# SAS Newsletter

## Society for Archaeological Sciences

**Volume 11** **Number 4** **October-December 1988**

## From the Editor

This will be the final issue of the *SAS Newsletter*. On directions from the SAS Board, our publication's name will be changed to the *SAS Bulletin* with the next issue. This change was suggested in recognition of our efforts to move beyond a newsletter format, with the inclusion of refereed research reports, reviews, and other material that transcends the context of a newsletter. We are not, of course, publishing a full-fledged journal here, and hope that the choice of Bulletin as a title will accurately reflect the intermediate position of our work.

We did not undertake this change lightly. We are aware that a number of librarians will be unhappy, for such changes cause problems for cataloguers. We have acquired a new ISSN number, so that our publication will be properly recognized, and have provided information to the publishers of *The Serials Directory*, linking the Newsletter and the Bulletin. I hope that these efforts will make the change relatively painless and/or transparent to those who read and use our publication.

Several members have mentioned the possibility of publishing book reviews. I am anxious to get this important activity off the ground, and have solicited some recent publications from two university presses. I will find willing reviewers for these particular titles. I also have a volunteer to take over the task of Review Editor! **Prudence Rice** of the University of Florida will solicit materials for review, choose reviewers, and edit their copy. Each of you must see that your work is offered for review. Don't take for granted that publishers will automatically circulate your work widely. **Insist that your publications are sent to SAS for review, or send them yourselves.**

Finally, for all those members who wish to obtain a copy of the SAS poster described in the last issue, you should write President **Garman Harbottle** at the address listed for him on the back page. Please enclose your check, payable to Gar, for $1 to cover postage and the mailing tube. This poster should be on the wall or door of every SAS member's workplace, where it will enhance the image of the Society and improve the local ambience. By the way, Gar not only conceived the poster, had it produced, and is circulating it, but he also has personally underwritten this effort.

*Patrick E. Martin, Editor*

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## Assistance Requested

Assistance is requested in obtaining samples for a research project on archaeomagnetic direction and paleointensity secular variation in the Americas. Samples should come from well-dated contexts: Archaic, Paleoindian, protohistoric and historic sites are of particular interest. The samples for the directional study must be taken by collectors who have been trained in archaeomagnetic sampling methods. Unoriented pottery samples can be used for paleointensities. Pottery on which previous mineralogical or chemical analyses have been done would be desirable. Contact: Rob Sternberg, Department of Geology, Franklin and Marshall College, PO Box 3003, Lancaster, PA 17604-3003, (717) 291-4134, BITNET: R_STERNBERG @ FANDM.

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## Goodway Named ASM Fellow

On September 27th, Martha Goodway was elected to Fellowship in ASM International at the first World Materials Congress, held in Chicago on the occasion of the Society's 75th Anniversary. This honor was bestowed by the ASM Board of Trustees in recognition of Martha's work in advancing the metallurgical analysis of ancient metal artifacts.

## Kingery Joins Arizona Faculty

In August, W. David Kingery , Kyocera Professor of Ceramics at the Massachusetts Institute of Technology, joined the University of Arizona faculty as professor of anthropology and of materials science and engineering. Kingery's appointment will help build bridges between the two departments, as well as contributing to the core programs in each area.

## Pollard Named Coordinator for Science-Based Archaeology in the UK

The appointment has recently been announced of Dr. Mark Pollard, Department of Chemistry, University College, Cardiff, as National Coordinator for Science-Based Archaeology. The post is jointly funded by the Science-Based Archaeology Committee of the Science and Engineering Research Council, the Historic Buildings and Monuments Commission, and the British Academy. He wil act as liason between the various funding bodies for Science-Based Archaeology, improving communication flow and encouraging the use of science-based techniques by archaeologists. More specifically, he will act as an information dissemination focus for the Science-Based Archaeology Committee, providing information on SBAC policies and priorities. He will undertake visits to appropriate institutions (including Universities, Museums, and Units), and will organize a series of one-day seminars on various aspects of archaeological science.

