

Collection Forum
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Papers

INVESTIGATION OF SOLID PHASE MICROEXTRACTION SAMPLING FOR ORGANIC PESTICIDE RESIDUES ON MUSEUM COLLECTIONS

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Solid-phase microextraction (SPME) in combination with gas chromatography/mass spectroscopy (GC/MS) analysis offers a simple and sensitive option for analyzing objects that have been contaminated with volatile and semi-volatile organic pesticides. In this project, items from the National Museum of the American Indian (NMAI) were placed in plastic bags and allowed to sit overnight. A SPME fiber was then inserted into the bag, exposed for approximately one hour, and analyzed by GC/MS. Naphthalene and para-dichlorobenzene were found on several objects. It may also be possible to detect other semi-volatile pesticides. A privately owned piece of reproduction trade cloth was studied more extensively to evaluate equilibrium times and reproducibility. Raising the humidity within the bag substantially increased the release of pesticides from the cloth. This preliminary project demonstrated that this simple setup is practical. Its ease of use and minimal effect on the object make it attractive to museum staff and may make it more attractive to Native constituents who have concerns beyond preserving the physical material of the object. Quantitative analysis appears feasible but will require further study.

TESTING CULTURAL MATERIAL FOR ARSENIC AND INTERPRETING THE RESULTS: A CASE STUDY AT CARNEGIE MUSEUM OF NATURAL HISTORY

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One hundred and seventy-one objects in the process of repatriation from the Carnegie Museum of Natural History to the Hopi Tribe were screened for the presence of arsenic pesticide residue using a commercial spot test. One hundred and three objects (60%) produced positive results, but unexpected positives led to suspicions that arsenic-containing pigments were responsible for some of the arsenic that had been detected. Analysis of pigment samples from four representative objects resulted in the

identification of the commercial artist's pigment emerald green (a copper acetoarsenite) and a native iron earth pigment that might contain arsenic naturally. A statistical analysis of the test results and object information, such as fabrication materials, previous locations within the museum, and absence/presence of green paint, was undertaken to determine whether correlations among certain factors could explain patterns in the test results or predict the sources of arsenic on objects within the test group as a whole. The study identified a correlation between positive test results and two early exhibitions, but in the end it was difficult to predict with certainty whether the source of the detected arsenic for particular objects was inherent or acquired. This project provides an example of the difficulties in interpretation that can result from the presence of arsenic-containing pigments when testing for pesticide residue.

PESTICIDE CONTAMINATION ON NATIVE AMERICAN ARTIFACTS – METHODS, RESULTS FROM SIX CASE STUDIES, AND NEXT STEPS

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This work describes several case studies involving the determination of pesticide contamination on objects from the Treganza Museum at San Francisco State University, the Phoebe Hearst Museum of Anthropology at the University of California at Berkeley, and the Elem Pomo, Hoopa, Karuk, and Yurok tribes of California. The focus of these studies was determination of arsenic and mercury via Flame Atomic Absorption Spectrophotometry and determination of six organic pesticides via Gas Chromatography/Mass Spectrometry. Mercury was detected in 31% of the samples at concentrations up to 16.6% by weight. DDT was detected in 44% of the samples with concentrations as high as 2900 ppm or 0.29% by weight. Significant contamination was found in several different collections, with mercury and DDT concentrations at levels that may be of toxicological significance. Native Americans, museum professionals, and any one handling potentially contaminated objects should continue to take appropriate measures to minimize exposure. In the future, it is hoped that government granting agencies will facilitate efforts to provide for free testing of pesticide contamination for tribes and museums, and that researchers will develop improved sampling techniques, analytical methods, and exposure and risk assessment data that more definitively address people's concerns about their safety.

DETECTION AND MITIGATION STRATEGIES FOR CONTAMINATED NAGPRA OBJECTS – THE SENECA NATION'S EXPERIENCE

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Many of the sacred objects repatriated to the Iroquois people under Native American Graves Protection and Repatriation Act (NAGPRA) are contaminated with pesticides.

