

# SAS

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## NEWSLETTER

SOCIETY FOR ARCHAEOLOGICAL SCIENCES

Archaeological Research Unit, Radiocarbon Laboratory, Department of Anthropology  
University of California, Riverside – Riverside, California 92512

### CURRENT RESEARCH

#### ANALYSIS OF ORGANIC PIGMENTS IN ARCHAEOLOGICAL AND ETHNOGRAPHIC TEXTILES

Despite the widespread interest in the identification of raw materials used in the manufacture of artifacts, analysis of organic colorants in textiles has received less attention than similar studies of inorganic colorants in paints and ceramics. This omission can be partially attributed to the relative scarcity of ancient textiles, but more important is the limited number of specialists who have addressed the problems involved in the archaeological applications of such analysis.

Max Saltzman, SAS Board member, is one of these few specialists. Formerly of Allied Chemical Corporation and Adjunct Professor of Chemistry at Rensselaer Polytechnic Institute, Saltzman has been actively engaged in the analysis of prehistoric dyes for many years. This long-term involvement has made him aware of the need for cooperation between scientists and archaeologists with respect to the availability of appropriate technical information for the analysis of archaeological and historical specimens. He has recently drawn on his long industrial experience and expertise to establish a laboratory at UCLA in the Institute of Geophysics for the analysis of non-industrial organic dyes.

Although he has analyzed samples from all over the world, his current focus is the distribution of particular Pre-Columbian Peruvian dyes in time and space, and its implications for trade and specialization in the cultures involved. The initial impetus for the study came from Junius Bird in 1962. He wondered if any of the red or purple dyes from Ocucaje (south coast of Peru, Paracas, ca. 100 B.C.) were from marine molluscs. Saltzman confirmed that the dye from *Concholepas concholepas*, found today off the coast of Peru, was identical to the purple in some of the ancient Paracas textiles. Further analysis of these specimens and subsequent samples submitted by Mary Elizabeth King indicated that purple was also produced by combining indigo with red from either cochineal or possibly relbunium, a Peruvian madder-like plant.

The use of these two sources of red in the same area and the same period posed interesting questions because they have different natural distributions. Furthermore, the use of cochineal as a dye is more obvious than relbunium. While cochineal only needs to be crushed to produce a dye, relbunium is a woody root which must be dug up and boiled. It seemed that each was used predominantly at different times during the period, with relbunium preceding cochineal. To test this idea, Saltzman has obtained a set of well-documented samples from the Museo Nacional de Arqueología y Antropología in Lima. They cover a long time sequence in the same area, and will allow him to investigate the pattern of dye use.

The methods for the analysis of organic colorants are well-established in industry. Saltzman has chosen to emphasize solution spectrophotometry in his work. The technique is based on the fact that dyes and pigments give characteristic colors when dissolved in certain solvents, such as chloroform, concentrated sulfuric acid, acidified acetone, dimethyl formamide, and dilute sodium hydroxide. The spectrophotometric curves of these solutions are run and compared with curves of known materials for identification.

Advantages of the technique include its relative simplicity, the availability of the appropriate equipment, and the fact that very small samples can be used. It is fast and reliable if an adequate reference file is available. Furthermore, it is possible to identify a dye despite the fact that it has been treated to produce visually different colors.

The greatest disadvantage is the lack of samples of known origin. This is particularly true for Peru, so Saltzman's initial step was to establish a comprehensive file of curves of known dyes for Peru. Samples of dyeings from native Peruvian materials were first obtained from Barbara Mullins, of England. These were augmented through the fieldwork of ethnobotanist Kay Antunez de Mayolo. She was able to obtain 40 of the 70 target species of Peruvian natural dye plants, as well as cochineal from different locations and samples from the mollusc *Concholepas concholepas*. Most of the species of relbunium were located, and this was of particular interest because the systematics of the genus and references to species of this genus in earlier ethnobotanical literature seem to be confused. Future studies of its characteristics and distribution in Peru are necessary to answer questions related to the method of dyeing employed and its replacement in Peru.

Standard curves for the dyes from the plant collections are now being run in the laboratory, as are curves for the archaeological specimens. At the present time, Saltzman can identify the four principal red dyes of Peru with a single solution curve. These are brasilwood, madder, relbunium, and cochineal. He can also distinguish indigo blue from purple di-bromo indigo produced by marine molluscs. The yellow and brown dyes are more difficult to identify, and usually require curves in more than one solvent. The chemicals which produce yellows are common to many plants, and the source of these Pre-Columbian dyes are not known. This is a more complex problem, and even advanced techniques have not provided answers.

