of conservation, biochemistry, and conservation

science. The moderator is Robert Hauser, Museum/Paper Conservator, The New Bedford Whaling Museum. Featured speakers include: Helen Burgess, Senior Conservation Scientist, Canadian Conservation Institute (CCI); Sherry Guild, Paper Conservator, CCI; Jamie Martin, Paintings Conservator, Williamstown Regional Art Conservation Laboratory, Inc.; Debbie Hess Norris, Photographic Conservator, Winterthur Museum; Pia DeSantis Pell, Senior Paper Conservator, National Gallery of Art; Dennis Piechota, Conservator, Object and Textile Conservation; Alan J. Russell, Assistant Professor, Chemical and Petroleum Engineering Department, University of Pittsburgh; Leslie Melville Smith, Head Textile Conservator, The Fine Arts Museums of San Francisco; Season Tse, Assistant Conservation Scientist, CCI; and Richard Wolbers, Conservator, Winterthur Museum.

For further information, contact:

Technology and Conservation, One Emerson Place, Boston, MA 02114, (617) 227-8581, or Robert Hauser, New Bedford Whaling Museum, 18 John Cake Hill, New Bedford, MA 02740, (508) 997-0046.

Fifty Years of Discovery: The Lubbock Lake Landmark

Texas Tech University
October 17 - 19, 1990
Lubbock, Texas

Scholars from around the world will gather in Lubbock, Texas to celebrate fifty years of investigation at the Lubbock Lake Landmark and to participate in a symposium focusing on the interaction of the geological and biological sciences in archaeology. In addition to the symposium, there will be a week-long series of events recognizing the half-century of discovery, exploration and community involvement at Lubbock Lake, including the dedication of new facilities at the Landmark, a public lecture series, and a regional field trip. Among the invited symposium faculty are Mary Leakey, Gustavo Politis, Paul Goldberg, Johan Kamminga, Wan-Po Huang, Marylene Patou, Vivendra Misra, Andrey Dodonov, Thomas Dillehay, and Joe Ben Wheat.

For information and registration materials, contact:

Eileen Johnson, Director, Lubbock Lake Landmark, The Museum of Texas Tech University, Lubbock, TX 79409.

Announcements

Saying So Doesn't Make It So:

Papers in Honor of B. Foss Leach

New Zealand Archaeological Association

Monograph 17, Douglas G. Sutton, Editor

Eighteen former students of Foss Leach honor his contribution as a teacher and mark his departure from the University of Otago in this series of papers on archaeology and related topics in New Zealand, Oceania and the Pacific Rim.

Contents include: "Biographical Sketch" by Douglas G. Sutton; "Historical Essays" by Roger Fyfe, Stuart Park and Atholl Anderson; "Papers in Archaeozoology" by Ian G. Smith, Rick McGovern-Wilson and Douglas G. Sutton; "Lithic and Technological Studies" by Michiko Intoh, Graeme K. Ward, Andrea Seelenfreund and Charles Bollong, and K. E. Prickett; "Papers in Paleobotany" by Kevin L. Jones and Yvonne Marshall; "Dating Study" by K. John Dennison; and "Papers in Physical Anthropology" by Jennifer Evans and Michelle Horwood.

The volume is \$25(NZ) plus \$2 postage and packaging within New Zealand, \$7 overseas (surface mail). Order from:

Sales Manager, New Zealand Archaeological Association Publications, c/o Auckland Institute and Museum, Private Bag, Auckland 1, New Zealand.

New Staff at Missouri Research Reactor

The Archaeometry Laboratory at the Missouri University Research Reactor (MURR) is pleased to announce the addition of a new staff member, Dr. Hector Neff. Dr. Neff, formerly with the Smithsonian's Conservation Analytical Laboratory, will participate in many of the collaborative research efforts now underway in the Lab. Dr. Neff's expertise in ceramic compositional analysis as well as his archaeological field experience will greatly enhance the capabilities of the MURR Archaeometry Lab.

Proposals requesting support for neutron activation analysis for collaborative research projects with the MURR Archaeometry Lab are accepted two times per year (April 15 and December 1). Researchers interested in collaborating with MURR should contact:

Dr. Michael D. Glascock, 223 Research Reactor, University of Missouri, Columbia, MO 65211. Telephone (314) 882-5270, BITNET: GLASCOCK@MURRVAX.

Meeting Review

International Symposium on Archaeometry 2-6 April 1990, Heidelberg, Federal Republic of Germany

In this year when Europe is coming closer together, what better place could the Archaeometry Symposium have met than in the home of one of Europe's first citizens, *Homo heidelbergensis*. Nearly 300 participants from over 30 countries gave over 200 presentations during the week-long symposium. The setting provided a wonderful background for the science - the weather was spring, the city was romantic, and the wine was Rhein.

As Dr. Gunther Wagner, co-organizer of the symposium pointed out in his introductory remarks, archaeometry is hardly surpassed by any other academic exercise in its integrating aspect. The talks presented were proof that this was no hyperbole. The meeting was divided into several symposia: Geoarchaeology; Dating of Inorganic Materials; Dating of Organic Materials; Provenance of Non Metals; Provenance of Metals; Technology of Non Metals; Technology of Metals; Geophysical Prospection; and a theme session on Chronology and Environment of Early Man - The Archaeometric Approach. The theme session was particularly interesting in providing a more general review of related studies on a certain topic.

It is impossible to summarize all the talks, but I (RSS) might point out a few of my personal favorites. The first talk of the symposium by Sealy, Sillen, Kruger and van der Merwe on "Strontium Isotope Measurements of Ancient Skeletons" not only gave me a clear and concise introduction to a technique I was just slightly familiar with, but it reminded me that many of our techniques face common problems. In this case, the "washing profiles" used to examine the solubility of different strontium components are perfectly analogous to the magnetic cleaning or demagnetization needed in my own field of paleomagnetism/archaeomagnetism. Many of us have to worry about separating out our signals from the noise, but at least in many cases, the signal is more stable. Batt and Noel's talk on "Recent Investigations in Archaeomagnetism" was interesting to me because one of the central problems that I have faced in my own research, how to fit a secular variation curve to archaeomagnetic data, is now on their minds as well. Jones and Papamarinopoulos, in "Geophysical Prospection at Archaeological Sites in Greece - A New Initiative," described Project Geotech,

Meeting Review

which equips a geophysical/archaeological team to step in when land development potentially threatens archaeological sites in order to carry out geophysical surveys that can help to rapidly assess the nature of the cultural heritage. Becker and Kromer, "A 9927-Years Holocene Oak Tree-Ring Chronology: Dendrodating and Radiocarbon Calibration," in one of the very few C14 talks, discussed the implications of their extensive tree-ring record for the dating of the Mesolithic and the end of the Ice Ages. Loy, in "Prehistoric Organic Residues - Recent Advances in Identification, Dating, and their Antiquity," presented some fascinating results, including accelerator dating of blood residues used for rock art.

