SAS
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NEWSLETTER
SOCIETY FOR ARCHAEOLOGICAL SCIENCES

NEWS OF THE PROFESSION

CMRAE SUMMER INSTITUTE

Biological Materials from Archaeological Sites: Fauna

The Center for Materials Research in Archaeology and Ethnology (CMRAE) announces its 1983 Summer Institute. This summer's intensive lecture-laboratory course will focus on animal osteology and will be held June 1 to 30 at the CMRAE Graduate Laboratory located at the Massachusetts Institute of Technology. The course will be taught by Richard Meadow, head of the Zooarchaeology Laboratory, Peabody Museum, Harvard University, and by Dr. Hans-Peter Uerpmann of the Institute for Prehistory, University of Tübingen, West Germany. The purpose of the course is to introduce new approaches to faunal analysis and to develop analytical skills in the study and interpretation of animal bones from archaeological sites. The course will be valuable to those who study the prehistoric or historic archaeology and zooarchaeology of the New or Old World.

The zoological and cultural information which can be derived from the study of faunal remains is potentially much greater than that which comes from the mere identification and counting of specimens. Many years of osteological research in central Europe have demonstrated the value of detailed morphological and osteometric analysis for the interpretation of animal bone remains. The accumulated experience represented by this tradition has never been effectively transmitted to English-speaking analysts. This course will help fill that gap through lectures, readings, and intensive laboratory work concentrating on the comparative osteology of large and medium-sized terrestrial mammals from the northern hemisphere. Emphasis will be placed on qualitative and quantitative measures of age, sex, and species variability and on the differentiation of closely similar forms. There will be additional discussion of the considerable amount of research by biologists and medical investigators that has been carried out on the physical structure and chemical composition of bone and how these reflect aspects of phylogeny, physiology, and environment. A series of seminars will consider the potential of such studies for investigating archaeological problems as well as the methods and results of current research in these fields. The course is limited to 15 participants and is open to graduate students and faculty or post-doctoral staff. Credit must be arranged at the student's home institution. The cost is $350.00, which covers registration and course materials. Dormitory housing at M.I.T. can be arranged for an additional fee. Financial assistance is available.

For further information and application forms, write to:

Professor Suzanne De Atley
Director, CMRAE Summer Institute
Massachusetts Institute of Technology
Room 8-138
Cambridge, Massachusetts 02139

The filing deadline for applications is 15 February 1983.

CERAMIC NOTES

CERAMIC NOTES is an occasional publication series devoted to anthropological and archaeological studies of pottery and related materials. A variety of approaches to pottery study are embraced by this orientation, including the role of pottery within modern and ancient socioeconomic systems (pottery manufacture, use, and exchange) and strategies for the analysis of ceramic materials (excluding typological descriptions). Publications will include contributions ranging in length from short notes to monographs. The series is edited by Prudence M. Rice, with Ann S. Cordell serving as editorial assistant, and is produced by the Ceramic Technology Laboratory and the Florida State Museum Associates.

CERAMIC NOTES no. 1, ready for immediate distribution, is an annotated bibliography of ceramic studies, compiled by Prudence M. Rice and Marian Saffer. Covering ethnographic, archaeological (non-typological), and technical studies of pottery and potters around the world, the bibliography includes over 1000 entries with publication dates through 1981. The bibliography is 75 pages in length, with an additional 18 pages of crosslistings of entries under topic headings used in the annotations.

Subsequent issues of CERAMIC NOTES being planned at present will have a narrower geographic focus, being initially restricted to the Eastern and Southeastern United States and Caribbean. This reflects the research orientation of archaeology at the University of Florida and the Florida State Museum, as well as the need for a publishing outlet for ceramic research in these areas. It is strongly hoped that as circulation and readership of this series expands, contributions from outside these regions will be received.

