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Analysis of Residue in Pipes that were Smoked by Prehistoric North American Indians in the States and Portions of Canada East of the Mississippi

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Research
Analysis of Residue in Pipes that were Smoked by Prehistoric North American Indians in the States and Portions of Canada East of the Mississippi River

Collaborating with this research are Dr. Charles R. Cobb, Director of the South Carolina Institute of Archaeology and Anthropology at the University of South Carolina; Dr. Sean M. Raftery, Department of Anthropology at the University at Albany, State University of New York; and Tommy Charles, Archaeologist at the South Carolina Institute of Archaeology and Anthropology at the University of South Carolina.

The Beginning
Charles' interest in prehistoric American Indian smoking pipes came about inadvertently. In 1995, while excavating a Middle Woodland Period site (38GR226) in Greenville County, South Carolina, a stone pipe was recovered from a pit feature. A radiocarbon date of 1470 +/- 50 BP (Fig. 1; Table 1, Sample 1) was obtained from a charred residue (dottle) that was in the pipe bowl. Curious about the substance that was smoked at that early time, a sample was sent to Dr. Dale C. Wingleth, ChemaTox Laboratory, Inc., Boulder Colorado, to see if the substance might be identified. Dr. Wingleth was unable to determine the approximately 50 years ago, and from which the possibility of chemical contamination was not a factor. The pipe was a type belonging

<table>
<thead>
<tr>
<th>County</th>
<th>Site</th>
<th>Type</th>
<th>Material</th>
<th>Lab. #</th>
<th>C-14 Date</th>
<th>Material Smoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38GR226</td>
<td>Elbow</td>
<td>Steatite</td>
<td>Beta-40640</td>
<td>Conventional radiocarbon age: 1470 +/- 50 BP Calibration resulting AD 530 to 665 (2 sigma, 95% probability)</td>
<td>Undetermined</td>
</tr>
<tr>
<td>2</td>
<td>38MI388</td>
<td>Elbow</td>
<td>Steatite</td>
<td>38MI388</td>
<td>1470 +/- 60 BP (CARIS-76/37)</td>
<td>Undetermined</td>
</tr>
<tr>
<td>3</td>
<td>38RI34</td>
<td>Irene</td>
<td>Clay</td>
<td>DMA577</td>
<td>640 +/- 40 BP</td>
<td>Cannabis (Marijuana)</td>
</tr>
<tr>
<td>4</td>
<td>9GA</td>
<td>Clay</td>
<td>collector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Turkey Creek, Edgefield Co.</td>
<td>Elbow</td>
<td>Steatite</td>
<td>collector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dogwood River at Lake Hartwell</td>
<td>Limer</td>
<td>Clay</td>
<td>S830-15-1660</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hickory Creek, NC, Near Richmond, Said to be from Iron Creek</td>
<td>Clay</td>
<td>Clay</td>
<td>S830-16-80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Data from pipe analysis. (Table by Tommy Charles)

substance because, in his opinion, modern agricultural chemicals had contaminated it. In the year 2000, from a cultivated field at a nearby site (38GR226), a similar pipe was found and the process was repeated. The date returned was almost identical to the pipe from site 38GR226, but again, the substance was contaminated and could not be identified (Table 1, Sample 2). A third pipe was then acquired from a small mound that was excavated to the Irene culture, and because the pipes estimated age was known, it was deemed unnecessary to spend funds for radiocarbon dating, so only substance analysis was attempted. Upon completion of his analysis, Dr. Wingleth called Charles to inform him that the substance smoked was cannabis (marijuana), and suggested that a radiocarbon date be obtained. A portion of the carbon was sent to Dr. Tom Stafford, Stafford Radiological Labs, Boulder Colorado, and a date of 640 +/- 40 years before present was determined to be much earlier than generally believed for cannabis entry into the New World (Table 1, Sample 3). These data stimulated Charles interest in

Fig. 1: Steatite pipe excavated at site 38GR226. (SCIA44_photo)
determining what other substances might have been smoked during North America’s prehistory. To reduce the risk of wasting funds on pipes whose smoked residues might be contaminated, he resolved to find pipes that were from sources other than modern cultivated fields. To that end, he contacted Dr. Patricia L. Nietfeld, Collections Manager at the National Museum of the American Indian (NMAI), Cultural Resources Center in Suitland, Maryland, and inquired if the NMAI had pipes that might be available for this research. Because of the high cost of analysis, the area of research would be restricted to the states and portions of Canada cast of the Mississippi River. Nietfeld informed Charles that they held approximately 3,000 prehistoric American Indian pipes from sites located cast of the Mississippi, but they were housed in New York at that time. The collections were to be moved to the present NMAI facility in Suitland Maryland, but it would be several years before the transfer was completed and the pipes available for inspection. With the prospect of such a large assemblage of pipes to work with, and all in a single location, it seemed prudent to postpone the project until the move was completed. Becoming involved in other research projects, Charles put pipe research on the back burner until 2007, when Dr. Charles R. Cobb was installed as Director of the South Carolina Institute of Archaeology and Anthropology. Dr. Cobb, or “Charlie,” as he prefers to be called, expressed immediate interest in continuing the pipe research. He requested that Charles contact Dr. Sean M. Rafferty, Department of Anthropology at the University at Albany, State University of New York, because Rafferty was already involved in the study of Native American smoking, and he is on the cutting edge of identification of nicotine by gas chromatography/mass spectroscopy analysis. Cobb suggested that Rafferty might be interested in collaborating with the research. Rafferty did not hesitate to get on board, and Cobb agreed to serve as Project Director for the study. With the support of these two well-established researchers, in the fall of 2007, Charles again contacted Dr. Nietfeld and was informed that the pipe collection was now in the NMAI facility at Suitland, and Charles scheduled a visit for the month of February 2008.