Other than the theme session, about 1/3 of the papers were presented orally, and the remainder as posters. Even though the posters were given equal billing, the large number made it difficult to visit many of them during the four hours of official poster time, when the authors were expected to be available. A compensating factor was that the posters were left up for the entire week, so they could be viewed when one had the time. Alain Tabbagh made some pointed, pertinent, and accurate comments in his introduction to the Geophysical Prospection sessions. After carefully selecting a group of oral presentations for a session, the convenor can find the integrity of the session easily disturbed when authors simply don't show up at the meeting. He also reminded us that we must not mistake the quantity of archaeometric work for quality. The number of prospection talks at this meeting was 40, an all-time high, yet some of them were of distinctly lower quality than others. We are past the time, Tabbagh correctly stated, when we should have to (or feel we have to) justify the ability of our techniques to provide useful results. Rather it is incumbent upon us to show that prospecting (or archaeometry in general) can be successfully integrated into a research design of our own or of the archaeologists. Although a good number of the papers at the meeting provided answers to well-posed problems, there were the inevitable progress reports on problems which are as yet unanswered, as well as papers which provided answers to no obvious problem, and some that kept things simple by posing neither a problem nor an answer. I am being a bit facile, but even in a field with a diverse number of techniques that must indeed be developed and refined, we should strive to apply carefully selected techniques to well-chosen suites of samples in order to maximize the chances of getting results that will be of interest to someone.

Drs. Pernicka and Wagner and the rest of the organizing committee are to be congratulated for orchestrating an

excellent meeting. The main "technical" flaw seemed to be an extremely unreliable set of electronic pointers. Both the unofficial and official social programs were superb. As Mark Twain says in his book *A Tramp Abroad*, "Heidelberg by day - with its surroundings - is the last possibility of the beautiful;" we were all forced into difficult decisions between how much of the technical program we could afford to miss in order to see some of the sights. The former Student Prison was just around the corner from the conference, and I shall now have an alternative type of sanctions to suggest should I ever serve again on the Student Conduct Committee. At least we were able to officially play hooky during the afternoon field trip to the nearby town of Mauer, the find site of the lower jawbone of *Homo heidelbergensis*. A pre-trip and on-site presentations described the renewed efforts by the Max-Planck Institut for Nuclear Physics, Heidelberg, along with colleagues at the University of Heidelberg to apply a barrage of techniques to reassess the dating of this important fossil, now given as about 500,000 years old. The city of Mauer, obviously very proud of its first citizen, extended the usual visiting hours of the Ancient History Museum and hosted a delightful banquet. We were similarly feted by the city of Heidelberg in the magnificent reception room of city hall. The conference banquet was held - where else - in the King's Hall of Heidelberg Castle, and we were even treated to a fireworks display. The two-day post-conference field trip was advertised as an excursion to palaeolithic sites of the Middle Rhine area, although there was much emphasis on the Quaternary vulcanism of the eastern Eifel region, and its relation to the paleoenvironments, paleoecology, and preservation of the archaeological sites, although now the mining of the tuff and pumice threatens some of these same sites. Dr. Turner of the Museum for Ice Age Archaeology in Neuwied and Dr. v.d. Bogaard, University of Bochum, provided much of the archaeological and vulcanologic expertise, respectively. Lunch at the Vulkan Brauerei on the second day gave the participants a final chance to share some of our favorite specialties of the region.

Proceedings of submitted papers from the symposium are due to be published by Birkhauser Verlag before the end of this year, timely enough, but somewhat expensive at 160 Swiss francs.

Robert Sternberg, Garman Harbottle, and James Burton

Laboratory Profile

Laboratory for Archaeological Chemistry

Department of Anthropology
University of Wisconsin-Madison
Madison Wisconsin 53706
(608) 262-2575

The Laboratory for Archaeological Chemistry occupies several rooms in the Department of Anthropology, including two wet labs, a darkroom, an office, and storage space. There are two primary rooms for archaeometric research: a wet lab for sample preparation and a wet lab for sample analysis and the instrument. The sample preparation area is dedicated to processing samples for ICP and other types of analysis. Equipment in this room includes a fume hood, muffle furnace, freeze dryer, GP-45 cryogenic storage, Millique+ water system for 18 megohm deionized water, and necessary glassware and chemical equipment. In addition to the ICP Spectrometer in the Analysis Laboratory, equipment includes analytical balances, a visual spectrometer, a pH meter, and binocular microscopes. Macintosh, DEC, and IBM-compatible computers are used in the lab for data processing and are extensively networked to other computers. The Lab maintains an inventory of nearly three thousand samples of bone and bone ash. The Laboratory of Archaeological Chemistry is supported by funding from the National Science Foundation and cost recovery charges.

Instrumentation

The primary instrument in the Laboratory for Archaeological Chemistry is an Applied Research Labs Model 3520 inductively-coupled plasma (ICP) atomic emission spectrometer. ICP spectroscopy is applicable to an unusually wide range of elements, is extraordinarily free from multi-element interferences, and has a linear working range for concentrations varying by several orders of magnitude. The 3520 is a fixed-grating, sequential spectrometer with multi-tasking software for fully automated operation and data processing. It is capable of quantitatively analyzing approximately six dozen elements at sub-part-per-million levels and can perform duplicate analyses for a dozen or more elements within less than five minutes. Since beginning operation in October of 1988, the 3520 has been used for more than 2000 analyses of archaeological samples.

Other instrumentation available includes equipment for electron microscopy, X-ray diffraction, IR spectroscopy, and ion-specific electrode analysis. These instruments are

located in the Departments of Geological Science, Geography, and Chemistry on campus and are readily accessible. Electron microscopes in Geology are used for quantitative or rapid qualitative chemical analysis of fine-grained materials such as pigments, for chemical and textural characterization of materials such as ceramic pastes and tempers, and for the high-resolution spatial imaging of artifacts. Available instrumentation includes an ARL SEM-Q microprobe with an energy-dispersive X-ray analyzer (EDX), three wavelength-dispersive (WDX) spectrometers, six mono-chrometers, a back-scattered electron detector and the Tracor-Northern TN-2000 system for fully automated analysis and data reduction. A JEOL 50-A scanning electron microscope equipped with a Princeton Gamma-Tech EDX analyzer, a back-scattered electron detector, and Tracor-Northern software for data reduction is also available. Both instruments are available for laboratory use for nominal fees (\$10-15/hr) on an equal priority with other users.

A Scintag PAD-V X-ray diffractometer in Geology is used for mineralogical identification of unknown materials, for characterization of raw and fired clays and ceramic pastes, and for determining the degree of crystallinity of bone samples. The diffractometer is available for laboratory use without cost and on an equal priority with other users.