CERAMIC NOTES will be published at irregular intervals, determined by the availability of manuscripts. Cost of the issues will vary depending on number of pages, volume of printing, and offset print charges. CERAMIC NOTES no. 1, 93 pages, is available for $8.00 (postage included in this charge). Make checks payable to FLORIDA STATE MUSEUM ASSOCIATES.

Please address orders, manuscript submissions, or other correspondence to:

Dr. Prudence M. Rice
Ceramic Technology Laboratory
Department of Anthropology
Florida State Museum
Gainesville, FL 32611

POSITION AVAILABLE

The Center for Materials Research in Archaeology and Ethnology (CMRAE) at M.I.T. has a position available for a Research Scientist or Principal Research Scientist, depending upon level of experience, to begin September 1983. The holder of the appointment will also be Lecturer in Archaeology in the Anthropology-Archaeology Section.

We are seeking an archaeobiologist with an interest in nutrition whose specialty is archaeobotany and/or zooarchaeology. Preference is for an archaeologist with a strong anthropological background whose geographic research area is Mesoamerica. Applicants must have extensive experience in fieldwork and especially in laboratory aspects of materials analysis. Teaching responsibilities include undergraduate courses in archaeology and in laboratory studies of archaeological materials as well as graduate courses offered in the Center in biological materials in archaeology.

Applicant must have the Ph.D. Send only covering letter and vita to Arthur Steinberg, CMRAE, M.I.T., Room 8-138, Cambridge, Massachusetts 02139. Equal Opportunity/Affirmative Action Employer.

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SAS RESEARCH REPORTS

NUMBER 2 FALL 1982

"INVISIBLE" HYDRATION RIMS ON OBSIDIAN ARTIFACTS:

A TEST CASE

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From time to time, obsidian dating laboratories encounter the dilemma of undetectable hydration on artifacts of unquestionable antiquity. The need to explain such occurrences can sometimes lead to speculation regarding the possibly unpredictable role of soil chemistry, obsidian composition, or other factors in limiting the reliability of the hydration technique. It is therefore important to demonstrate, whenever possible, that undetectable hydration rims are actually present but elusive, and that the problem is with the hydration rim detection process itself.

A case in point is that of fifteen Northern Side-Notched projectile tips recovered by Thomas N. Layton during the excavation of the Last Supper Cave, Nevada. These were submitted for hydration dating, along with more than one hundred other specimens, to a major Obsidian Hydration Laboratory in the U.S. Among the fifteen Northern Side-Notched projectiles, nine yielded detectable and measurable hydration rims. In contrast, no hydration was observed on the remaining six specimens despite repeated attempts at detection. The Laboratory concluded that no hydration rims were present on these specimens.

The Penn State Obsidian Dating Laboratory was asked to look into the problem of the six missing hydration rims as part of its NSF-sponsored research on the effects of chemical variation on hydration of obsidian. An examination of the thin sections at Penn State (generously made available by the other Lab) also failed to reveal any hydration. Fresh thin sections were then prepared from the original artifacts. These were also examined, but with similar negative results.

It was therefore decided to test the presence or absence of hydration by preparing a depth profile of hydrogen concentration by means of secondary ion mass spectrometry (SIMS). One of the six specimens, Specimen No. 31-528, was selected. A small segment was removed from the base of the point for analysis. As Figure 1 illustrates, the hydrogen profile that resulted reveals an initially high concentration phase followed by a gradual decline which, in turn, is followed by a sharp downward gradient that leads to a lower and more stable concentration level. We have come to recognize this type of profile as characteristic of hydrated obsidian (see Tsong <u>et al.</u>, 1978). We can therefore assert unequivocally that Specimen 31-528 does, in fact, possess a hydrated zone.

Furthermore, we can determine its hydration depth. The point of maximum gradient on the profile in Figure 1 is equivalent to the optically discernable "diffusion front." This point was reached after 70 minutes of sputtering (ion-beam bombardment). With a beam current of 1.6 A, the sputtering rate was 750 A per minute. Thus 70 x 750 A equals a hydration depth of 5.25 microns.