Dr. Pollard has a degree in Physics from York University, and a D. Phil. from the same University as a result of research on the chemistry and corrosion of Mediaeval window glass from York Minster. He was a Research Officer for six years at the Research Laboratory for Archaeology and the History of Art, Oxford University, and was appointed a "New Blood" lecturer in Archaeological Chemistry at University College, Cardiff, in 1984. He teaches in both the Chemistry and Archaeology Departments, and undertakes research on various aspects of archaeological chemistry. He has had practical experience of excavation at York and Danebury.

The appointment is for two years on a part-time basis, and Dr. Pollard can be contacted at the Department of Chemistry, University College, Cardiff, CF1 1XL, Phone 0222 874210.

## Laboratory Profile
### Archaeometric Laboratory
### Department of Physics and Astronomy
### University of Maryland

William Hornyak and the staff of the Archaeometric Laboratory at College Park have dedicated significant effort and energy to the refinement of thermoluminescence research, particularly in relation to archaeological dating problems. Some of the key participants in this work are pictured in Figure 1.

**Figure 1. Laboratory staff, left to right, William Hornyak, Norbert Kristianpoller (Visiting Professor from Tel Aviv), Reuven Chen (Visiting Professor from Tel Aviv), Anne Tschirgi (Faculty Research Associate), Kari Trice (Student), and Alan Franklin (Visiting Professor permanent status).**

Thermally-stimulated luminescence, or simply thermoluminescence (TL), is light emission derived from the thermally-activated release of trapped electrons (and/or hole) created by ionizing radiation interacting with matter. In the simplest experiments, the emitted light is measured as a function of the sample temperature; this yields a so-called "glow curve." Spectral information may or may not be gathered at the same time. The materials generally studied using this phenomenon are crystals (or microcrystals or even glasses) such as quartz, zircon, feldspar, apatite and obsidian, to name a few. The radiation dose received by the crystal may have either a geological or archaeological origin, or may be laboratory-induced by using gamma- or beta-radiation from radioactive sources.

Thermoluminescence research at the Archaeometric Laboratory is centered on (1) a program of pure condensed matter physics (CMP) related to crystal structure and electron- and hole-trapping phenomena, and (2) application to geological and archaeological studies. At present, the CMP program of experimental work is directed to developing a kinetic model for the TL process in relatively simple crystalline systems such as $CaF_2$:Mn, $CaF_2$:Dy, and $CaSO_4$:Dy. Such models would offer a logical starting point for analyzing more complex systems. This program uses the TL process itself in combination with ancillary experiments designed to enumerate such phenomena as lattice defects and impurity centers to verify the model and determine the physical properties which are operating. In this laboratory, preliminary TL experimental work with $CaF_2$:Mn already exists. A theoretical model for the TL process operating in both the isothermal decay and the linear heating rate modes has been developed. The fit to the data is quite good, and acceptable physical parameters have been obtained. Continuing research will emphasize working with single crystals grown with special attention to purity and homogeneity in order to minimize the system's complexity.

Spectroscopic analyses of the TL glow curves may be used to isolate any possible single luminescent system,

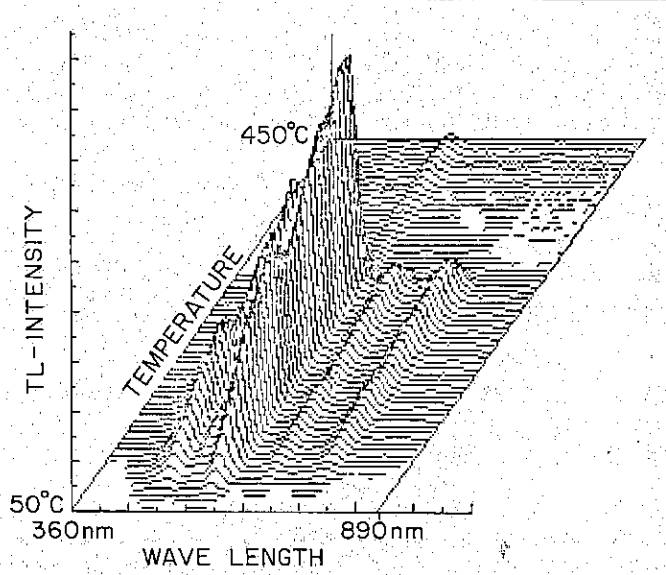


**Figure 2. The 3-D isometric curve obtained for $CaF_2$:Dy.**

further reducing complexity. These studies use a high luminosity spectrophotometer which has been specifically designed to give three-dimensional temperature/wavelength/TL glow curves. An inexpensive high sensitivity 3D-spectrophotometer has been developed giving on-line spectral and temperature information during a TL glow curve run. A wavelength resolution of 6 nm is achievable in the spectral range of 400 to 850 nm. The sensitivity is adequate for most phosphors subjected to archaeological or geological radiation doses.