Other equipment available on a courtesy basis for pilot studies includes a Nicolet fourier-transform infrared spectrometer (FTIR), available through Chemistry. This instrument is used for the characterization of bone crystallinity and to measure relative amounts of anionic groups in bone apatite (e.g. CO_3 , PO_4 , OH^- , and F^-).

Staff

Dr. T. Douglas Price, Professor (PhD 1975, Michigan), has been Director of the Laboratory for Archaeological Chemistry in Madison since 1985. Price is responsible for overall direction of the laboratory, coordinating new projects, report preparation, and supervision of staff. Current interests involve continuation of bone chemistry/dietary reconstruction studies and the chemical characterization of anthropogenic soils.

Dr. James Burton (PhD, 1986 Geology, Arizona State) is the Associate Director of the Laboratory for Archaeological Chemistry and is responsible for the day-to-day operation of the laboratory. Burton maintains active professional affiliations in several disciplines, including chemistry, geology, and archaeology. His research interests involve the applications of emerging technologies for the characterization and 'fingerprinting' of archaeological artifacts and the determination of prehistoric exchange networks through the distributions of provenienced raw materials and artifacts.



Figure 1. Staff, from the left: T. Douglas Price, Michael Marchbanks, Jennifer Blitz, James Burton, Joe Ezzo and Mike Kimball

Laboratory personnel include a number of graduate and post-graduate researchers. These individuals are trained in laboratory procedures, sample preparation, and instrument operation. Archaeology graduate students currently working in the lab include:

Jennifer Blitz (MA Wisconsin) - Current interests include the reconstruction of dietary patterns of prehispanic Mesoamerican societies and their association with social organization. She is currently involved in a study of status differentiation at Monte Alban, Mexico.

Joseph A. Ezzo (MA Arizona) - Primary archaeological interests in paleonutrition in North America, methodological interests in bone washing procedures and the establishment of biological ranges of barium and strontium in modern and prehistoric faunal material.

Michael Marchbanks (MA Texas) - Research interests involve organic residue analysis, technical analyses of ceramics, and bone and soil chemistry.

Affiliates of the Laboratory at the University of Wisconsin

include Dr. Philip Helmke of the Department of Soil Science, Drs. John Valley and Clark Johnson of the Department of Geology and Geophysics, and Dr. James B. Stoltman of the Department of Anthropology.

Basic Research

Projects of the Laboratory for Archaeological Chemistry focus on (1) elemental analysis of prehistoric human and animal bone for information on past diet and environment, (2) analysis of the mineral and elemental composition of prehistoric lithics and ceramics for information on sources of raw material and regional variation, (3) analysis of archaeological soils for characterization and the detailed study of within-site variation, (4) the development of analytical procedures, and (5) the study of sample variability.

Projects of the Laboratory have included identification of mineral pigments from Peruvian burials, sourcing of groundstone objects from the southwestern U.S., chemical correlation of Quaternary glacial deposits, and determination of exchange networks in the northern Andes through ceramic petrography. Paleodietary studies include the development of a trace element method for measuring the utilization of marine resources, the development of procedures for reducing the problems of diagenesis in prehistoric bone, and projects examining the trajectory of human diet in the southwestern U.S., Mexico, southern Alaska, Ecuador,

Recent Activities

In addition to the basic research of the laboratory involving the elemental characterization of bone, stone, soils, and pottery, several important projects have developed in recent months:

Bone barium and strontium levels in desert environments

Investigations of barium and strontium as paleodietary indicators (Burton and Price, in press, The ratio of barium to strontium as a paleodietary indicator of consumption of marine resources, *Journal of Archaeological Sciences*) demonstrate that barium, like strontium, is a paleodietary indicator, and that there are quantitative relationships between barium and strontium, relationships which are sensitive both to trophic position and to the consumption of marine resources (Figure 2). There are consistently anomalous patterns, however, in desert regions (Great Basin, Sonoran, and Atacama deserts) indicating that the usual correspondence between strontium and trophic position is not maintained in arid environments.

Recent analyses of faunal material from Ventana Cave and elsewhere in the southwest indicate that, in the desert environment, the food "chain" must be considered as a food "web", and that barium and strontium behave as independent vectors mapping the positions within this web.

Initial faunal results suggest that the anomalous patterns arise from immobilization of barium, but not of strontium, in strongly alkaline soils of desert playas and basins, and from significant alkaline-earth enrichment in the roots and woody parts of halophytic plants. We intend that isolation of the factors responsible for these anomalies will permit a finer-grained interpretation of trace-element paleodietary studies, e.g. resolution of differential utilization of desert-basin resources versus upland/semi-arid resources. A second application will be to test models, such as proposed for the Hohokam, that cultural changes may be related to over-salinization of agricultural soils.

A simple method for chemically characterizing ceramics

A simple chemical method was recently developed (Burton and Simon, in preparation, An efficient method for the characterization of archaeological ceramics) that reliably correlates "genetically" related ceramics with one another and with their clay sources. The method uses an ion-extraction of the ceramic paste and is relatively insensitive to temper and to bulk chemical composition of the paste. It is highly sensitive to the minor and trace element composition of the clay paste, however, and partly sensitive to production parameters such as firing temperature. In all test cases, the method was able to correctly correlate fired, tempered clays regardless of temper, and to match potsherds with one another and with the archaeological clay from which they were made. In one illustrative application, the method was used to chemically differentiate

three modern pottery production centers in the Valley of Oaxaca (Figure 3). It was possible not only to resolve the production loci but also to characterize and distinguish the wares of individual potters.

In the current project, we plan to further develop and test the method through applications not only in the Tonto Basin, but with other ceramic assemblages in the southwest, assemblages which will be independently analyzed by other methods. We have arranged to analyze

with ionic extraction approximately 400 sherds from the Tucson Basin of a ceramic, Tanque Verde Red-on-brown, which was widespread in southern Arizona from 1200-1400 AD. These same sherds will be analyzed by neutron activation analysis at the Archaeometric Research Laboratory at the University of Missouri. A comparable set of sherds from the Phoenix Basin is being analyzed both by the ion-extraction method and independently at Arizona State University by electron microprobe (for clay paste composition) and by optical petrography.