Reassured that the six Northern Side-Notched specimens with the missing rims were indeed hydrated, a second examination of the Penn State thin sections was undertaken, this time under cross-polarized light.

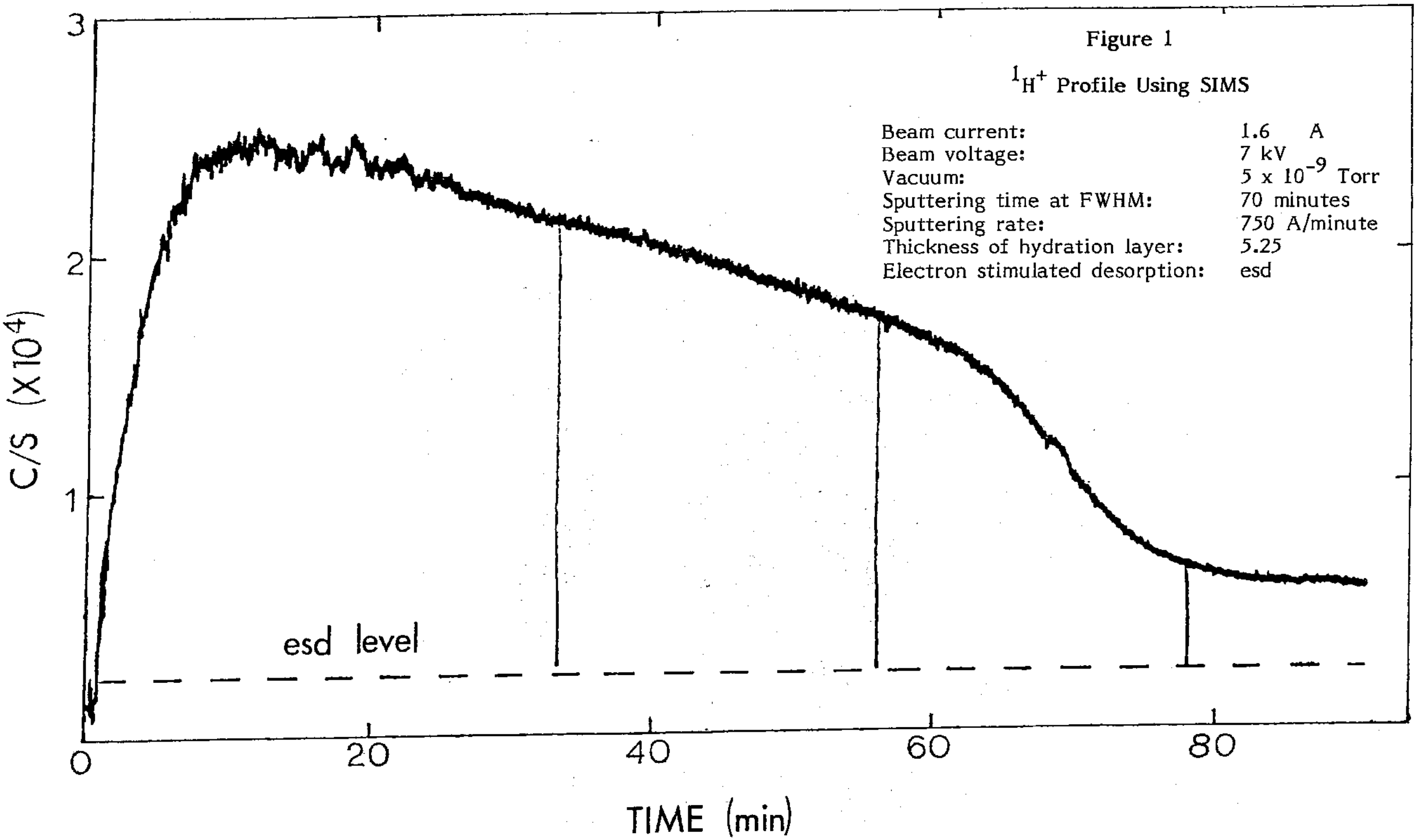
Figure 1
$^{1}H^{+}$ Profile Using SIMS
Beam current: 1.6 A
Beam voltage: 7 kV
Vacuum: 5 x 10^{-9} Torr
Sputtering time at FWHM: 70 minutes
Sputtering rate: 750 A/minute
Thickness of hydration layer: 5.25
Electron stimulated desorption: esd
esd level
C/S (X 10^4)
TIME (min)
0
20
40
60
80
1
2
3