A major use of the spectrophotometer in archaeometry has been to indicate proper narrow pass-band filters that might be used to isolate a reliable glow peak from others nearby (and possible overlapping the desired peak). A second important use of the spectrophotometer is related to the solid state physics of the TL process. As a graphic illustration of this connection, the accompanying illustration (Figure 2) shows an isometric presentation of the 3D-spectrum (intensity/wavelength/temperature) obtained for $CaF_2$:Dy phosphor. In this phosphor the host crystal is $CaF_2$ and the Dy is a dilute dopant. A number of wavelength maxima are apparent forming constant wavelength "ridges" in this plot. The wavelengths from 480 nm to 840 nm may all be identified with atomic transitions in the $Dy^{3+}$-ion. The observed wavelengths are only slightly shifted from the free ion values, indicating the insensitivity of rare earth optical transitions to the effects of the crystal lattice fields of the host $CaF_2$ structure. This is not an unexpected result since the optically active electrons in the rare earths are in the "inner" 4F subshell and are shielded by the "outer" 6S subshell from nearby crystal lattice charges, thus greatly weakening their effects.

For many years the application of the TL phenomenon has held great promise for dating geological and archaeological materials. In determining the age of an archaeological sample, a currently-achievable precision of about ten percent is possible; this is considerably poorer than the inherent potential precision. Part of the problem is associated with the fact that TL is a many-faceted phenomenon involving subtle interactions among factors such as the composition of phosphor material, the content and distribution of various radioactive components in the specimen and its surroundings, the geological history of the burial site and the measurement techniques used. In addition, only barely-adequate theoretical understanding of the electron trapping-untrapping kinetics exists at present. The CMP part of the research relates directly to this latter point. A very extensive techniques-development program has been launched to address the earlier points.

Specific anthropological projects currently in progress involve TL sediment-dating of a series of Pleistocene-Early Holocene sediments from archaeological sites in the northeast Kalahari Desert and from along the Semliki River in Zaire (Western Rife). We expect our results to be compared with the results of other dating techniques carried out elsewhere on the same materials. Details of the TL technique tested for these materials include:

1. The separation of materials (such as quartz, 90-150 μm) suitable for TL dating. These materials could be separated physically, or the TL spectrophotometer could be used to separate TL signal components;
2. Determination of the TL output removed by sunlight exposure during deposition;
3. Determination of the minerals' general TL characteristics (such as fading, sensitivity and linearity);
4. Determination of the radioactive element content of the soil samples; disequilibrium effects would be included. For the Zaire material, this determination would be supplemented with on-site dosimeter measurements.

Successful completion of the work will contribute to assigning reliable dates to specific time-marker horizons for the areas studied; it will also help develop the TL sediment-dating technique. By focusing on specific minerals reoccurring in sediments spanning a wide range, this work should also (certainly for the Kalahari sediments) result in their calibration as useful dosimeter materials.

In addition, a number of other archaeological projects are in progress. These involve dating pottery materials from Jemmeh in th Gaza Strip, Stobi in Yugoslavian Macedonia, Caesarea in Israel, and dating Grecian transport amphoras. In the latter case, a 14C dating check of the TL results will be possible because of the presence of an interior resinous coating applied to reduce seepage loss and make amphoras less permeable.

Other possible TL-dating measurements may be applied in the future to calcite cave deposits, the atmospheric entry of meteorites, and volcanic ash and lava.

The Archaeometric Laboratory welcomes research collaboration inquiries from archaeologists and others with applications for their expertise. The Lab has provided significant support for such work in the recent past, as evidenced by the visiting scholars from Israel, Professors Chen and Kristianpoller. Researchers with interests in the use of TL techniques on sediments and cave deposits are particularly encouraged, as the Lab's instrumentation and experience is most strong in this area of TL research.

