

SAS

Volume 8

Number 1

Summer 1984

NEWSLETTER

SOCIETY FOR ARCHAEOLOGICAL SCIENCES

FROM THE EDITOR

With this issue your new editor and associate editor, Judy Holz, take full control of and responsibility for this newsletter. We expect to continue the coverage initiated by Suzanne DeAtley and we plan to expand the SAS RESEARCH REPORT. Our current policy is to attempt to make each RESEARCH REPORT fit as two- or four-page inserts that can be removed easily and filed separately or copied for reprints. Upon receipt a RESEARCH REPORT will be reviewed by the editor and at least one other archaeological scientist. A note of acceptance or rejection will be sent to the author(s). Criteria for acceptance include (1) of significant interest to SAS readers, (2) timeliness, and (3) readability. Succinctness is assumed in such short pieces. We encourage submission of a RESEARCH REPORT on any aspect of archaeological science.

VANDA VITALI, this month's RESEARCH REPORT author, believes that journals of archaeometry and archaeological science should be used to a much greater extent to debate current scientific issues. Are there no outlets for reasoned dispute?

Newsletters can offer a timely forum for discussion of the results of our disciplined inquiry or of the weaknesses and limitations inherent in many of our methods. Until further notice we solicit your informed opinion on debatable issues in archaeological science. Come on you young Turks, identify yourselves and your issues!

Rip Rapp

GEORGE (RIP) RAPP, JR.

SAS Newsletter

Volume 8

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Summer 1984

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NEWS OF THE PROFESSION

CALIFORNIA MISSION STUDIES ASSOCIATION

In January 1985 the California Mission Studies Association will have its yearly meeting at Mission San Jose. For more information or for inclusion on the mailing list, contact Nicholas M. Magalousis, Department of Anthropology, Chapman College, Orange, California 92666; (714) 997-6623.

CENTER FOR ARCHAEOLOGICAL SCIENCES - UNIVERSITY OF GEORGIA

In May, the Center for Archaeological Sciences was formally established at the University of Georgia. There are 27 associates of the Center on campus: the Associate Director Kathryn Jakes, and others drawn from the departments of Geology (8), Anthropology (7), Classics (4), Geography (2), and 1 each from the Center for Applied Isotopic Studies, Art, Natural History Museum, Science Education, and the School of Forest Resources. There are 11 associates off campus from 9 universities and 1 institute. Norman Herz is Director-Programs and James A. Whitney is Director-Financial.

The Center was established to facilitate and encourage cooperation between anthropologists and archaeologists with scientists working in archaeometry. Field archaeology is now being carried out in ancient historical sites in the Mediterranean, southeastern United States, and Mexico. Studies of cave and littoral environments of Pleistocene and Holocene age are going on in this country and Somalia. Some of the work on archaeological materials includes: ancient fabrics, as represented today by mineral pseudomorphs - a pioneer effort; ancient old world coins; southeastern Indian cooking vessels and their residues; an isotopic data base for marble quarries of Classical Greece and Rome; and age dating of archaeological and Holocene material by ^{14}C methods.

NEWS OF ARCHAEOMETALLURGY

The award of a MacArthur Prize to Professor Heather N. Lechtman of MIT has brought recognition not only to herself but to archaeometallurgy as well. Professor Lechtman is Director of the Center for Materials Research in Archaeology and Ethnology (CMRAE). Dorothy Hosler has a two-year postdoctoral fellowship there for the study of

prehistoric metallurgies of the Americas, documenting cultural relations between the ancient peoples of western Mexico and the Andes. Professor Lechtman and Dr. Hosler are collaborating on a paper for volume 10 of the series "Advances in Archaeological Method and Theory," edited by Michael B. Schiffer, to be published in 1985. Their paper will be on metals and metallurgy, and they welcome suggestions. CMRAE's address is Room 8-138, MIT, Cambridge MA 02139. The telephone number is 617:253-1375.