Future research is planned to investigate mechanisms by which particular organic colorants yield various colors. For example, he would like to know if there are species differences that can be detected, or variations that can be produced using dyes from plants of different ages or grown under different conditions.

Saltzman is also interested in the development of the use of mordants in Pre-Columbian Peru. Mordants bind the dye to the fiber to make colors wash and light fast. In addition, mordants change the color of the dye. Because they lack color themselves, it is unlikely to be a chance discovery. Rather, it implies technical specialization and study of cause and effect in the dyeing process. To study the introduction of mordants, Saltzman is examining the natural metal contents of the various fibers used by ancient Peruvians. If the undyed fibers have no metal content, the mordant was actively added in the dye process.

Although he has concentrated on identification of organic colorants, Saltzman's work shows the productivity of interdisciplinary cooperation. In the course of his research, he has benefitted from the expertise of specialists in such diverse fields as chemistry, botany, malacology, entymology, inorganic trace elements analysis, and archaeology. He finds such an approach extremely rewarding, although adjusting to the different patterns of cooperation in industry and academia has not always been easy.

He believes that at the present time his laboratory is unique in being able to focus on such systematic, interdisciplinary research in dye analysis. Although there are a number of European laboratories which have made significant contributions to the history of dye use, most must restrict their analysis to a limited aspect of museum collections. As a result, there is no unified framework or synthesis for the history of dyeing apart from the standard histories of technology, nor are there many studies which put the technical results into a larger cultural perspective. For this, the analyst and the archaeologist must collaborate closely, and it is an important step in the development of dye studies.

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**SAS**

# MEETING NOTES

## COMPUTER APPLICATIONS IN ARCHAEOLOGY

The 1979 Conference for Computer Applications in Archaeology will be held on 24-25 March at the University of Birmingham, England. Further details may be obtained from S. Laflin, Computer Center, University of Birmingham, England.

## SEMINAR ON EARLY PYROTECHNOLOGY

This seminar, to be held on April 19 and 20, 1979, is sponsored jointly by the Conservation - Analytical Laboratory of the Smithsonian Institution and the National Measurement Laboratory of the National Bureau of Standards. It is one of a continuing series on the Application of Materials Science to Archaeology and Museum Conservation.

The purpose of the seminar is to bring together archaeologists, art historians, and materials scientists to consider the early development of materials processing techniques based on the use of fire: the manufacture of metals, ceramics and glass, plasters and cements, and glazes. Areas of discussion will cover the basic materials themselves and their antecedents, interfaces between their processes, and modern scientific techniques of studying artifactual data. Major themes will include study of artifacts and processing relics, such as slags, and inferences that follow about the history of the object and the treatment needed to produce it; ethnographic study of current primitive practices; and field observations of ancient technological sites. In addition to presenting the technical details of these studies, the seminar is aimed at elucidating the relationship between early pyrotechnical practices and cultural development, and understanding in general how man's ideas of his world were influenced by his growing control over materials through the use of fire.

A limited number of contributed papers can be accepted, but because of space limitations, attendance may be limited. Early registration is recommended. Questions concerning the seminar should be directed to Joan Mishara, Conservation Analytical Laboratory, Smithsonian Institution, Washington, D.C. 20560; or to Alan D. Franklin, A329 Materials Building, National Bureau of Standards, Washington, D.C. 20234.

## REPORTS ON RECENT MEETINGS

The 18th International Symposium on Archaeometry and Archaeological Prospection was held from 14-17 March, 1978, at the Rheinische Landesmuseum in Bonn, Germany, and was chaired by I. Scollar. Papers centered around ceramics, glasses, metals, dating methods and aerial prospecting. Among the most notable exhibits were examples of the effective use of balloon-altitude photoreconnaissance for Old World archaeological sites. The meeting was attended by about 100 experts from around the world.

On April 8, 1978, Henri de Lumley chaired a working discussion at the University of Lyon, France, to agree on a long-term project designed to accurately date Palaeolithic cultural transitions in Europe. The meeting was attended by approximately 25 field archaeologists and dating experts from Europe and the U.S. who gathered to formulate procedures and priorities for the project.