*William Hornyak, Department of Physics and Astronomy, University of Maryland, College Park MD 20742-4111*

## Meeting Report

The Second Advanced Seminar on Paleodietary Research took place in Cape Town, South Africa, during June, 1988. The format was similar to that of the First Seminar, organized by T.D. Price in Santa Fe, NM, March, 1986. The Second Seminar was organized by A. Sillen and others from the University of Cape Town (UCT). Each of the 17 participants presented a paper on their efforts toward elucidating paleodiet through chemical analysis. There was a natural division between those who use isotope ratios and those who use trace or minor elemental analysis, but the objectives were similar for both groups. The meeting summarizer, G. Armelagos (U. Massachusetts), said: " Food has emerged as a critical factor in understanding human adaptation. The reconstruction of human subsistence patterns provides a key to interpreting the ways in which our species adjusts to the environment. The reconstruction of paleodiet is necessary to understand the shift from gathering-hunting to primary food production. The development of an agricultural subsistence pattern has had profound effects on our diet and nutrition."

Somewhat more than half the Seminar was concerned with problems in interpretation of isotope ratios (13C/12C, 15N/14N, and strontium). A. Sillen, J. C. Sealy, and N. J. van der Merwe (UCT) discussed a number of these problems. The relative contributions of carbohydrate and protein to isotope ratios are not known, and these different dietary fractions may produce different ratios. The influence of water or dietary stress emphasized by P. E. Hare (Carnegie Institution) and S. H. Ambrose (U. of Illinois-Urbana) and of nitrogen recycling emphasized by the UCT group is not fully understood, in the context of nitrogen ratios. Interpretation of such numbers remains uncertain. L. L. Tieszen (Augustana College) pointed out a number of ecological factors that influence isotope ratios. Although basic division of diet into C3 and C4 components according to the carbon isotope ratios is possible, additional refinement appears to be difficult. H. P. Schwarz (Mc Master U.) similarly addressed geochemical factors.

H. W. Krueger (Geochron Lab.) presented convincing evidence that the carbonate fraction of bone apatite can give valid carbon isotope ratios. J. A. Lee-Thorp and N. J. van der Merwe arrived at similar conclusions, and presented the first, preliminary analysis of early hominids, the Australopithecines. Other archaeological results were presented by J. Parkington (UCT) and J. E. Buikstra (U. of Chicago), respectively on Western Cape and on Illinois populations. Although interpretations based on nitrogen isotopes must be held in abeyance, the results from carbon isotopes, even those derived from bone apatite carbonate, can give useful information on the relative amounts of C3 and C4 foods. This technique is not strongly influenced by contamination during burial, although carbonate analysis requires a chemical pretreatment. Further refinements may be possible as the various contributing ecological factors are better understood.

On the other hand, levels of trace elements are strongly dependent on the burial environment. J. B. Lambert (Northwestern U.) reported that physical cleaning of the bone surface returns almost all elements to their biogenic levels, so that dietary interpretations are possible. T. D. Price (U. Wisconsin) also emphasized the importance of dealing with diagenetic factors, and J. E. Ericson (U. California—Irvine) discussed difficulties in dealing with levels of lead. A. Sillen (UCT) has developed a chemical technique for separating biogenic bone apatite from diagenetic fractions. An alternative chemical cleaning procedure by H. W. Krueger also can remove diagenetic material. There was general agreement that suitably cleaned bone can give trace elemental levels on which valid dietary conclusions could be based.

*Joseph Lambert, Northwestern University*

## Microscopy for the Archaeologist

Proceedings from the Symposium, "Microscopy for the Archaeologist", sponsored by the Society for Archaeological Sciences during the May 1987 meeting of the Society for American Archaeology in Toronto are being published as the March 1989 issue of the Materials Research Society Bulletin.