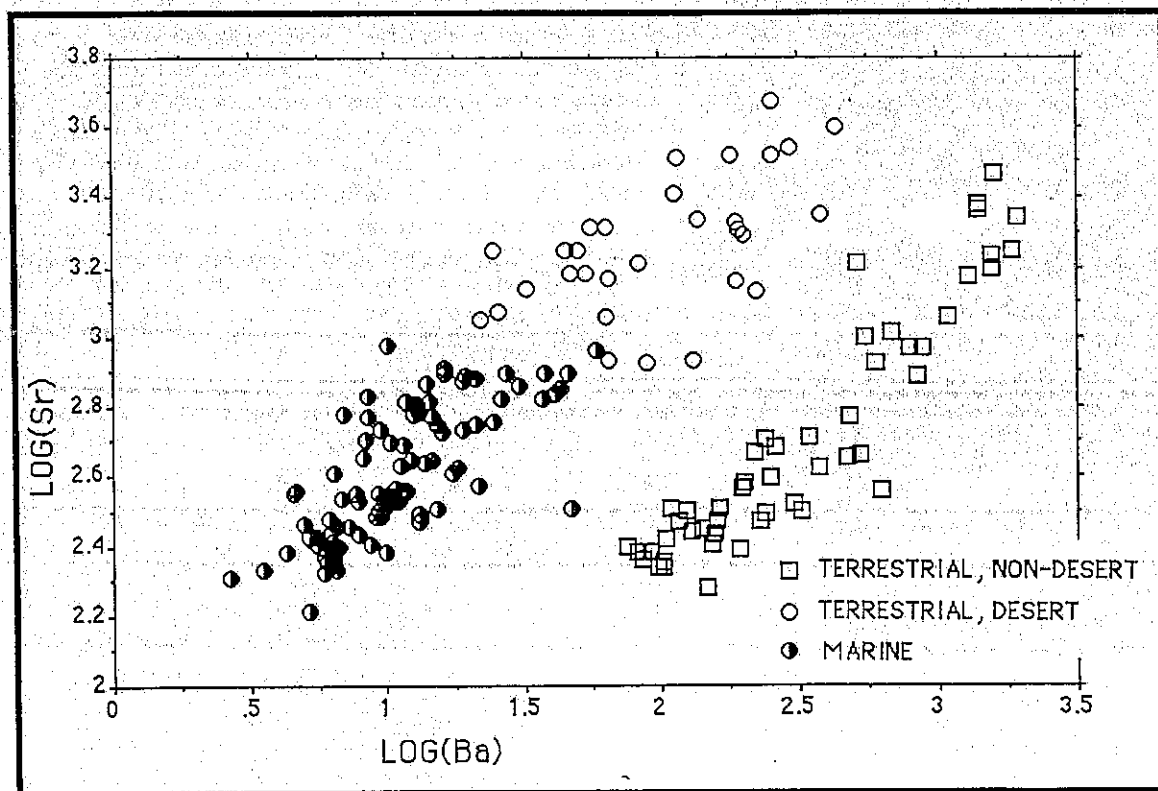


Figure 2. Barium/strontium ratios

Many federal and state agencies and private firms are currently collecting large numbers of faunal materials, both modern and archaeological, from both the Great Basin and the Sonoran Desert for our analyses. We have also arranged to examine large numbers of human as well as faunal material from Pueblo Grande, Grasshopper, and the Tonto Basin, AZ. This understanding of the patterns of alkaline-earth distributions will be essential for correct interpretation of these, and other, trace-element paleodietary studies in desert environments.

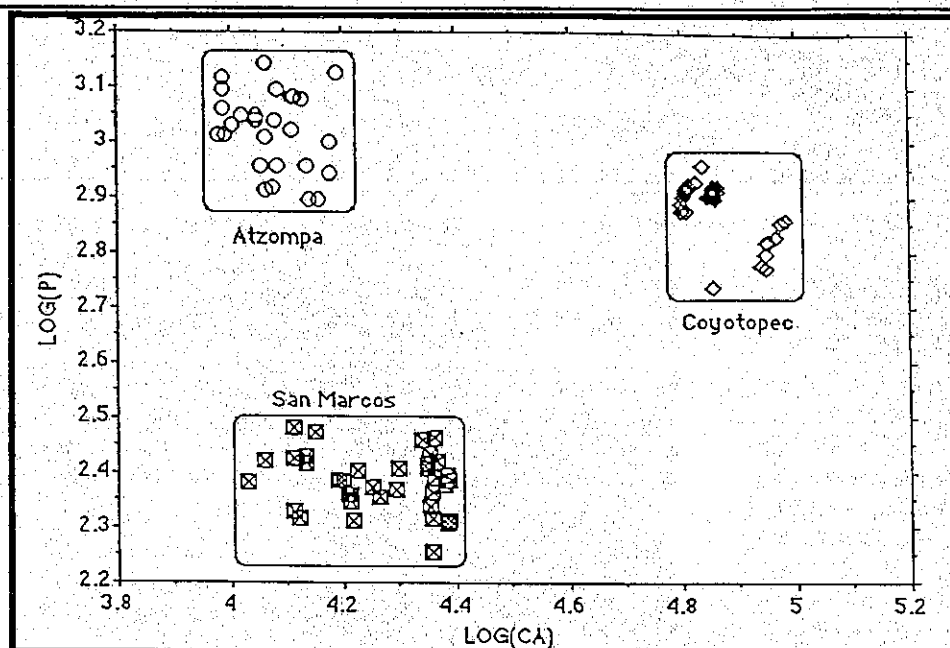


Figure 3. Trace-element characterization of pottery centers

Although we are using ICP spectroscopy, a highly-sensitive multi-element technique, it was possible in every test case to reliably correlate ceramics and clays with only three or four elements, detectable at levels which could be measured by widely available instrumentation (e.g. flame atomic absorption) and at extraordinarily low costs. While the ceramic analysis will address archaeological problems, the primary objective is to develop a reliable method of ceramic compositional analysis that can be used by those without access to sophisticated instrumentation or large research budgets.

Organic residue analysis

Differential preservation of organic materials in archaeological contexts can result in the misinterpretation of their relative importance in analysis of past cultures. However, it has been shown that some components of organic materials can survive for thousands of years with few or relatively minor alterations. Analysis of microscopic organic residues that have adhered to or been absorbed into the structural matrix of archaeological materials can provide information about the function of the artifact(s) and the diet, lifestyles, and, perhaps, ceremonies of a past culture.

Several classes of archaeological materials can be examined for organic residues, including, but not limited to, ceramics, stone tools, grinding stones, cooking slabs, soil, and sediments. The best preservation seems to be in artifacts that have absorbed the residues into their structural matrix (such as pottery), thus preventing, or at least hampering, contamination such as handling, post-depositional treatments, and oxygen-induced degradation that can interfere in the identification of the original parent material. To analyze the matrix of an artifact of this nature is destructive, but it only requires a small sample (3-10

grams). Artifacts made of relatively impermeable materials, such as chert, can have surprisingly large quantities of organic residues on their surfaces or stuck in irregularities such as flake scars. The method used for the surface analysis is not destructive, but extreme care must be taken to reduce the effects of any post-depositional handling and alteration of the residues. The samples should not be cleaned; they should be placed unwashed in either aluminum foil (shiny side in) or inert plastic bags.

Plants and animals have distinctive organic constituents that can be identified by chemical analysis. These

organic constituents, called lipids, come in several different forms including fatty acids and sterols. Much of the research emphasis is on fatty acids, although sterols are becoming increasingly more important for their potential to distinguish individual species.