Bismuth and magnesium were the subjects of two interesting papers published recently on the analyses of bronze artifacts. Professor Robert B. Gordon's "Bismuth bronze from Machu Picchu, Peru" *Science* 223 (10 February 1984) 585-6, with John W. Rutledge, also of Yale's Kline Geology Laboratory reported 18% bismuth in the bronze head of a llama cast onto a low-tin bronze knife blade.

A recent letter to the editor of *Metallography* 17 (1984) 215-221 by L.E. Samuels explained the presence of magnesium, which has been reported occasionally in bronzes from Egypt, as a consequence of corrosion and not an original component of the alloy. Magnesium was detected by electron microprobe in the corroded interdendritic areas of a section cut from a bronze arrowhead, which Professor Joshua Pelleg supplied.

There are several new publications of interest. One is the Swedish quarterly journal for the history of technology, *Polhem, Tidskrift for Teknikhistoria*. The ISSN number is 0281-2142, and subscription is 75 Swedish kroner per year. It is issued by the Swedish National Committee for the History of Technology (Svenska Nationalkommitten for teknikhistoria, SNT) Ingenjorsvetenskapsakademien, Box 5073, 102 42 Stockholm. Stig Blomgren and Erik Tholander have a paper in English on "A prehistoric engraving tool of nickel-alloyed steel found in Sweden" in volume 1 number 3 (1983) 1-11.

The other new publication is the quarterly Bulletin of the Groupe d'histoire des Mines et de la Metallurgie. It costs 50 French francs from the Association pour la sauvegarde et l'animation des Forges de Buffon, Buffon, F21500 Montbard, France.

The Historical Metallurgy Society has announced a program of reprinting Percy's Metallurgy. The first volume,

Percy's Iron and Steel, is available for L24.75 postpaid from Kathleen Taylor, Membership Secretary, Windermere, Maules Lane, Hambrook, Bristol BS16 1QF England.

Professor Tohru Ishino (Castings Research Division, Department of Metallurgy, Faculty of Science and Technology, Kinki University, 3-4-1 Kowakae, Higashiosaka 577, Japan) has just published (1984) a third beautifully illustrated volume on Japanese casting: Temple Bells in Japan, Their History and Casting Technique. An 18-page booklet with English translation accompanies the volume, but the diagrams of the casting methods are themselves unusually clear and informative.

The proceedings of the 19th Annual Conference of the Microbeam Analysis Society, Bethlehem, Pennsylvania, 16-20 June 1984: "Microbeam Analysis 1984," edited by A.D. Romig, Jr. and J.I. Goldstein, contains the papers from the session on archaeological applications organized by Professor Michael Notis of Lehigh University. All but two of the eleven papers were on metals. They covered a wide range of topics: early copper from the middle east (Notis et al., 240-2) and from Batan Grande (Thorpe and Franklin, 227-230), iron in early copper (Roeder et al., 243-6), early steel from Jordan (Liu et al., 261-3), brazing gold (Demortier, 249-252), the Inariyama sword (Murata and Sasaki, 257-260), Saugus pig iron (Vecchio and Marder, 247), wrought iron (Gordon, 231-4) and the relationship among ore, slag and metal compositions (Todd, 235-9). The volume is published by San Francisco Press, Inc., Box 6800, San Francisco CA 94101-6800. The ISSN number is 0278-1727 and the price is \$30.

Dr. G. Kuppuram (2, Airport Colony, Trichy-620007, Tamilnadu, India) was the editor of the proceedings of the seminar "Ancient Metal Industries of South India" which was held 15-16 March 1983 at Tamil University. All but one of the papers are in English.

