

**PI:** Dr. Sean Rafferty, Anthropology  
**CO PI's:** Dr. Stuart Swiny and Dr. Igor Lednev  
**Sponsor:** National Science Foundation (NSF)  
**Award:** \$122,410  
**Dates:** 6/1/08 – 5/31/10

## Residue Analysis of Alkaloids

A goal of archaeological research is the attribution of function to material culture. With few exceptions, functional characterizations of material culture have been made based on analogical rather than empirical criteria. Direct identification of organic residues on material culture provides empirical evidence of function, removing the need for analogical characterizations. Numerous applied studies have demonstrated this potential and generated new knowledge of the past. This research has been dominated the analysis of subsistence remains based on the identification of lipid compounds.

This project will apply newly developed techniques (focusing on Raman microscopy) to alkaloid residues. Use of alkaloid-bearing plants is often (though not exclusively) ritual in nature. Accordingly, analysis of alkaloid residues can provide empirical data on ideational aspects of human culture that are difficult to access archaeologically. Funding is requested to support applied research into the use of alkaloids in two areas: prehistoric Eastern North America (focusing on tobacco) and the Bronze Age Mediterranean (focusing on Opium). Data generated in these regional studies will be applied to research questions addressing ritual practices, symbolism, economic relations, and medicinal practices.

This project has educational goals as well as research goals, and will provide opportunities for graduate and undergraduate students in analytical chemical approaches as part of the University at Albany anthropology department's focus in archaeometry. The project will strengthen ties between anthropology and other academic units, including chemistry, forensics and life sciences, greatly increasing student training opportunities in diverse but related fields. In addition, select students taking part in the department of anthropology's high school outreach program will be able to take part in this research, greatly enriching the education of urban, pre-college students.

The intellectual merit of the proposed project is based primarily on its potential to contribute to knowledge of the function of prehistoric material culture using proven objective methods to underutilized sets of data. The degree to which alkaloids played a role in prehistoric material culture, such as pottery or stone vessels, is at present largely an unknown variable. A multi-regional, diachronic analysis of material culture for the presence of alkaloid compounds has the potential to contribute to archaeological knowledge of this poorly understood aspect of human behavior.

This project has broader implications for how archaeologists interpret ancient material culture. Despite the critique of empiricism that has characterized much of archaeological theoretical discourse in recent decades, the discipline has lacked a useful methodology that can scientifically evaluate ideational phenomena. The use of techniques derived from analytical chemistry to interpret the function of artifacts will provide an exemplar of research that is empirical in method but not empiricist in theory. It is the hope of the project's investigators to to issues often considered beyond archaeology's ability to investigate, or in the case of the Bronze Age Mediterranean, too contentious to have attracted systematic research projects.