Although individual species of plants and animals cannot yet be identified because of the mixing of different parent materials on any individual artifact and the absence of a large enough database of modern reference samples, the results of numerous analyses indicate that species identification may be possible with future research. Even now, with the current limitations, the organic residues can be characterized fairly easily between land animal, vegetal, or fish materials. In addition, several archaeological questions can be addressed, including (1) multiple use(s) of an artifact class (or individual tools), (2) whether specific plants or animals could have been stored in or processed by the artifact (e.g., could corn have been stored or processed using this item?), and (3) possible dietary changes over time.

Collaborative Research and Training

The Laboratory actively seeks joint research projects involving collaboration between our staff and researchers at other institutions. Please call or write to discuss your project and learn about sample requirements, submittal forms, and potential costs. Most analyses are destructive but normally less than a few grams are required. We have facilities for faculty and students to participate in archaeometric research, either in a formal classroom or individual projects. You are cordially invited to visit the Laboratory at any time. If you are interested in research, training, or a guided tour, please contact either Douglas Price (608-262-2575/Bitnet: tdprice@wiscnmac) or Jim Burton (608-262-4505/Bitnet: jhburton@wiscnmac).

Geoarchaeology News

Society for American Archaeology Atlanta, 1989

A symposium titled "Paleoshorelines and Prehistoric Settlement" was presented at the 54th annual meeting of SAA in Atlanta. The symposium was organized by Lucy Lewis Johnson (Vassar College). Papers discussed research on coastal sites in both North and South America.

The SAA Fryxell Award was given to Joseph Lambert, for his interdisciplinary research on archaeological chemistry. A description of his work is given in Volume 54, No. 3, of *American Antiquity*.

Society for American Archaeology Las Vegas, 1990

A symposium titled "Fires and the Archaeological Record: Depositional and Post-Depositional Formation Processes" was presented at the 55th annual meeting of SAA in Las Vegas. The symposium was organized by Kenneth P. Cannon and Melissa A. Connor (National Park Service, Lincoln, Nebraska). Papers discussed the mechanics of wild fires, the impact of these fires on archaeological sites, and the effects of fires on archaeological materials.

A symposium titled "Late Quaternary Paleoenvironments: Paleoclimatic Interpretations and Archaeological Implications" was organized by James L. Phillips and Ofer Bar-Yosef. Participants discussed primarily the paleoenvironments of the Near East. Participants were: A. Garrard, P. Goldberg, W. Farrand, E. Tchernov, A. Belfer-Cohen and O. Bar-Yosef, B. Gladfelter and J. Phillips, B. Byrd, A. N. Goring-Morris, Z. Herzog; with discussants L. Keeley and F. Hassan. The infusion of Old World research to the SAA was a delightful treat.

For the first time this year the SAA had many participants display their research in poster sessions, many of which were geoarchaeological. Participants and their titles were:

Davis, Simmons, Mandel, Rollefson, Dafafi "A postulated Early Holocene summer precipitation episode in the Levant: Effects on Neolithic adaptations"; McFaul "Assessing the magnitude of Middle-Late Archaic mesic paleoclimatic episodes"; Price-Beggerly "Kahana Valley, Hawaii: A geomorphic artifact"; Shaw "Tree-ring based summer drought estimates for the Pinelawn/Reserve and Mimbres Region in New Mexico"; Olsen "Solifluction as a major taphonomic process at Solutre, France"; Sikes and Ambrose "Soil carbon isotope evidence for Holocene habitat

change in the Kenya Rift Valley"; Bartolotta "Sediment as artifact: a substantive example from a Norwegian farm-mound"; Peterson, Caran, Neck, and Winsborough "Marshes, ponds, and paleosols: Holocene biostratigraphy at Palo Duro in the Southern Plains"; Mabry "Prehistoric water management in the Jordan River Valley".

The SAA Fryxell Award was given to Patty Jo Watson, for her facilitation of interdisciplinary research. A description of her work will appear in Volume 55, No. 3, of *American Antiquity*. Congratulations.

The symposium organized by Dr. Katherine Moore in honor of the Fryxell recipient was "The State of Interdisciplinary Research in Archaeology", Participants: Moore, Redman, Wylie, Stein, Pearsall, Redding, Marquardt, Watson, and Wright all gave strong statements on interdisciplinary research and where it will be going in the future. Many of the articles will appear in various journals soon. Write to each author if you would like a copy of their paper.

Geological Society of America St. Louis, 1989

The Archaeological Geology Division sponsored a symposium, "Geological Controls on the Regional Distribution of Archaeological Sites", organized by Robert M. Thorson. Participants were: Bettis, Wells, Chrzastowski and Kraft, Winslow and Johnson, Phillips, Farrand, Davis, Mandel and Simmons, McCoy and Heiken, Hajic and Bettis, Smith and Bennett. If you would like more information write to: Robert Thorson, Geology, University of Connecticut, Storrs, Connecticut.

A second session included many geoarchaeology papers. Presenters were: Dunn, Johnson, May and Holen, Blum, Ferring, Fisher, Cotkin, Carr and Cotkin, Craft, Rapp, Gifford, Aschenbrenner and Tziavos, Mazer, Bates and Stevenson, Miller and Beaumont, Young, Donahue and Watters. If you are interested in the research of these individuals please check the abstracts of the GSA Annual Meeting, St. Louis.

At the business meeting of the Archaeological Geology Division the division award was given to Herbert E. Wright for his contributions to archaeology and geology especially those associated with the research of Robert Braidwood and the origins of Agriculture. Presentation of the award by William Farrand and Julie Stein and the acceptance speeches of the recipient will be published in the *GSA Bulletin* in 1990.

Nominations for the next Archaeological Geology Division Award are being solicited now. Please forward the names of individuals, who have contributed significantly to archaeological geology, to (Chair of the Awards Committee) c/o Reid Ferring, Secretary-Treasurer Archaeological Geology Division, Institute of Applied Sciences, University of North Texas, Denton, Texas. Nominations can be made by mail or phone, only the name is needed.

Volume 4 of the Decade in North America Geology series is ready. *Archaeological Geology of North America*, edited by Norm Lasca and Jack Donahue will be ready for sale in May 1990. The volume contains 33 articles concerning archaeological geology of Canada, Mexico, and the United States.

Geological Society of America Dallas, Oct. 28 - Nov. 2, 1990

In the autumn the GSA will be held in Dallas. The Archaeological Geology Division will be organizing a symposium, an awards presentation, and a field trip.

A symposium entitled "Effects of Scale on Archaeological and Geological Perspectives" is being organized by Julie Stein and Angela Linse. For more information contact them at Department of Anthropology DH-05, University of Washington, Seattle, WA 98195.

A pre-meeting field trip is planned for Oct. 28, 1990, "Archaeology in the Upper Trinity River Drainage Basin", organized by Reid Ferring. The group will visit the Aubrey Site, a new Paleoindian site excavated by Reid Ferring in 1989. The trip will begin early Sunday morning and will cost an estimated \$40. For further information write to Reid Ferring, Institute for Applied Sciences, P.O. Box 13078, University of North Texas, Denton, Texas 76203.