Early on, Friedman and Smith (1960: 479-480) had observed that the hydrated layer would appear as a distinct luminescent band against a dark field when viewed between crossed nicols. Unhydrated obsidian is an isotropic medium. Hydrated obsidian, however, has undergone strain due to the interdiffusion of hydronium ions (H_3O^+) with mobile alkali ions (Laursen and Lanford 1978:153). The hydrated layer therefore becomes anisotropic and exhibits the property of strain birefringence. It is this property that causes the hydrated layer to appear bright against a dark field when viewed between crossed nicols.

The reexamination proved successful. By rotating the microscope stage one could extinguish or illuminate along the edge of the thin section a uniformly thick birefringent zone that displayed alternating bands of colored light (principally red, yellow, and green) sometimes separated by black lines. The luminescent band for Specimen 31-528 had a thickness of 5.28 microns +/- 0.08 . This compares favorably with the SIMS generated measurement of hydration depth (5.25 microns) on the same specimen, and warrants the inference that the optical phenomenon being measured was in fact the hydrated layer. Hydration rims were detected, after careful inspection, in all six cases. Hydration depth measurements and their associated standard deviations are given in Table 1.

TABLE 1

31-528	5.28 microns +/- 0.08
31-395	5.27 microns +/- 0.10
31-726	5.56 microns +/- 0.13
31-5049	5.17 microns +/- 0.12
31-213	4.96 microns +/- 0.18
31-1640	5.33 microns +/- 0.09

Hydration depth measurements for the nine Northern Side-Notched specimens successfully measured by the other Laboratory are listed in Table 2.

TABLE 2

31-3311	5.68 microns
31-1506	6.14 microns
31-3812	6.19 microns
31-4467	7.06 microns
31-5152	5.41 microns
31-2192	5.07 microns
31-3157	5.20 microns
31-5122	6.57 microns
31-3620	6.59 microns

Although there is a discrepancy in the mean hydration value for the two measurements sets (PSU = 5.26 , other = 5.99) amounting to 0.73 , there is no question but that both laboratories are detecting comparable hydration in these typologically homogeneous specimens. If, as has been demonstrated, so-called "missing" or "invisible" hydration rims are actually present, how do we account for the difficulty sometimes encountered in detecting them?

The problem originates with the inherent optical properties of the obsidian specimen. The clarity with which the hydration rim manifests itself under transmitted light varies among specimens derived from different geological sources and, indeed, even among specimens coming from the same flow. Differences in cooling history, in chemical composition, in the density and nature of microlitic and crystallitic inclusions, can all affect the relative clarity with which the hydration rim is manifested.

Such inherent clarity as is characteristic of the type of obsidian involved in any given dating effort can be enhanced or diminished in the process of preparing the microscope thin section. For a full discussion of this aspect of the problem, see Michels and Bebrich (1971:202-209). Most dating technicians are familiar with this source of difficulty and routinely prepare additional thin sections when encountering a problem in detecting the hydration rim.

Yet even with optimal thin sections, the inherent clarity with which the hydration rim manifests itself is sometimes insufficient for rim detection. In such a case, the problem probably lies either with microscope technique or in the experience and skill of the technician (or both).

