



**Peabody Museum**  
of Archaeology and Ethnology at Harvard University

For Immediate Release

## **New application of peptide mass fingerprinting in the identification of materials used in cultural objects at the Peabody Museum of Archaeology and Ethnology**

*Project funding provided by the National Center for Preservation Technology and Training, a unit of the National Park Service.*

**Cambridge, MA. November 12, 2013.** The Peabody Museum of Archaeology and Ethnology has received a grant to begin sampling and identifying materials used in cultural artifacts in its collections. The Peabody Museum will be collaborating with the Straus Center for Conservation at the Harvard Art Museums and the Harvard FAS Division of Science to analyze the samples. Peptide Mass Fingerprinting (PMF) is a method developed in recent years that allows scientists to identify proteins. For museums, this technique means the ability to identify with accuracy to the species level the mammalian sources of objects made of skin, tendon, ligament, bone, and gut.

Until now, the identification of mammalian materials used in objects has principally utilized oral histories and visual and/or tactile examination, all of which can be inaccurate. Other testing techniques required destructive sampling, which was not desirable. An important advantage to PMF is that it uses only micro-samples, a few tens of micrograms, minimizing the damage to artifacts in testing.

The Peabody Museum partnered with the Straus Center for Conservation in use of PMF as part of a recent project involving the study and conservation of nineteenth-century Alutiiq and Yup'ik kayaks, including the only known example of an Alutiiq warrior-whaler kayak. Analyzed samples were found to be of common seal, whale, sea lion, bearded seal, and caribou.

Project results will be used to begin to define a cultural map of mammalian use of objects from coastal Native Alaska, the North West, Northern California, and the High Plains. PMF offers a significant step forward for museums in their efforts to understand and preserve their collections. It also increases the amount of information museums are able to provide to researchers and to the communities from which the objects come. For indigenous groups, the use of traditional materials and manufacture is an important part of cultural revitalization efforts and a frequent topic of discussion and collaboration with collecting museums.

### **The PMF Technique**

Collagen is the chief proteinaceous component of vertebrate connective tissues (skin, tendon, ligament, bone, and gut). PMF uses enzymatic digestion of extracted collagen to cleave proteins at specific amino acid sites forming a peptide mixture. Each protein amino acid sequence is unique, thus the mixture of peptides is unique. The mixture is then analyzed by Matrix Assisted Laser Desorption/Ionization Time of Flight Mass Spectrometry, resulting in a mass spectrum containing characteristic marker peptides—a “peptide mass fingerprint.” Markers are compared with those from known materials to determine the species from which they were derived. Since few mammalian collagen sequences are known, species identification by PMF requires the generation of a reference database.

The Project team anticipates taking approximately 300 samples from North American collections for analysis and 100 from reference materials to build the reference database, which currently holds some 50 samples relevant to the mammals of coastal Alaska and western United States.

### **Project Principals**

**Principal investigator/project coordinator:** T.Rose Holdcraft, Peabody Museum of Archaeology and Ethnology. Ms. Holdcraft serves as Head Conservator at the Peabody Museum of Archaeology and Ethnology. She is a Fellow of the American Institute for Conservation and has directed the Peabody Museum’s conservation services for 20 years.

**Primary analytical investigator/scientist:** Dr. Daniel Kirby, Straus Center for Conservation and Technical Studies. Dr. Kirby has worked as an associate in Conservation Science at the Straus Center

for Conservation and Technical Studies, Harvard Art Museums, for the past 8 years. For many years, he worked with IBM as an engineer, analytical chemist, development scientist, and engineering manager. In the early 1990s he began a second career in bio-analytical mass spectrometry in the Boston area and became involved in protein sequencing, developing micro-analytical techniques, and instrumental design.

**Mass spectrometrists/scientist:** Dr. Sunia Trauger, Harvard Fas Division of Science. Dr. Trauger is the Director of the Small Molecule Mass Spectrometry Facility at FAS Division of Science at Harvard. She will supervise and conduct the peptide marker discovery work at her facility. Before coming to Harvard, Sunia was the Associate Director at the Scripps Research Institute's Center for Mass Spectrometry and Metabolomics in La Jolla, CA, where she worked for ten years with Professor Gary Siuzdak, an innovator in the field of mass spectrometry. She has over 20 years of mass spectrometry and analytical chemistry experience both in academia and industry.

### **About the Peabody Museum**

The Peabody Museum is among the oldest archaeological and ethnographic museums in the world with one of the finest collections of human cultural history found anywhere. It is home to superb materials from Africa, ancient Europe, North America, Mesoamerica, Oceania, and South America in particular. In addition to its archaeological and ethnographic holdings, the Museum's photographic archives, one of the largest of its kind, hold more than 500,000 historical photographs, dating from the mid-nineteenth century to the present and chronicling anthropology, archaeology, and world culture.

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