Mr. Wallace M. Yater of Boonesboro, Maryland, an amateur blacksmith, has been successful in producing a cake of wootz on June 16. It is thought that this is the first wootz produced in the United States using traditional Indian methods. The production of this cake will be the subject of the last article in Yater's four-part series on "The Legendary Steel of Damascus" in The Anvil's Ring, published quarterly by the Artist-Blacksmiths' Association of North

America (ABANA). The first three parts of the series were published in Spring 1982: 10 (1) 2-8, Summer 1983: 11 (2) 2-13, and Winter 83/84: 11 (4) 2-17. Back issues are obtainable from Dr. Carl VanArnum, ABANA Secretary-Treasurer, P.O. Box 1191, Gainesville FL 32602, for \$8 per issue.

The Society of Jewellery Historians has announced that the Third International Symposium on the History of Jewellery Materials and Techniques will be held 4-6 November 1985 in London at the Society of Antiquaries, Burlington House. Immediately following, on 7-8 November 1985, the British Museum will hold a symposium on Precious Metals: Conservation and Technology. Further information can be obtained from the Hon. Secretary of the SJH, Judy Rudoe, Department of Medieval and Later Antiquities, British Museum, London WC1B 3DG England.

Earlier this year, after a long illness, one of the pioneers of archaeometry, Professor Earle R. Caley of The Ohio State University passed away. His contributions covered many areas but he is perhaps best known to archaeometallurgists as the author of "The Analysis of Ancient Metals," the standard work in the field for many years. His research materials, including samples, data, correspondence, reprints, and books were generously donated by Mrs. Caley to SARCAR, the Smithsonian Archaeometric Research Collections and Records facility, where they will be made available to other scholars. According to the director, Dr. Ronald L. Bishop, this is the first major donation to SARCAR. This facility is an activity of the Conservation-Analytical Laboratory, located in new quarters at the Smithsonian's Museum Support Center in Suitland, Maryland.

Send news and announcements to Martha Goodway, Conservation Analytical Lab., Museum Support Center, Smithsonian Inst., Washington DC 20560. Telephone: (202) 287-3733.

Call for Papers

SEM

● A session on SEM uses in Archaeology is being formed for the 1985 meeting of the Scanning Electron Microscopy Society to be held in Las Vegas, Nevada (March 31 - April 5, 1985). All general and specific techniques, research, and applications are solicited to provide

broadest possible range of uses: e.g., phytoliths, lithic use wear, pollen, seeds, osteological analysis. Completed papers must be submitted by January 1, 1985 for publication-quality review prior to acceptance in the Symposium.

For more information contact:
W.M. Hess, (Symposium Organizer)
Director of Electron Optics Laboratory
Department of Botany and Range Science
401 WIDB
Brigham Young University
Provo, UT 84602

or

Irwin Rovner
Associate Professor of Anthropology
Department of Sociology and Anthropology
NCSU
Raleigh, NC 27695-8107

ASA

4 ● The Archaeological Survey Association of Southern California solicits contributions for its publication series, including Occasional Papers and the ASA Journal. The Occasional Papers consist of outstanding monographs on topics of broad general and research interest pertaining to the prehistory and ethnology of Southern California, Baja California, the greater Southwest and the Sonoran Desert. The ASA Journal is ideally suited for the publication of articles which are short and of general interest to a broad audience consisting of student, professional, and avocational archaeologists.

The editors of the ASA Journal recognize that many brief reports are of considerable scholarly value, and welcome submission of these papers, including technical notes, reports of research in progress, descriptions of innovative techniques, lithics and ceramics analysis notes, and scientific applications to archaeology. Quality contributions from students and first-time authors are encouraged. For specifications and a style guide, write to:

Nadine Zelenka, Editor
Archaeological Survey Association
University of Redlands
Redlands, California
92374

Requests for Cooperation

● Dr. Joseph Schuldenrein, Commonwealth Associates, Jackson, MI, (Phone [517] 788-3551) is in need of M.A., M.S. or ABD level geoarchaeologists to undertake both field and laboratory projects

across the U.S. Projects are initially CRM contracts and should provide enthusiastic workers with long-term research opportunities amenable to theses and publishable papers.