The GSA meeting in 1991 will be in San Diego, California. Ideas for field trips associated with this meeting are now being solicited by Art Bettis, Iowa Geological Survey, 123 N. Capital, Iowa City, Iowa 52242.

New publications in geoarchaeology

Courty, Marie-Agnes, Paul Goldberg, and Richard MacPhail (1990) *Soils and Micromorphology in Archaeology*, Cambridge University Press.

Harris, Edward (1989) *Principles of Archaeological Stratigraphy* (2nd edition). Academic Press

Jacobsen, T. W. and W. R. Farrand, with contributions by F. A. Cooper and C. J. Vitaliano (1988) *Franchthi Region*, Fascicle 1, *Excavations at Franchthi Cave, Greece*, Indiana

University Press.

Van Andel, T. H. and S. B. Sutton, with contributions by J. M. Hansen and C. J. Vitaliano (1988) *Landscape and People of the Franchthi Region*, Fascicle 2, *Excavations at Franchthi Cave, Greece*, Indiana University Press.

Perles, Catherine (1988) *Les Industries lithiques Taillees de Franchthi: tome I, Presentation Generale et Industries Paleolithiques* (The chipped stone industries of Franchthi: Volume I, General Presentation and Paleolithic Industries), Fascicle 3, *Excavations at Franchthi Cave, Greece*, Indiana University Press.

Shackleton, Judith C. (1989) *Marine Molluscan Remains from Franchthi Cave; with a report on the Oxygen Isotope Analyses of Marine Molluscs from Franchthi Cave* by M. R. Deith and N. J. Shackleton, Fascicle 4, *Excavations at Franchthi Cave, Greece*, Indiana University Press.

GEOARCHAEOLOGY: An International Journal (editor Jack Donahue, Department of Anthropology, University of Pittsburgh, Pittsburgh, PA 15260) is now in the middle of Volume 5. Subscriptions to the journal are \$48.00 for members of SAS.

Haynes Named to National Academy

C. Vance Haynes has been elected to the National Academy of Science. His geochronological research associated with many excavations of Clovis Sites has benefitted the entire discipline. His research in the arid regions of North Africa represents outstanding geology as well as historical research. We all congratulate you, and support your election to the Academy.

Julie K. Stein, Department of Anthropology, University of Washington, Seattle, WA 98195, BITNET:STEIN@MAX.



Meetings Calendar

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., "12(4):13" for Volume 12, Number 4, page 13. The Meetings Calendar editor receives additional information for many of the listed meetings. You may contact him, preferably by BITNET, for further details.

August

Aug. 5-9. 41st Annual Meeting, American Institute of Biological Sciences; with Botanical Society of America. Richmond. Meetings Department, AIBS, 730 11th Street NW, Washington, DC 20002-4521 (202-628-1500).

Aug. 6-9. Annual Statistical Meetings; co-sponsored by the American Statistical Association, the Biometric Society, and the Institute of Mathematical Statistics. Washington, DC. ASA, 1429 Duke Street, Alexandria, VA 22314-3402 (703-684-1221).

Aug. 6-10. 17th Annual ACM Conference on Computer Graphics and Interactive Techniques (SIGGRAPH 90). Dallas. Lois Blankenstein, SIGGRAPH Conference Liaison, Association for Computing Machinery, 11 West 42nd Street, New York, NY (212-869-7440; E-mail: lois.blankenstein@um.cc.umich.edu); sponsored by International Commission for Optics. Garmisch-Partenkirchen, FRG. G. von Bally, Laboratory of Biophysics, Institute of Experimental Audiology, University of Munster, Kardinal-von-Galen-Ring 10, D-4400 Munster, Federal Republic of Germany.

Aug. 12-18. 12th International Congress on Electron Microscopy. Seattle. Dr. J. K. Koehler, University of Washington, Biostructure SM-20, Seattle, WA 98195.

* **Aug. 13-16. 16th International Conference on Very Large Data Bases.** Brisbane, Australia. David Reiner, Lotus Development, 1 Canal Park, Cambridge, MA 02141 (617-577-8500).

* **Aug. 15-31. International Geographical Union, Regional Conference.** Beijing. Wu Chuanjun, Institute of Geography, Chinese Academy of Sciences, Beijing 10011, People's Republic of China.

Aug. 19-25. 20th Meeting of the Federation of European Biochemical Societies. Budapest. 20th FEBS Meeting Secretariat, Hungarian Biochemical Society, MTESZ, Budapest 1368, PO Box 240, Hungary.

Aug. 26-31. Austceram '90. Perth, Western Australia. Austceram '90, PO Box 515, South Perth, WA 6151, Australia (619 474 1699; FAX 619 474 1460). 13(1):16.

Aug. 26-31. 200th National Meeting of the American Chemical Society. Washington DC. Meetings Department, American Chemical Society, 1155 16th Street NW, Washington, DC 20036 (202-872-4396).

Aug. 26-31. Euroanalysis VII - European Conference on Analytical Chemistry. Vienna. Prof. Dr. M. Grasserbauer, c/o Interconvention, A-1450, Vienna, Austria (43-222-2369-2647). 13(2).

Aug. 26-Sept. 1. 13th International Association of Sedimentology Congress. Nottingham, U.K. I. N. McCave, Department of Earth Sciences, Cambridge University, Downing Street, Cambridge CB2 3EQ, United Kingdom. 13(2).

Aug. 27-Sept. 1. International Association of Hydrology, 22nd Congress; Symposium on Water Resources in Mountainous Regions. Lausanne. Dr. A. Parriaux, Laboratory of Geology EPFL (GEOLEP): CH-1015 Lausanne, Switzerland.

Aug. 28-30. IMACS European Simulation Meeting on Problem Solving by Simulation. Esztergom, Hungary. A. Javor, Central Research Institute for Physics of the Hungarian Academy of Sciences, H-1525 Budapest 114, PO Box 49, Hungary. 13(1):17.

* **Aug. 29-31. International Conference on Data Base and Expert System Applications.** Vienna. A. M. Tjoa, University of Vienna, Department of Statistics and Computer Science, Liebiggasse 4, A-1010 Vienna, Austria (43-0222-436712; Email A4423 DAB@AWIUNI11).

September

Sept. 3-7. 3rd International Symposium on X-ray Microscopy. London. Dr. A. G. Michette, Department of Physics, King's College, Strand, London, WC2R 2LS, United Kingdom.

Sept. 3-8. International Congress on Volcanology. Mainz. G. Brey, Max Planck Institut fur Chemie, Abtl. Kosmochemie, Saarstrasse 23, 6500 Mainz, Federal Republic of Germany. 13(1):17.