Contents include:

*"Petrographic Analysis of Archaeological Ceramics"*, by Terry S. Childs. This paper presents the results of a petrographic examination of ceramic materials from the Kagera region in northwestern Tanzania recovered from Early Iron Age (300 BC - AD800) iron smelting sites. Differences in the clay types used in the production of domestic pottery, furnace bricks furnace liners, and tuyeres are used to address patterns of clay source exploitation over time.

*"Determining the Origin and Age of Metal Artifacts"*, by Michael L. Wayman. The methodological approach to addressing the problems of metal identification, geological origin, manufacturing technology, and age are reviewed. The use of optical and x-ray characterization techniques are illustrated with three case examples utilizing copper and iron artifacts recovered from archaeological sites in the Canadian Arctic region.

*"Reading Shell Thin Sections"*, by Cheryl Claassen. The optical procedures used to identify and measure the growth layers of molluscan shells are reviewed and potential problems discussed. The ability of the method to determine the seasonal occupation of archaeological sites is presented in a case example.

*"Phytolith Analysis in Archaeology"*, by Susan

C. Mulholland and George Rapp. The problems associated with the classification of silica cell phytoliths from grasses are explored with the assistance of the scanning electron microscope. The current ability of this method to identify the plants utilized by prehistoric peoples and the nature of past environments is discussed.

*"Microware Analysis of Prehistoric Stone Tools"*, by S. Berry and D. Banforth. Optically observed microware, in the form of edge damage, striations, and polishes, is discussed in terms of its utility in forming reliable inferences concerning the function of prehistoric stone tools. The attributes of polishes produced by the experimental use of stone tools on a variety of materials is emphasized.

This special issue of the Materials Research Society Bulletin can be purchased by SAS members for $8.00 (postpaid) directly from the Materials Research Society. Send your name, address, and check payable to the Materials Research Society to:

Materials Research Society Bulletin
9800 McKnight Road, Suite 327
Pittsburgh, PA 15237

Ask for the March 1989 issue, "Microscopy for the Archaeologist".

# Meetings Calendar

New listings are marked by a *. The Meetings Calendar editor receives additional information for many of the listed meetings. You may contact him, preferably by BITNET, for further details.

## October 1988

* *Oct. 12-14.* Computer-based Mapping Short Course. Madison, Wisconsin. Department of Engineering Professional Development, University of Wisconsin, 432 N. Lake St., Madison, WI 53791-9943 (800-247-8678). Fee: $595.
* *Oct. 12-15.* Cartographic Information Society, Annual Meeting. Denver. North American Cartographic Information Society, 6010 Executive Blvd., Suite 100, Rockville, MD 20852 (301-443-8075).
* *Oct. 13-15.* Society of Vertebrate Paleontologists, Annual Meeting. Drumheller, Alberta. Becky Kowalchuck, Tyrrell Museum of Paleontology, Box 7500, Dumheller, Alberta, Canada (403-823-7707).
* *Oct. 14-16.* 22nd Annual Meeting of the Council for Northeast Historical Archaeology. Quebec City. Pierre Beaudet, CNEHA Conference Chair, 840 Sir Adolphe Routhier, Quebec City, Quebec, Canada G1S 3P3.
* *Oct. 17-20.* Instrument Society of America, Annual Meeting. Houston. ISA, 67 Alexander Dr., PO Box 12277, Research Triangle Park, NC 27709.
* *Oct. 18-20.* International Biotechnology Exposition. Oakland, California. Cartlidge & Associates, 3097 Moorpark Ave., #202, San Jose, CA 95128 (408-554-6644).
* *Oct. 24-28.* Federal Archeology Program Coordination Workshop. Harper's Ferry, West Virginia.. Dave Dahlen, c/o Mather Employee Developments Center, PO Box 77, Harper's Ferry, WV 25425. An objective of this program is to improve Federal agency archeological programs through interaction, exchange of information, and identification of problems at the national and regional levels.
* *Oct. 26-28.* Pacific Conference on Chemistry and Spectroscopy. San Francisco. Malcolm Singer, 15049 San Pablo Ave., Richmond, CA 94804-0010 (415-231-6238).
* *Oct. 28-30.* 20th Algonquian Conference. Hull, Quebec. A. D. DeBlois, Canadian Museum of Civilization, Ottawa, Ontario K1A 0M8, Canada (613-953-3271).
* *Oct. 30-Nov.4.* 7th International Congress on Applications of Lasers and Electrooptics. Santa Clara, California. Laser Institute of America, 5151 Monroe St., Suite 102W, Toledo, OH 43623 (419-882-8706).