Dr. Schuldenrein is currently engaged in research in human ecology and geoarchaeology of the southeast, central plains, and great basin provinces. He is investigating applications of geoarchaeological methods to development of comprehensive

● Nicholas M. Magalousis, Chapman College, Orange, CA (714:997-6623) requests assistance nationally in order to produce a volume concerning Spanish Period Ceramics. The volume would include ceramics throughout the Spanish empire and would also include general history, manufacturing techniques, trade systems utilizing ceramics, and their social, political, and economic implications. Spanish documents such as inventories that are manifest at archives internationally and also chemical and geologic analysis would be necessary to verify some questionable ceramic types. Research on Spanish Metallurgy would also be another appropriate study beginning with the mining of ores.

Are there areas
you would like to
see covered?



SEND YOUR IDEAS!

STATISTICAL PACKAGES FOR CLASSIFICATION AND DISCRIMINANT ANALYSES

Vanda Vitali

Department of Metallurgy and Materials Science
University of Toronto, Ontario, Canada

Sophisticated statistical procedures for data evaluation and analysis are employed with increasing frequency in anthropological and archaeological research.

This is, in general terms, a desirable trend; however, the various statistical packages offer different methods for performing the required analyses and are not necessarily interchangeable or comparable. The choice between them has to be made with caution and discretion. The purpose of this report is to facilitate this process.

Several computer packages have been developed which perform classification and discriminant analyses. The three most widely used and fully programmed packages, namely: SAS (SAS User's Guide; Statistics, 1982), SPSS (SPSS^x User's Guide, 1983) and BMDP (BMDP statistical software, 1983) are reviewed here. Table 1 summarizes the essential characteristics of the three packaged programs. SAS packages offer separately two classification and two discrimination programs. Unlike other packages SAS includes programs for non-parametric as well as heteroscedastic data. For normally distributed data all packages have programs based on the classical estimative approach to discriminant analysis and classification. The SPSS Discriminant Analysis package, which computes both linear discriminant and classification functions, has a more thoroughly developed stepwise procedure with five different selection criteria available. BMDP which offers only a stepwise discriminant program nevertheless has the advantage of incorporating a jackknife procedure for estimating the misclassification rate.

It appears then that all basic tasks of classification and discrimination for different types of data can be successfully performed using one or more of the above packaged programs.

While the use of statistical packages is desirable because they allow for a much wider application of these statistical procedures and for a much better comparability of the obtained results, there are several points to be noted.

First, terminology concerning classification and discriminant functions is often unclear and non-uniform. Names are often used interchangeably and may refer to other functions than classical classifications and discriminant functions (e.g., clustering or canonical functions). In addition, user manuals for these programs have very short and insufficient descriptions of the statistical procedures, assumptions, and requirements on which the programs are based. Even the latest edition of the SPSS manual (SPSS^x) which in previous versions was quite informative, now merely lists available options. Consequently, in order for the packaged programs to be applied correctly and used fully, a certain degree of theoretical knowledge of the statistical procedures and their characteristics has to exist.

TABLE 1: Essential Characteristics of SAS, SPSS and BMDP Statistical Packages for Classification and Discriminant Analyses

FUNCTION		STATISTICAL PACKAGES (TRADE NAMES)		
TYPE	USES OR FEATURES	SAS	SPSS	BMDP
CLASSIFICATION	Non-normal data (non-parametric procedure)	NEIGHBOR (nearest neighbor method)	-	-
	Normal heteroscedastic data	DISCRIM (quadratic discriminant function)	-	-
	Normal homoscedastic data	DISCRIM (linear discriminant function)	DISCRIMINANT (direct and stepwise linear discriminant functions)	P7M (stepwise linear discriminant function)
	Prior probability option	NEIGHBOR DISCRIM	DISCRIMINANT	P7M
	Detection of outliers and non-identified groups	DISCRIM ("other" group feature)	DISCRIMINANT (for each case probability of membership to each group listed)	P7M (Mahalanobis D^2 from each case to the group centroid listed)
	Estimating misclassification rate	-	-	P7M (jackknife procedure)
DISCRIMINATION	Normal homoscedastic data	CANDISC (canonical discriminant function - includes all variables) STEPDISC (stepwise discriminant function, including forward selection and backward elimination; only one variable selection criterion)	DISCRIMINANT (canonical discriminant - includes all variables; stepwise includes forward selection and backward elimination and five variable selection criteria)	P7M (stepwise discriminant - includes forward selection and backward elimination; only one variable selection criterion but possibility of modifying it using "contrasts")