Sept. 4-8. World Archaeological Congress 2. Cartagena, Columbia. Dr. Paul Reilly, IBM UK Scientific Centre, St. Clement Street, Winchester SO23 9DR, UK (FAX 44-962-84009; E-mail: WAC2@ECS.SOTON.UK). 12(4):11.

Sept. 4-8. 8th General Conference of the European Physical Society. Amsterdam. L. Roos, FOM-Institute for Atomic and Molecular Physics, PO Box 41883, NL-1009 DB Amsterdam, The Netherlands.

Sept. 9-13. Large Lakes and Their Stratigraphic Record; Geological Society of America Penrose Conference. Lake Tahoe, California. Andrew S. Cohen, Department of Geosciences, University of Arizona, Tucson, AZ 85721 (602-621-4691). 13(1):17.

Sept. 10-13. African Geology, 15th Colloquium; co-sponsored by CIFEG. Nancy, France. Marc Deschamps, Université de Nancy 1, Laboratoire de Petrologie, BP 239, F-545006 Vandoeuvre-les-Nancy Cedex, France. 13(2).

Sept. 18-21. Annual Conference, Remote Sensing Society: Remote Sensing and Global Change. Swansea. M.G. Coulson, Department of Geography, University College of Swansea, Singleton Park, Swansea SA2 8PP, UK.

Sept. 18-23. 4th International Symposium on the Mesolithic of Europe. Leuven. Pierre M. Vermeersch, Mesolithic Symposium, Redingen-straat 16bis, B-3000 Leuven, Belgium.

Sept. 20-24. 5th Nordic Conference on the Application of Scientific Methods in Archaeology. Stockholm. Arkeologiska Forskningslaboratoriet, Greens villa, Stockholm Universitet, 106 91 Stockholm, Sweden (08/16 21 77; BITNET: P396220QZCOM.BITNET. 12(4):10.

Sept. 23-27. Society of Exploration Geophysicists, 60th International Meeting. San Francisco. Convention Assistant, SEG, PO Box 3098, Tulsa, OK 74101.

Sept. 24-28. Past and Present Climate Dynamics: Reconstruction of Rates of Change; convenors include Swiss Committee for the International Geosphere/Biosphere Program. Ticino, Switzerland. K. Kelts, ProClim90, Postfach 7613, CH-3001 Bern, Switzerland (41-21-2114; FAX 411-22-9164).

Sept. 24-29. 7th International Conference on Geochronology, Cosmochronology, and Isotope Geology. Canberra. Organizing Committee, IGOC7, Research School of Earth Sciences, Australian National University, Box 4, Canberra, ACT 2601, Australia. 13(1): 17.

Sept. 25-27. Linnean Society: Annual Regional Meeting: The Present State of the Biosphere and Evolution. Reading, UK. Dr. John Marsden, Linnean Society of London, Burlington House, Piccadilly, London W1V 0LQ, UK.

Sept. 25-28. Symposium on Time and Environment; sponsored by the Department of Archaeology and the Dating Laboratory of the University of Helsinki, and Group PACT. The Dating Laboratory, University of Helsinki, Snellmaninkatu 5, SF-00170 Helsinki, Finland. 12(4):10.

Sept. 29-Oct. 7. 6th Meeting of the Association of Euro-

pean Geological Societies. Lisbon. MEGS VI, Sociedade Geologica de Portugal, Rda Escola Politecnica, P. 1294, Lisbon Portugal.

October

Oct. 1-7. International Earth Sciences Congress on Aegean Regions. Izmir. IESCA-1990, Dokuz Eylul University, Department of Geology, P.K. 74 (E.U.-PTT): Bornova, Izmir, Turkey (51-182919; FAX 51-220978).

Oct. 7-12. 17th Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies. Cleveland. Charles J. Belle, Lucas Aerospace PEC, 4259 W. 192nd Street, Fairview Park, OH 44126 (216-062-1001).

Oct. 8-12. 5th Australasian Remote Sensing Conference. Perth. Dr. Norman Campbell, Technical Paper Coordinator, 5th Australian Remote Sensing Conference, PO Box 411, West Perth, Western Australia 6005, Australia. 13(1):17.

+ Oct. 15-20. Association for the Study of Marble and Other Stones in Antiquity (ASMOSIA): 2nd Biennial Meeting. Leuven, Belgium. Norman Herz, Department of Geology, University of Georgia, Athens, GA 30602. Abstract deadline: 6/15/90. Topics include: materials and extraction techniques from the prehistorical through the Roman Period; prefabrication in ancient cultures; trade of stone materials; provenance determination. Day trip to international exhibition in Brussels on "Eternal Stones: Quarrying and Prefabrication from the Nile to the Rhine," and to the Muse Royal de Mariemont which houses an outstanding collection of Egyptian and Classical antiquities. 13(1):17.

Oct. 21-25. 2nd International Conference of Ethnobiology. Kuming, China. International Society for Ethnobiology, 2220 Piedmont Avenue, University of California, Berkeley, CA 94720. 13(1):17.

Oct. 21-26. Soil Science Society of America Annual Meeting. San Antonio, Texas. SSA, 677 S. Segoe Road, Madison, WI 53711 (608-273-8080).

*** Oct. 23-26. Visualization 90.** San Francisco. Arie Kaufman, Computer Science Department, State University of New York, Stonybrook, NY 11794-4400 (516-632-7441). Paper deadline: 5/15/90.

Oct. 29-Nov. 1. Geological Society of America Annual Meeting. Dallas. GSA Meeting Department, PO Box 9140, Boulder, CO 80301 (303-447-2020).

*** Oct. 29-Nov. 16. Workshop on Mathematical Ecology.** Trieste. International Centre for Theoretical Physics, PO Box 586 Miramare, Strada Costiera 11, I-34100 Trieste,

Evert van der Gaag, EAEG, Wassenaarseweg 22, NL-2596 CH The Hague, The Netherlands.

* May 30-31. Discussion Meeting on the Foraging Strategies and the Natural Diet in Monkeys, Apes and Humans. London. Scientific Meetings Secretary, The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG, UK.

June - December 1991

* June 9-14. 27th Colloquium Spectroscopicum Internationale. Bergen. Secretariat of XXVII, HSD Congress-Conference, PO Box 1721 Nordnes, N-5024 Bergen, Norway (47-5-318414; FAX 47-5-324555).

* June 15-19. American Society of Mammologists, Annual Meeting. Manhattan, Kansas. M.E. Hight, Department of Biological Sciences, Marshall University, Huntington, WV 25755.

July 7-11. 47th International Conference of Americanists. New Orleans. Secretariado ICA 1991, Roger Trayer Stone Center for Latin American Studies, Tulane University, New Orleans, LA 70118-5698.

Aug. 2-9. 13th INQUA International Congress on Quaternary Research. Beijing. Secretariat, 13th INQUA Conference, Chinese Academy of Sciences, 52 Sanlihe, Beijing 100864, People's Republic of China.