## November 1988

* *Nov. 1-3.* Finnish Chemical Congress. Helsinki. Finnish Fair Corporation, Helsinki Fair Centre, Rautatielaisenkatu 3, PO Box 21, SF-00521 Helsinki, Finland.
* *Nov. 2-4.* 5th Symposium on Liquid Chromatography/Mass Spectrometry. Freiburg, Federal Republic of Germany. R. W. Frei, Free University, Department of Analytical Chemistry, De Boelelaan 1083, 1081 HV Amsterdam, The Netherlands.
* *Nov. 4-6.* 4th Annual California Indian Conference. Berkeley. William Simmons, Program Chair, Department of Anthropology, University of California, Berkeley, CA 94720. Symposium and abstract deadline: 10/7/88.
* *Nov. 5-6.* 7th Northeast Conference on Andean Archaeology and Ethnohistory. Amherst. Donald A. Prouix, Department of Anthropology, University of Massachusetts, Amherst, MA 01003.
* *Nov. 9-10.* Evolution and Extinction; Bicentenary Joint Meeting of the Linnean Society and the Royal

Society. London. The Linnean Society, Burlington House, Piccadilly, London W1V 0LQ, United Kingdom.

* *Nov. 11-13.* Southeast Friends of the Pleistocene, Annual Meeting. Hammonton, NJ. John Wyckoff, U.S. Geological Survey, MS 926, Reston, VA 22029 (703-648-6951).

* *Nov. 16-20.* American Anthropological Association. Phoenix. AAA, 1703 New Hampshire Ave. NW, Washington, DC 20009 (202-232-8800). Workshops include: Introduction to Flintknapping - Debitage and Tools; Computer Analysis of Anthropological Data. Sessions include: The Use of Airborne Remote Sensors; Paleolithic Europe; Ceramic Ecology Revisited - Current Research on Ceramic Materials; Archaeological Studies of Industrial Societies; Visions of the Sky -Studies in North American Ethnoastronomy; Anthropological Algorithms - A Panel for Active Computer Programmers; Archaeological Studies of Complex Societies; The Physical and Cultural Transition of 40,000 Years Ago; Computer Solutions to Anthropological Questions; Archaeological Methods - Implications from Studies of Modern Populations and Artifacts; Mesoamerican Archaeological Studies; Preliminary Program in Anthropology Newsletter, 9/88. Abstract deadline: 4/1/88.

* *Nov. 17-19.* Workshop on Hybrid Tandem Mass Spectrometry. Lake Louise, Canada. Paul Brooks, Geological Survey of Canada, 3303 33rd St., N.W., Calgary, Alberta T27 2A7, Canada (403-284-0342).

* *Nov. 28-Dec. 3.* Materials Research Society, Fall Meeting. Boston. Materials Research Society, 9800 McKnight Road, Suite 327, Pittsburgh, PA 15237. Symposia topics include: Materials Science of Mineralized Biological Tissues; High Resolution Microscopy of Materials; Frontiers of Materials Research. Short courses include: Modern Materials Analysis Techniques; Scanning Electron Microscopy and X-Ray Microanalysis; Optical Microscopy; Nuclear Magnetic Resonance Spectroscopy.

* *Nov. 27-Dec. 2.* Soil Science Society of America. Anaheim. SSSA, 677 S. Segoe Road, Madison, WI 53711 (608-273-8080). (Date and place given previously for this meeting were incorrect.)

* *Nov. 30-Dec. 2.* Geographical/Land Information Systems, International Meeting. San Antonio, Texas. GIS/LIS, MS 3, 210 Little Falls St., Falls Church, VA 22046 (703-241-2446). Fee: $255.