The identity of the pesticides, amount and method of application that were applied to preserve the objects by museums and private collections are often unknown and undocumented. The focus of this study was two fold: identifying arsenic, mercury, and lead on objects repatriated to the Seneca Nation of Indians, and investigating strategies for removal of such contamination. The sampling methods used here were nondestructive and involved the use of wipe samples or direct, nondestructive analytical methods. A variety of analytical techniques, including spot tests, atomic spectroscopy, and X-Ray Fluorescence were used. The results showed the presence of arsenic and mercury residues. First attempts to mitigate these contaminants by vacuuming and washing showed no improvement. In this project, a multi-step approach will be investigated for mitigation of these residues. This approach begins with use of a Surface-Active-Displacement Solution (SADS), replacement of certain components combined with traditional cleaning techniques. Medicine masks highly contaminated with mercury residues showed only trace amounts of mercury residues after the first treatment with a SADS formulation.

USE OF HANDHELD XRF FOR THE STUDY OF PESTICIDE RESIDUES ON MUSEUM OBJECTS

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A handheld X-ray fluorescence spectrometer (Niton XLi-700 series) has been successfully used for detection of heavy metal based pesticide residues on museum objects. The instrument is versatile, easy to use, and economical to operate. It provides rapid, accurate analytical information without destructive sampling. Based on the greater medical risk of heavy metal residues, qualitative and quantitative analysis of these persistent but highly toxic contaminants has been the focus of studies undertaken at the University of Arizona to adapt this technology to the pesticide contamination issue as associated with museum objects.

EXPOSURE OF MUSEUM STAFF TO FORMALDEHYDE DURING SOME WET SPECIMEN ACTIVITIES

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Biological specimens are frequently preserved for study and display by initial treatment with formaldehyde. Significant quantities of this chemical are retained in these specimens throughout the transfer to less toxic storage solvents such as alcohol, when these specimens are used for necropsy, and in some specimens which are permanently

stored in formalin. Anyone working with these objects, including their transfer to other containers, is potentially exposed to both the formaldehyde as well as the current storage solvent. Exposure assessments during several operations with these materials measured the levels of exposure and found these exposures were generally below maximum recommended levels in those situations where local exhaust ventilation was used, but levels did exceed some recommended criteria where only general room ventilation was available. It is recommended that some type of local ventilation system be made available in facilities which work with wet specimens on a routine basis and that personal protective equipment such as gloves, eye protection and aprons or lab coats also be utilized to reduce exposures.

ON THE DEVELOPMENT, CARE, AND MAINTENANCE OF COLLECTIONS OF REFERENCE AND SUBFOSSIL SEED AND PLANT MACROREMAINS

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This paper describes the procedures used at the Royal Alberta Museum for long-term maintenance and care of collections of reference and subfossil seeds and plant macroremains. The reference collections are used primarily as comparative material to aid in identifications of subfossil material of Late Quaternary age that is mostly derived through processing sediment from palaeoenvironmental and archaeological sites in Alberta. For the reference material, processing involves cleaning and preparing materials collected in the field. For the subfossil material, processing entails separation of plant remains from any adhering clastic or organic sediment, and concentration into size fractions. For both types of collections, the main objective is to ensure that materials do not deteriorate in long-term storage and that characteristics critical for identification are preserved. It is recommended that chemical treatments in processing and chemical preservatives are avoided if possible so that the materials can be used for further analyses, including SEM imagery and, for the subfossil material, radiocarbon dating. The techniques that have been tested and developed for the preservation of these collections at the Royal Alberta Museum may be more widely applicable to similar collections held in institutions elsewhere.

THE EFFECT OF RELATIVE HUMIDITY ON MOLLUSC PERIOSTRACUM AND THE USE OF COATINGS TO PREVENT LOSS

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The periostracum is a thin layer of protein that covers the exterior surface of some mollusc shells. Although apparently insignificant, the periostracum may be important in taxonomic research and environmental monitoring. Loss of mollusc periostracum through peeling and flaking has been recorded in natural history collections and is generally attributed to desiccation of the protein. This study investigates the relative humidity conditions under which periostracal loss occurs. Gastropod (*Helix aspersa*) and bivalve (*Mytilus edulis aoteanus*) shells were exposed to a range of stable and fluctuating relative humidities to determine whether desiccation or fluctuating relative

humidity cause periostracal damage. Traditional coating materials (petroleum jelly, mineral oil, and 50:50 mineral oil/white spirits) were tested to determine their effectiveness in preventing damage to the periostracum. Other properties of the coating materials were tested including gloss, dirt retention, and stability on thermal aging. Results suggest that desiccation is a more significant factor in periostracal loss than fluctuations in relative humidity. Maintaining a range of 40% to 60% relative humidity in the storage environment is recommended. Traditional coatings, however, are inappropriate for preventing periostracal loss in natural history collections because they will affect the appearance of shells and can reduce the analytical value of the specimens.