The First Conference on Radiocarbon Dating with Accelerators, attended by around 80 specialists, took place at the University of Rochester on April 20 and 21, 1978. The experimental results obtained by a number of groups were revealed and future work was discussed. Accelerator-based dating holds high promise for the fast dating of small samples: 10 mg. sample size with machine-measurement in 15 minutes appears feasible. Moreover, larger samples might be dated as far back as 100,000 years if contamination problems can be solved and the natural background permits.

Submitted by Rainer Berger, Radiocarbon Laboratory, Institute of Geophysics, UCLA, Los Angeles, Calif. 90024.

# RECENT PUBLICATIONS

## PACT 1/1977

The first issue of PACT, the Journal of the European Study Group on Physical, Chemical and Mathematical Techniques Applied to Archaeology, is now available. This volume consists of papers presented at the 1977 symposium on the application of X-ray fluorescence to archaeology, chaired by Mme Madeleine Hours of the Laboratoire de Musees de France, Paris. The following topics are covered:

- L'application de l'analyse en microfluorescence X au Romisch-Germanisches Zentralmuseum a Mayence, by D. Ankner, Mayence
- Etude comparative de la fluorescence X et des methodes nucleaires dans leur application a l'archaeologie, by J.N. Barrandon, Orleans
- Energy dispersive X-ray fluorescence analysis of ancient gold alloys, by M. Cowell, London
- The alloy content of folles and imitations from the woodeaton hoard, by C. King, Oxford
- L'application a l'archeologie des methodes de fluorescence X au laboratoire de recherche des musees de France, by Ch. Lahnier, Paris
- Analyse de 120 figurines gallo-romaines en terre cuite blanche, by Ch. Lahanier and M. Rouvier-Jeanlin, Paris
- X-ray fluorescence spectrometric analysis of Etruscan mirrors, by L. Maes, Brussels
- Non-dispersive XRF applied to ancient metalworking in copper and tin bronze, by H. McKerrell, Edinburg
- X-ray fluorescence at the Rathgen Research Laboratory in Berlin, by J. Riederer, Berlin
- The Presence of Mercury in Kufic Silver Coins, by Zofia Stos-Fertner and Jan Kusinski, Cracovie
- An attempt at a statistical evaluation of the results of the X-ray fluorescence analysis of the chemical composition of dirhams and their imitations from the 8th-10th c. A.D., by Z. Stos-Fertner, A. Fertner, and T. Florkowski, Cracovie
- The analysis of non-metallic inclusions in ancient iron, by J.A. Todd and J.A. Charles, London.

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Recognition of the utility of the analysis of organic colorants is long overdue. However, through research programs such as Max Saltzman's, archaeologists should become aware of the wide applicability of information on dyes in studying culture history and processes. With growth in the use of the spectrophotometric technique and the availability of reference file curves of known materials, it should be as easy to identify organic as inorganic colorants.

In general, the analytical techniques are well developed, although improvements are necessary in some areas, such as the identification of yellows. Another technique which has become very popular is thin layer chromatography followed by mass spectroscopy. It takes less material, but currently it cannot be used to detect cochineal, a very serious limitation for analyzing American dyes.

One of the major frustrations in Saltzman's experience in interdisciplinary work is the general lack of communication among specialists. This results in situations such as archaeologists "discovering" techniques well known in modern industrial labs, and in duplication of research efforts. If adequate dissemination of available information were possible, it would be less problematic. As it is, investigators usually know little of the limitations or advantages of techniques that they use from other disciplines.

## RESEARCH NOTES

### ARCHAEOLOGICAL SCIENCE IN NEW ENGLAND

The Institute of Conservation Archaeology, Peabody Museum of Archaeology and Ethnology, headed by Dr. Michael Roberts, is involved in several projects. Sub-surface radar remote sensing has been tested on the historic Shaw site, Litchester, Massachusetts, and on a pre-historic site in the Merrimac River Basin. The survey defined a number of features which were subsequently validated by excavation. Dr. Roberts is positive about the success of the instrument. The ICA is also involved in interdisciplinary work. Dr. Roberts reports that the Outer Continental Shelf survey combines aspects of geology, biology, and archaeology, as well as the most up-to-date marine archaeology recovery strategy. Dr. Russell Barbera, ICA Research Director, has been studying the sensitivity of land snails as micro-climatic indicators. J.E. Ericson, also at the Peabody Museum, has begun feasibility studies on quartz hydration dating and bone apatite TL dating.