## January 1989

* *Jan. 5-9.* The First Archaeological Congress, including American Philological Association, Archaeological Institute of America, American School of Oriental Research, and the Society for Historical Archaeology Annual Meeting. Baltimore. Elizabeth Comer, Program Chair for SHA, Baltimore Center for Urban Archaeology, Baltimore, MD 21202. Abstract deadlines: 2/1/88 for Congress and 4/1/88 for SHA. SHA sessions include Materials Analysis; Continental Shelf Research; Prehistoric and Historic Resources; Diet and Food; Ethnicity and Ceramics; Paleoenvironmental Reconstruction; Settlement Patterns and Environment.

*Jan. 14-19.* American Association for the Advancement of Science, Annual Meeting. San Francisco. AAAS, 1333 H Street NW, Washington, DC 20005 (202-326-6640). Abstract deadline: 11/1/88. A full preconvention program will be published in the 28 Oct. issue of Science.

* *Jan. 19-21.* Colloquium on The Discovery of Metal Before the End of the 3rd Millennium B.C. Saint-Germain-en-Laye, France. La Musee des Antiquites Nationales, Chateau National, 78103 Saint-Germian-en-Laye, France (1-34.51.53.65)

## March 1989

* *March 10-12.* Central States Anthropological Society, Annual Meeting. Notre Dame, Indiana. Program Chair Oswald Werner, Department of Anthropology, Northwestern University, Evanston, IL 60208. Abstract deadline: 12/1/88.

* *March 16-19.* Northeast Anthropological Association, Annual Meeting. Sherbrook St. Montreal, Quebec. Kenneth Jacobs, Department of Anthropology, University of Montreal, CP6128 Succursale A Montreal PQ H3C 3J7, Quebec, Canada.

* *March 19-22.* Association of American Geographers, Annual Meeting. Baltimore. Association of American Geographers, 1710 16th Street NW, Washington, DC 20009 (202-234-1450).

* *March 29-31.* Remote Sensing Short Course. Madison, Wisconsin. Department of Engineering Professional Development, University of Wisconsin, 432 N. Lake St., Madison, WI 53791-9943 (800-262-6243). Fee: $395.

## April 1989

* *April 5-9.* 54th Annual Meeting of the Society for American Archaeology. Atlanta. Kenneth L. Kvamme, Arizona State Museum, University of Arizona, Tucson, AZ 85721. Submission deadline: 10/1/88.

* *April 11-14.* Joint Mathematics Meetings. Phoenix. H. Daly, American Mathematical Society, Meetings Department, PO Box 6248, Providence, RI 02940.

* *April 24-29.* Materials Research Society, Spring Meeting. San Diego. Robin F. C. Farrow, IBM Almaden Research Center, 650 Harry Road, MS K32/801D, San Jose, CA 95120-6099 (408-927-2389). Abstract deadline: 10/17/88.

* *April 26-28.* 50 Years with Nuclear Fission; co-sponsored by the National Bureau of Standards, American Physical Society, American Nuclear Society, American Chemical Society. Gaithersburg, Maryland. J. W. Behrens, B109 Radiation Physics Building, National Bureau of Standards, Gaithersburg, MD 20899 (301-975-5572).

### May 1989

* *May 1-4.* American Physical Society, Spring Meeting. Baltimore. W. W. Havens Jr., APS, 335 E. 45th St., New York, NY 10017.
* *May 4-5.* 20th Annual Pittsburgh Conference on Modeling and Simulation. Pittsburgh. W. G. Vogt, Modeling and Simulation Conference, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh, PA 15261. Abstract deadline: 3/8/89.
* *May 8-12.* American Geophysical Union, Spring Meeting. Baltimore. AGU, Convention Director, 2000 Florida Avenue NW, Washington, DC 20009 (202-462-6903).
* *May 10-13.* 21st Annual Meeting of the Canadian Archaeological Association. Fredericton, New Brunswick. Christopher Turnbull, Conference Coordinator, Tourism, Recreation, and Heritage Archaeological Services, Old Soldiers Barracks, PO Box 6000, Fredericton, New Brunswick E3B 5H1, Canada (506-453-2792). Titles due: 12/2/88; abstract deadline: 1/6/89. All aspects of prehistoric and historic archaeology.
* *May 14-17.* Geological Society of Canada, Annual Meeting. Montreal. Colin Stearn, Local Organizing Committee for Montreal 89, Room 238, 3450 University Street, Montreal, Quebec H3A 2A7, Canada (514-398-4082). See SAS Newsletter, 11(3).
* *May 14-19.* Society for Imaging Science and Technology, Annual Meeting. Boston. SPSE, 7003 Kilworth Lane, Springfield, VA 22151 (703-642-9090).
* *May 24-28.* World Summit Conference on the Peopling of the Americas. Orono, Maine. Robeson Bonnichsen, Center for the Study of Early Man, 495 College Avenue, Orono, ME 04473 (207-581-2197).