THE FUTURE OF COLLECTIONS: AN APPROACH TO COLLECTIONS MANAGEMENT TRAINING FOR DEVELOPING COUNTRIES

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Natural history collections in Latin America are growing, and the rates of collection use are increasing. In response to the need for professional collections care training in Latin America, we developed a comprehensive workshop to provide on-site training. The workshop uses a combination of lectures, readings, and hands-on activities to teach participants how to better manage collections and identify archivally sound materials. The workshop is structured around a conceptual model for teaching the theoretical bases of collections management that integrates preventive conservation with concepts of order and collection growth, and includes the history of collections, emphasis on the quality of the storage environment, and collection assessment. The workshops have identified several new areas for collections care research. The model can be successfully applied to other developing regions outside of Latin America.

Resumen—Las colecciones de historia natural de América Latina están creciendo, y la tasa de su uso también esta creciendo. Por lo tanto la necesidad de oportunidades para capacitación profesional del cuidado de las colecciones en América Latina, desarrollamos un taller completo para proveer capacitación en sitio. El taller es una combinación de presentaciones, lecturas, y actividades para enseñar a los participantes como manejar mejor las colecciones e identificar materiales archivables. El taller esta estructurado sobre un modelo conceptual para enseñar las bases teoréticas del manejo de colecciones que integra conservación preventiva con los conceptos de orden y crecimiento de las colecciones, e incluye la historia de las colecciones, un énfasis en la cualidad del ambiente de almacenamiento, y la evaluación de las colecciones. Los talleres han identificado algunas áreas nuevas para la investigación del cuidado de las colecciones. Nuestro modelo puede ser aplicado con éxito en las regiones en desarrollo fuera de América Latina.

COLOMBIAN HERBARIA

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Abstract.--Decree 309/2000 establishes the legal guidelines for scientific investigation of biological diversity in Colombia and Resolution 1115/2000 determines the procedure to continue for registering biological collections with the Humboldt Institute. In Colombia there are 59 herbaria: 57 registered, 33 associated with the Colombian Association of Herbaria (ACH), and 24 cited in Index Herbariorum. Overall, 39% are national in character, 59% are regional, and 2% are local. The La Salle University Herbarium, founded in 1912, is the oldest collection. The main herbarium is the Colombian National Herbarium (COL), with 500,000 specimens.

USING CAPILLARITY FOR DETERMINING AND MAINTAINING A POLYMER CONSOLIDANT CONCENTRATION AFTER SOLUTION PREPARATION

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The use of consolidants to stabilize and strengthen fragile fossil material plays an important role in the preparation and conservation of palaeontological specimens.

Polymers

such as polyvinyl acetate, dissolved in acetone or ethanol solvents, are widely used as consolidants because of their versatility and long-term stability. The concentration of dissolved polymer can be high (35% by weight) producing a thick solution useful as archival glue, or low (<5% by weight) to provide a thin solution that can penetrate dense cortical bone. Additionally, there is often an optimal concentration that provides maximum penetration of consolidant into the object being conserved. The optimal concentration can be within a narrow range and vary from specimen to specimen, therefore determining and maintaining consolidant concentration is important. A method based on the capillary action of fluids is used to quantify and monitor the polymer concentrations of consolidant working solutions. The procedure is quick, inexpensive, and requires no specialized equipment. Regular assessment of working solution concentrations can increase quality and consistency of artefact conservation.

Reviews

[The Conservation of Fur, Feather and Skin, edited by Margot M. Wright](#)

[Old Poisons, New Problems a Museum Resource for Managing Contaminated Cultural Materials, by Nancy Odegaard, Alyce Sadonzei and Associates](#)