References Cited

BMDP Statistical Software 1983 Printing with Additions, W.J. Dixon (Ed.)
 Berkeley: University of California Press, 1983.
 SAS User's Guide: Statistics. Cary, NC: SAS Institute Inc., 1982.
 SPSS^X User's Guide. New York: McGraw-Hill Book Co., 1983.

Acknowledgments

The author wishes to thank Professor J.W. Simmons, University of Toronto, for his advice and valuable insights into all aspects of this work and Professor U.M. Franklin, University of Toronto, for her critical assessment of this paper. The support of an NSERC fellowship is gratefully acknowledged.

CONFERENCE REPORT

REPORT OF A PHYTOLITH RESEARCH WORKSHOP

Irwin Rovner

Department of Sociology and Anthropology
North Carolina State University, Raleigh NC

A research workshop entitled "Archaeological Uses of Plant Opal Phytolith Analysis," was held on May 12-13, 1984 at North Carolina State University, Raleigh. The workshop was organized and hosted by Irwin Rovner, Associate Professor of Anthropology, North Carolina State University, and supported by a grant from the Wenner-Gren Foundation for Anthropological Research, New York.

The workshop brought together experts from several disciplines to discuss and assess the status of the application of phytolith analysis to problems of archaeobotany, paleobotany, and paleoecology. The workshop consisted of panel sessions, each with a moderator, panelists who provided formal papers or topical statements, and a discussant. Open discussion and questions followed the panel sessions. Topics included: phytolith taphonomy and extraction from soil; taxonomic methods of identification and diagnostic precision; research designs and sampling strategies; current research efforts; and future research directions and priorities.

Glenn Fredlund's discussion of his process for simultaneous extraction of pollen and phytoliths from soil samples was singularly significant in terms of future use of phytoliths in archaeological research. Rovner addressed the contention that phytoliths are susceptible to "downward percolation" even in stable soils, possibly precluding use of phytolith data from archaeological sediments. He pointed out that soil science literature overwhelmingly demonstrates that the problem is nonexistent in stable deposits.

Page Twiss addressed the distribution of plant populations, especially grasses, on a global ecological scale. The ecologically-related distribution of 3-carbon or 4-carbon photosynthetic pathway grasses is clearly detectable and measurable using current basic phytolith taxonomy. This assertion was supported by Fredlund's second paper, which reported a 620,000-year phytolith record of grass populations from paleosols in a deeply stratified loess profile in central Nebraska. This record also confirmed the immobility of phytoliths in stable soil deposits. Dwight Brown discussed systematic identification and cataloging of phytolith types for over 100 species of North American midcontinent plains grasses. In a second paper, he reviewed the current distribution of plains grasses with respect to ecological factors, dispersal mechanisms, barriers to distribution, etc. These data were used to develop alternative models for the history of grass populations through time. Such structural-historical models are hypotheses testable by phytolith analysis, providing a powerful research design for study of regions lacking pollen data. Rovner discussed sampling strategies for archaeological sites, rejecting the employment of pollen sampling strategy for phytoliths. Proper sampling must consider expected patterns of biased plant selection, use, concentration, and desposition in a site or context--with sampling for control planned accordingly.