* August 11-24. International Union of Geodesy and Geophysics, 26th General Assembly. Vienna. F. Wiederstein, BM für Land- und Forstwirtschaft, Hydrographisches

Zentral-buro, Marxergasse 2, A-1030 Vienna, Austria.

Aug. 18-23. International Symposium on Engineering Geology in a Desert Environment, Rock-Water Interaction. Jerusalem. The Secretariat, International Symposium on Engineering Geology in a Desert Environment, Rock-Water Interaction, PO Box 50006, Tel Aviv 61500, Israel. 13(1):18.

Aug. 26-30. 12th International Mass Spectrometry Conference. Amsterdam. RAI Organisatie Bureau Amsterdam, Europaplein 12, NL-1078 GZ Amsterdam, The Netherlands.

Sept. 1-7. International Union of Prehistoric and Protohistoric Sciences, 12th Congress. Bratislava, Czechoslovakia. Archeologicky stav Slovenskij Akadmie Vied, Sekretarit XII Kongresu UISSP, 949 21 Nitra-hrad, Czechoslovakia. 12(4):4.

Sept. 6-11. Paleoecology, 2nd International Congress. Nanjing. Ma Yu-Ying, Nanjing Institute of Geology and Palaeontology, Academia Sinica, Chi-Ming-Ssu, Nanjing 210008, People's Republic of China.

Oct. 6-11. 8th International Congress on Human Genetics. Washington, DC. John J. Mulvihill, M.D., Secretary-General ICHG, 9650 Rockville Pike, Bethesda, MD 20814.

Rob Sternberg, Department of Geology, Franklin and Marshall College, PO Box 3003, Lancaster, PA 17604-3003. BITNET: R_STERNBERG@FANDM. Phone: (717) 291-4134.

Archaeometry

The prime research journal for the archaeologist interested in the involvement of the physical sciences in archaeology and art history. Articles are written with the non-specialist in mind while Research Notes provide state-of-the-art specialist reports.

The February issue includes: Cult objects and Edomite vessels from the Horvat Qitmit shrine (Gunneweg & Mommsen), Optical dating of sediments (Smith et al), Analysis of the Lycurgus Cup using analytical transmission electron microscopy (Lambert et al), Neutron radiography in archaeology (Tugrul), Age at death determination using D-aspartic acid (Gillard et al), Vindobala, Hadrian's Wall: a shear-wave seismic refraction survey (Goulty et al), Thermal archaeological surveying (Noel & Bellerby), The Thera eruption: the Third Congress (Manning), Radiocarbon AMS dates from Oxford (Hedges et al)

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Italy.

* Oct. 31-Nov. 2. **Pacific Conference on Chemistry and Spectroscopy.** San Francisco. Richard Gaver, Chemistry Department, San Jose State University, San Jose, CA 95192 (408-924-4974). Abstract deadline: 5/1/90. Topics include: atomic spectroscopy; computers in chemistry; GC; ICP; IR.

November

Nov. 11-16. **Eastern Analytical Symposium.** Franklin Township, New Jersey. EAS, PO Box 633, Montchanin, DE 19710 (302-453-0785).

Nov. 12-13. **2nd World Climate Conference.** Geneva. World Meteorological Organization, Ave Giuseppe Motta 41, CH-1202 Geneva, Switzerland.

* Nov. 13-15. **2nd International Ceramic Science and Technology Congress.** Orlando, Florida. American ceramic Society, 757 Brooksedge Plaza Drive, Westerville, OH 43081-6136 (614-890-4700).

Nov. 14-18. **American Anthropological Association Annual Meeting.** New Orleans. AAA, 1703 New Hampshire Avenue NW, Washington, DC 20009 (202-232-8800).

Nov. 27-Dec. 2. **Materials Research Society, Fall Meeting.** David Sours, Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237 (412-367-3003; FAX 412-367-4373).

December

Dec. 2-9. **20th International Ornithological Congress.** Christchurch, New Zealand. Ben D. Bell, Secretary-General, XX International Ornithological Congress, Zoology Department, Victoria University, Private Bag, Wellington, New Zealand. 13(1):18.

Dec. 3-7. **American Geophysical Union Fall Meeting.** San Francisco. AGU Meetings, 2000 Florida Avenue NW, Washington, DC, 20009 (202-462-6900).

* Dec. 16-19. **11th Annual Conference on Information Systems.** Copenhagen. Lewis E. Leeburg, UCLA, AGSM, 405 Hilgard Avenue, Los Angeles, CA 90024-1481 (213-825-1428).

Dec. 27-30. **Annual Meeting of the American Society of Zoologists; also the American Microscopical Society.** San Antonio. Mary Adams-Wiley, American Society of Zoologists, 104 Sirius Circle, Thousand Oaks, CA 91360 (805-492-3585; FAX 805-492-0370).

January 1991

Jan. 9-13. **Society for Historical and Underwater Archaeology.** Richmond. L. Daniel Mouer, Program Chair SHA '91, Archaeological Research Center, Box 2040, Virginia Commonwealth University, Richmond, VA 23284. 13(2).

* Jan. 14-18. **5th International Colloquium on Physical Measurements and Signatures in Remote Sensing.** Courchevel. International Society for Photogrammetry and Remote Sensing, Courchevel-Resevation, Colloque CNES, La Croisette, 73 120 Courchevel, France.

February

* Feb. 11-14. **4th Australian Archaeometry Conference.** Canberra. Archaeometry Conference, Prehistory Department, RSPacS, The Australian National University, GPO Box 4, Canberra ACT 2601, Australia (FAX 06-257-1893). Conference topics will include: examination of microscopic residues; biochemical analysis; materials analysis; dating systems; palaeoenvironments and site diagenesis; authenticity studies.

March

* March 20-21. **Discussion Meeting on Molecular Palaeontology.** London. The Scientific Meetings Secretary, The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG, UK.

* March 24-28. **European Union of Geological Societies, 10th Anniversary Meeting.** Strasbourg, France. Organizing Committee EUG VI, University of Trieste, Institute of Mineralogy, Piazzale Europa 1, I-34100 Trieste, Italy.

April

* April 14-18. **Institute of Mining and Metallurgy, 6th International Symposium and Exhibition.** London. IMM, The Conference Office, 44 Portland Place, London W1N 4BR, UK.

May

May 20-24. **14th International Radiocarbon Conference.** Tucson. Dr. Austin Long, Department of Geosciences, University of Arizona, Tucson, AZ 85721 (FAX 602-621-2672; BITNET: C14@ARIZRVAX). 12(4):10.

* May 27-29. **Geological Association of Canada Annual Meeting.** Toronto. J. Fawcett, Department of Geology, University of Toronto, Toronto, Ontario, Canada M5S 1A6.

* May 29-June 2. **European Association of Exploration Geophysicists, 53rd Annual Meeting.** Florence, Italy.

SAS

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Deadlines for Submissions:

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