### June 1989

* *June 5-9.* 2nd Karlsruhe International Conference on Analytical Chemistry in Nuclear Technology. Karlsruhe, Federal Republic of Germany. Hans J. Ache, Kernforschungszentrum, Karlsruhe, Institut fur Radiochemie, Postfach 3640, D-7500 Karlsruhe 1, Federal Republic of Germany. Topics include new developments in analytical methods; trace analysis of radionuclides in the environment. Abstract deadline: 2/15/89.
* *June 11-15.* 174th Meeting of the American Astronomical Society. Ann Arbor, Michigan. AAS, 2000 Florida Ave. NW, Suite 300, Washington, DC 20009.

### July 1989

*July 9-19.* 28th International Geological Congress. Washington, D.C. Dr. Bruce R. Hanshaw, Secretary General, 28th IGC, PO Box 1001, Herndon, VA 22070-1001 (703-648-6053). Symposia include: Geologic phenomena and archaeology; Archaeological geology - geologic controls on human habitation; Global change - impact on the earth, natural hazards, and human activities; Clovis origins and the Bering Land Bridge. Short courses include: Quaternary dating methods; Digital geologic and geographic information systems; Paleoenvironmental interpretation of paleosols. Field trips include: Quaternary geology of the Great Basin; Geology of the Colorado Plateau. Abstract deadline: 10/1/88.

*July 24-Aug. 4.* International Association of Geomagnetism and Aeronomy, 6th Scientific Assembly. Exeter, United Kingdom. Roy Jady, IAGA 1989 Organizing Secretary, Department of Mathematics, University of Exeter, Exeter EX4 4QE, United Kingdom.

*July 30-Aug. 4.* Computer Graphics and Interactive Techniques, 16th Annual Conference (SigGraph '89). Boston. C. Herot, Javelin Software Corporation, 1 Kendall Square, Building 200, Cambridge, MA 02139.

### August 1989

* *Aug. 7-11.* 12th Caribbean Geological Conference. Christiansted, St. Croix, Virgin Islands. Frederick Nagle, 12th Caribbean Geological Conference, c/o Department of Geological Sciences, PO Box 249176, University of Miami, Coral Gables, FL 33124.
* *Aug. 17-24.* 14th International Cartographic Conference. Budapest. Conference Secretary, Institute of Geodesy, Cartography, and Remote Sensing, PO Box 546, H-1373 Budapest, Hungary.
* *Aug. 22-29.* 5th International Theriological Congress. Rome. Secretariat, 5th International Theriological Congress, c/o Dipartimento di Biologia Animale e dell'Uomo, Universita di Roma "La Sapienza", Viale dell'Universita 32, I-00185 Roma, Italy.
* *Aug. 28-Sept. 2.* 9th International Clay Conference. Strasbourg. Helene Paquet, Institut de Geologie, 1 rue Blessis, 67084 Strasbourg, France.

### September 1989

* *Sept. 11-19.* 1st World Congress of Herpetology. Canterbury, United Kingdom. Dr. Ian R. Swingland, World Congress of Herpetology, Rutherford College, University of Kent, Canterbury, Kent CT2 7NX, United Kingdom.
* *Sept. 18-22.* 14th International Congress of Organic Geochemistry. Paris. Yolande Rondot, Institut Francais du Petrole, BP 311, 92506 Rueil-Malmaison cedex, France (33-1-47.49.02.14).

### November 1989

* *Nov 6-9.* Geological Society of America, Annual Meeting. St Louis. Geological Society of America, 3300 Penrose Place, Boulder, CO 80301 (303-447-8851).

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

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# SAS Newsletter

Society for Archaeological Sciences

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