### FRANCISCO PIZZARRO PROJECT

The remains and artifacts of Francisco Pizarro will be authenticated and conserved as part of a joint undertaking between experts from Peru and several U.S. institutions. The analytical methods will come from such diverse fields as forensic dentistry and medicine, geochemistry, physical anthropology, archaeology, conservation science, and laser holography. Three institutions are sponsoring the project in the U.S.: Harvard University, University of California at Los Angeles, and California State University at Fullerton. The project begins in November/December 1978.

### UCLA OBSIDIAN HYDRATION LABORATORY

The UCLA Obsidian Hydration Laboratory has been involved in a two-fold research objective during the past year and a half. The primary research concern has been to establish hydration rates for those sources in the American Southwest where none existed while further refining those rates already in use. The second concern has been focused on extending the areas to which the hydration technique may be applied. Samples have been solicited from the Central American area and tentative results suggest that, together with sourcing information, hydration rates developed from this area may be extremely useful to the archaeologist.

# NEWS OF THE SOCIETY

## CALL FOR NOMINATIONS

Under Article XIII of the SAS By-Laws, the Acting Executive Board is empowered to conduct the initial election of officers. The stipulations for holding elections for the first time were printed in the Summer 1978 issue of the *Newsletter* (Volume 2 Number 1).

Those wishing to run for the office of President/Vice President or Secretary-Treasurer/Assistant Secretary-Treasurer should indicate their intention to the Acting Secretary by providing him with a letter signed by the nominee with (1) the form of the name to be listed on the ballot; (2) the office being sought; and (3) bibliographic information (not to exceed 50 words) which will be included *verbatim* on the ballot sent out to the membership of the Society. Each nomination letter should include the statement that the candidate has read the By-Laws of the SAS and understands the duties and responsibilities of the office.

Nominating letters must be postmarked not later than February 9, 1979. Ballots will be sent out with the next *SAS Newsletter*.

Send all nominating letters to R.E. Taylor, Acting Secretary, SAS, Department of Anthropology, University of California, Riverside, CA. 92512.

## REGIONAL COORDINATORS APPOINTED

At their last meeting, the Acting Executive Board agreed to establish several positions for regional coordinators. It was hoped that this would be an effective mechanism for promoting the SAS as well as for generating up-to-date information and news for inclusion in the *Newsletter*. Two SAS members have agreed to accept positions for the 1978-1979 term. J.E. Ericson of the Peabody Museum, Harvard University, will act as the New England coordinator, and Prudence Rice, University of Florida, will be the Southeast representative. Briefly, their tasks involve encouraging membership and publicizing the SAS in their regions, and acting as reporters for regional news, research, meetings, and topics of interest to SAS members. If you have information that you would like included in the *Newsletter*, contact the Editor, or the regional coordinator. Individuals interested in serving as coordinators in other regions should contact R.E. Taylor, Acting Secretary.

# NEWS OF THE PROFESSION

## COURSES IN ARCHAEOLOGICAL SCIENCES OFFERED

The Center for Materials Research in Archaeology and Ethnology at MIT, headed by Heather Lechtman, has opened its new educational facilities. These include a sample preparation laboratory, specialized metallographic examination room, and a well-equipped classroom for microscopic examination. The Center is currently sponsoring a full-year graduate course on *Ceramics in Ancient Societies*. Coordinated by Professor Arthur Steinberg, the course combines lectures and laboratories which are presented by specialists in various fields touching on ceramic analysis. Topics include properties of clays, fabrication of artifacts, surface decoration, firing, glazes, mineralogy of fired ceramics, and historical aspects of European ceramics.

At Harvard University, the Department of Anthropology and the Peabody Museum of Archaeology and Ethnology have undertaken a joint program in Scientific Archaeology. Presently, a full-year lecture, laboratory and field course has been structured by J.E. Ericson to intensively survey aspects of archaeological science. Dating techniques, remote sensing, spatial analysis, statistics, material analysis, chemical characterization, and environmental reconstruction will be covered. An upcoming lecture series on "Practical Approaches to Lithic Identification" will be presented at the Peabody Museum by Dr. R.M. Gramly, who has recently been conducting a lithic source survey for the Maine Historic Preservation Commission.