Rip Rapp and Susan Mulholland each discussed the problems of phytolith systematics, with Mulholland providing copious illustrations of morphological variation that complicate classification of phytoliths from many plant species. A comparison of light microscope photos with SEM photos illustrated the detail provided by each technique. Brad Whitman demonstrated a new high resolution, video-enhanced television camera mounted on a light microscope that provided detail and contrast well above standard optical results. Cost-effectiveness of this technique compared to SEM makes it attractive for phytolith study.

Dolores Piperno discussed several tropical cultigens and elucidated the diagnostics teosinte versus domestic maize. Squash/pumpkin, beans, and other tropical domesticates provide what appear to be diagnostic phytoliths, especially hair cells and hair bases. However, root crops, manioc, sweet potato, etc., do not produce diagnostic phytoliths. Steven Bozarth's study of phytoliths in North American cultigens from the maize/beans/squash complex was highlighted when Piperno recognized one of Bozarth's diagnostic squash phytoliths as an "unknown" previously observed in soil from prehistoric Panamanian sites. Martha Tack reported on the absence of grain phytoliths in phytolith assemblages from the Egyptian site of Wadi Kubbaniya, further confirming the retraction of the claim for very early plant domestication.

Edward Clebsch, Rapp, and Twiss summarized the status of phytolith studies demonstrating broad application in a wide variety of paleobotanical problems. All agreed that more research is needed to improve techniques, reference systems, interpretation of fossil data, etc. Rapp concluded the workshop with a discussion of a "phytolith research agenda" to specify the most productive avenues of research for the immediate future. Rapp announced that funding has been obtained for a second Phytolith Research Workshop in 1985 at the University of Minnesota-Duluth.

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RECENT PUBLICATIONS

ENVIRONMENTAL ARCHAEOLOGY: A REGIONAL REVIEW

Edited by H.C.M. Keeley, this volume, now in press, contains surveys of the current state of environmental archaeology in the following regions: East Anglia, South-West England, Northern England and York. The papers have been written by scientists employed under government funded contract arrangements, at several English universities, to deal with the environmental evidence from rescue excavations. The surveys provide a retrospective/prospective review of the environmental archaeology of their regions, including detailed bibliographies of evidence already obtained and recommendations as to areas of work which might be emphasized in the future. Reviews have been prepared for the remaining areas, to be published in a future volume.

Environmental Archaeology is a DAMHB Occasional Paper, No. 6. It may be ordered from HBMC Publications Store, Building 1, Doe Headquarters, Victoria Road, South Ruislip, Middlesex HA4 ONZ. Cost is L10 per copy.

ARCHAEOMAGNETISM

Creer, K.M., P. Tucholka, and C.E. Barton (eds.), 1983. Geomagnetism of Baked Clays and Recent Sediments. Elsevier Science Publishing Co., Inc., Amsterdam.

Wolfman, D., 1984. Geomagnetic dating methods in archeology. In Advances in Archaeological Method and Theory, vol. 7, ed. M.B. Schiffer, pp. 363-458. Academic Press, New York.

DEADLINE DATE
FOR
FALL NEWSLETTER
ITEMS:

DECEMBER 1

POSITION ANNOUNCEMENTS

ARTHUR M. SACKLER GALLERY, CENTER FOR ASIAN ART, SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

The Freer Gallery of Art and the Arthur M. Sackler Gallery (under construction) comprise the Center for Asian Art. Increased demands for conservation and technical research necessitate the filling of three new positions starting in late 1984, pending Congressional approval and appropriation.

1) Conservation Scientist (GS-9, \$21,066 PA). To assist in the day-to-day scientific work of the laboratory, to aid in analyzing the materials used in Asian works of art, and to help in determining causes of deterioration and methods of conservation. Candidates should have a background in laboratory work in the physical sciences.

2) Conservator (Objects) (GS-9/11, \$21,066/\$25,489 PA). To perform conservation treatments on objects in the collection and to assist in the general work of the laboratory. It is desirable that the applicant have a particularly strong background in ceramics and glass restoration.