The selection of appropriate microscope accessories is an important part of instrumental technique. The Penn State Laboratory routinely examines all thin sections under polarized light with the aid of a 100X oil immersion objective, and an image-splitting measuring eyepiece. In cases where the inherent clarity of the hydration rim is poor, the examination is now done between crossed nicols, exploiting the birefringent effect that can be obtained by means of microscope stage rotation. Furthermore, the laboratory is equipped with two non-identical microscope stations. Dating technicians have discovered that it sometimes helps to examine a difficult thin section at both stations in hopes that hydration rim clarity may be significantly enhanced at one or the other.

Although procedures for enhancing visual resolution and contrast can be described (see Michels and Bebrich 1971:210-212), successful detection and focusing of the hydration rim image cannot be guaranteed by a mechanically faithful application of any set of procedures. There is no way one can exaggerate the complexity of the optical image produced when an obsidian thin section is viewed under transmitted, polarizing light at a magnification of 1000. Considerable experience is essential for success when working with specimens having low inherent hydration rim clarity and in general, formal training in optical microscopy should probably be required of all hydration dating technicians.

Surface corrosion, due to the chemical interaction of obsidian and soil, can destroy the hydrated portion of an artifact. For most obsidians, however, such a process takes hundreds of thousands of years. Even the most susceptible (obsidians with very high iron content --ca. 9%) require over 50,000 years to shed the original hydration rind (Michels et al. 1982).

"Invisible" hydration rims can thus only be said to truly exist when the depth of hydration falls below the optically discernible range, as would be the case for artifacts manufactured very recently--perhaps during the last century or two--or in instances where "bag fracture" has inadventently removed major portions of the artifact surface.

Acknowledgements

Funding for this research was provided by the National Science Foundation (BNS 78-24901).

SAS Research Reports is a **Newsletter** supplement designed to facilitate communication of current research and interim reports of data and analysis from long-term projects. Manuscripts should be submitted to the **Newsletter** Editor for consideration. Send 1 original and 1 copy. Reports must be limited to approximately 8 manuscript pages, double spaced, including tables and illustrations.

CORRECTION: In Issue No. 1 of the SAS **Research Reports**, the author's name was incorrectly listed as Patricia Turnbull. It should be Priscilla F. Turnbull. The Editors apologize for the mistake and regret any inconvenience to the author or readers.

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NEWS OF THE SOCIETY

REQUESTS FOR COOPERATION

Dating

Russell S. Harmon and Curtis R. McKinney, Jr. report that a laboratory for U-series disequilibrium geochronology and geochemical studies is being established at Southern Methodist University as part of an expanding program in isotope geology. They are interested in dating fossil bone and tooth enamel, and associated carbonate materials of Late Pleistocene age. Anyone with such organic materials that have been dated by other methods and for which there is good stratigraphic control, are asked to contact them. Address: Isotope Geology Laboratory, Department of Geological Sciences, Southern Methodist University, Dallas, TX 75275.

To compile data for research, **Robert S. Penze** would appreciate receiving the names of any New World sites that have been dated by both C-14 and any other method of dating, in the last three years. Please include the site name, any applicable references, and the two methods of dating used at that site. Address: Department of Anthropology, Northern Illinois University, DeKalb, IL 60115.

RECENT PUBLICATIONS

RECENT PUBLICATIONS IN REMOTE SENSING

Aikens, C. Melvin, William G. Loy, Michael C. Southard and Richard C. Hanes, 1980. **Remote Sensing: A Handbook for Archaeologists and Cultural Resource Managers.** Basic Manual Supplement: Oregon. Cultural Resources Management Division, National Park Service, Washington, DC. Supplement No. 4 to Remote Sensing: A Handbook for Archaeologists and Cultural Resource Managers.

Avery, Thomas Eugene and Thomas R. Lyons, 1981. **Remote Sensing: Aerial and Terrestrial Photography for Archaeologists.** Supplement No. 7 to the Handbook Series. Washington, DC: US Government Printing Office.

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