At the NMAI, Tom Evans, a Pawnee Indian from Oklahoma, was assigned to assist Charles with the pipe inspection and was quickly determined that pipe dottle would be scarce. It was a huge disappointment to learn that all but a few of the pipe bowls had been thoroughly cleaned and carbon, in amounts useful for our research, was found in only 35 pipes. Charles was then informed that the National Museum of Natural History (NMNH), a Smithsonian facility adjacent to the NMAI, had an extensive collection of pipes in their Department of Anthropology, and perhaps a search of their collections would be more rewarding.

Arrangements were made and several days were spent perusing the pipes with the NMNH Staff members David Rosenthal and James Krakker. More than 1,600 pipes were examined and as hoped for, the results were somewhat better, and 72 pipes containing various amounts of charred smoking residue were documented.

Where Do We Go From Here?

A research proposal has been submitted to the NMAI and the NMNH requesting permission to extract carbon residue from the pipes containing dottle. Assuming our request will be granted, we will have
two primary research objectives. First, we will attempt to identify the substances represented by extant residues associated with smoking pipes in the museum's collections. This will then allow us to assess whether there were regional and/or chronological differences in smoked substances.

One of the central questions in Native North American ceremonial behaviors is whether tobacco (native to South America) and smoking pipes were introduced together as a system, so we are particularly interested in the timing of the use of tobacco versus indigenous North American plants as smoking materials. Our second object, integrally related to the first, involves establishing a chronology of the pipes and their residues through AMS dating. This will help us to establish whether tobacco appeared across eastern North America in a relatively contemporaneous manner, or if it appeared in a location(s) from which it then spread. The chronological research will also allow us to make preliminary determinations about the functional and stylistic evolution of pipe forms. New developments in mass spectrometry and related techniques now allow even very tiny fractions of residues to be analyzed, thereby leaving sufficient residue from the sample for AMS dating. In the interim, Dr. Rafferty is conducting a pilot study with dottle collected from five pipes native to North and South Carolina. This will allow an opportunity to further evaluate methodology and the results that may be expected. Three of the pipes are illustrated in Figs. 2, 3 and 4.

**Data Needs**

Carbon samples must be obtained from each pipe that is to be tested. The amounts should be at least .5 gram to ensure that both substance analyses and radiocarbon dating might be done. Some pipes examined at the NMAI and the NMAH have carbon in sufficient amounts to

![Pipe](image)

Fig. 4: Pipe used in a pilot study of smoking substances.

accomplish this, others have lesser, but useful amounts for either of the two analyses but perhaps not for both. That can only be determined when removal of the carbon is done.

**Methodology**

Carbon samples will be collected from selected pipes and placed in sterile glass vials and the pipe data (museum and/or site provenience) recorded on each container. These samples will be split into two parts. One part will be used to obtain a radiocarbon date for the pipe and the other portion will be analyzed for substance identity. Substance identity will be attempted by a Gas Chromatography/Mass Spectroscopy technique (GC/MS) under the direction of Dr. Sean Rafferty. Each pipe will be photographed when the carbon samples are removed, and its museum provenience included in the photograph to insure data control.

**Significance to Knowledge**

Much has been written about the history of tobacco and other substances utilized by the Native Americans, but no in-depth study has been done to determine uses of these plants over a broad landscape and over time. Our knowledge in this regard has been greatly hindered by the tiny size of tobacco seeds, making them very difficult to recover using traditional archaeological screening methods. Moreover, ethnohistoric accounts describe a wide array of substances beside tobacco that were smoked, but we have a poor understanding of the chronological and regional appearance of those substances. New breakthroughs in chemical and physical analytical techniques provide the opportunity to directly identify substances smoked in pipes, rather than drawing inferences from botanical assemblages recovered in archaeological soil contexts. In addition, regardless of the degree of success in identifying all of the substances that were smoked, we will be able to firmly establish and refine smoking pipe-style chronologies for Eastern North America.

**Budget**

Radiocarbon dating will be by Beta Analytic, Inc., at an estimated cost of $600 per sample. The cost per sample for GC/MS analysis is pending. Funding for the project will come from a combination of grants and contributions from the private sector.