3) Conservator (Exhibits) (GS-9/11, \$21,066/\$25,489 PA). To assist with the objects conservation work of the Technical Laboratory, especially the aspects relating to internal and loan exhibitions. Experience with traveling exhibitions and their conservation is desirable.

United States citizens and Federal Register applicants will receive preference. Positions are open until filled. Applications and requests for information: Mrs. Sarah Newmeyer-Hill, Administrative Officer, Center for Asian Art, Smithsonian Institution, Washington, D.C. 20560. (202) 357-2253.

SMITHSONIAN RESEARCH FELLOWSHIPS IN HISTORY, ART, AND SCIENCE

The Smithsonian Institution announces its research fellowships for 1985-1986 in the fields of Social and Cultural History, History of Art, History of Science and Technology, Earth Sciences, Anthropology, and Biological Sciences.

Smithsonian Fellowships are awarded to support independent research in residence at the Smithsonian related to research interests of the Institution's professional staff and using the Institution's collections, facilities, and laboratories.

Pre- and postdoctoral fellowship appointments for six to twelve months and graduate student appointments for ten weeks are awarded. Proposals for research in the following areas may be made:

Social and Cultural History: American political, military, social, and cultural history, American folklore; material aspects of American everyday life, the history of music and musical instruments, American business history, and the history of money and medallic art.

Anthropology: Archaeology, ethnology, linguistics, and physical anthropology.

Biological Sciences: Solar radiation research, photobiology, tropical biology, ecology, systematics, natural history, evolutionary biology, animal behavior and pathology, paleobiology, marine biology, and environmental studies.

Earth Sciences: Sedimentology, planetary geology, mineralogy, petrology, meteoritics, volcanology, and paleobiology.

History of Art: American Art, particularly of the 18th, 19th, and 20th centuries, the decorative arts, modern painting and sculpture, Oriental and Near Eastern art, and African art.

History of Science and Technology: History of mathematics, physical sciences, medicine and pharmacy, engineering, transportation, agriculture, air and space, and electrical technology, history of science in America, industrial archaeology, and the social dimensions of science and technology.

Applications are due January 15, 1985. Stipends supporting these awards are: \$18,000 per year plus allowances for postdoctoral fellows; \$11,000 per year plus allowances for predoctoral fellows; and \$2,000 for graduate students for the ten-week period of appointment. Pre- and post-doctoral stipends are prorated on a monthly basis for periods less than one year.

Awards are based on merit. Smithsonian Fellowships are open to all qualified individuals without reference to race, color, religion, sex, national origin, age, or condition of handicap of any applicant. For more information and application forms, please write: Office of Fellowships and Grants, Desk J, 3300 L'Enfant Plaza, Smithsonian Institution, Washington, D.C. 20560. Please indicate the particular area in which you propose to conduct research and give the dates of degrees received or expected.

Back Issues

These SAS NEWSLETTER back issues can be ordered.

- Vol. 5, No. 1, Summer 1981
- Vol. 5, No. 2, Fall 1981
- Vol. 5, No. 3, Winter 1982
- Vol. 5, No. 4, Spring 1982
- Vol. 6, No. 1, Summer 1982
- Vol. 6, No. 2, Fall 1982
- Vol. 6, No. 3, Winter 1983
- Vol. 6, No. 4, Spring 1983
- Vol. 7, No. 1, Summer 1983
- Vol. 7, No. 2, Fall 1983
- Vol. 7, No. 3, Winter 1984
- Vol. 7, No. 4, Spring 1984

Please make checks (\$2.00 per issue) payable to the Society for Archaeological Sciences and send to the Office of the General Secretary, Radiocarbon Laboratory, Department of Anthropology, University of California, Riverside, CA 92521.

ANY QUESTIONS?

If you are interested in submitting a Research Report, the usual length is about 1600 words. However, if you have a shorter report, send it in anyway; we can always use good material.

Send material or inquiries to:

Rip Rapp
Judy Holz
108 Math-Geology
University of Minnesota
Duluth, MN 55812
(218) 726-7201

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SAS

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