Determining Ancient Maya Cuisine and Vessel Function at Cerro Maya, Belize

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Abstract

To determine what foods were prepared with ancient Maya pottery and ground stone, different methods of residue analyses can be used to investigate ancient food production tools. Artifacts from the Cerro Maya collection were evaluated for possible residue testing, and four ceramic vessels were selected for preliminary analysis. Samples taken from the interior of the vessels were collected and extracted in preparation for mass spectrometry testing. Results from the first vessel to undergo ultra high performance liquid chromatography-high resolution mass spectrometry (UHPLC-HRMS) testing, a small tripod cup dating to the Postclassic Period, revealed the presence of three chemical biomarkers for cacao, indicating that it once contained chocolate.

Introduction

Increasingly, residue analysis is being used to investigate the function of Maya vessels and tools and to determine what substances they may have held and processed. Residues may be visible or not, and may consist of burned, carbonized food, microscopic remains or chemical compounds adhering to the surface or absorbed into the walls of the vessel. Absorbed food residues within the pottery walls and ground stone tools can survive, and can include plant and animal fats and oils, waxes, resins and other organic chemical compounds such as alkaloids (see Evershed 2008).

Studies of these residues by gas chromatography-mass spectrometry (GC-MS), liquid chromatography-mass spectrometry (LC-MS) and stable carbon isotope analysis can, under certain conditions, be used for species identification. Compounds used to identify specific plants and food products are called biomarkers, and function as a "chemical fingerprint". Increasingly, these biomarkers are proving useful to the archaeological study of past foodways and technology, and pottery is proving to be a valuable source of these substances.

In addition to chemical residues, pottery vessels and stone tools used for food storage and preparation can also yield microscopic plant remains such as pollen, starch grains, and phytoliths. These microbotanical residues can undergo microscopic analysis and often reveal the presence of specific species, genus or families of plants (see Piperno 2009).

Selection Criteria

When selecting archaeological specimens for possible residue testing, there are multiple factors to consider. First is the archaeological context of the artifact, including where the item was physically located. Knowing whether it was found exposed on the surface, in a sealed burial, a midden, construction fill, or a low area prone to flooding or tides is critical as this affects an item's potential as a source of residues. Other important questions include the cultural context of the vessel as this affects the kinds of residues that may potentially be present. Vessels used in different contexts would be expected to have different residue profiles, and based on the preservation environment, might also have variable levels of surviving residues and potential contamination from soils and the surrounding environment.

Taking all of these factors into consideration, choosing the appropriate items for sampling should also be based on the research questions to be addressed and what residues are most likely to be found. If research is focused on basic subsistence or foodways, then cooking or food preparation vessels and tools from domestic household contexts would be appropriate (see Reber et al. 2004). Research that is more methodologically based could sample from all of these areas, particularly where good vessel preservation is demonstrated (see Coyston 2002). In this case, vessel choices could be based on comparing results from different preservation contexts, sub-complexes, vessel forms, geographic regions or confirming epigraphic labels or ethnographic analogues.
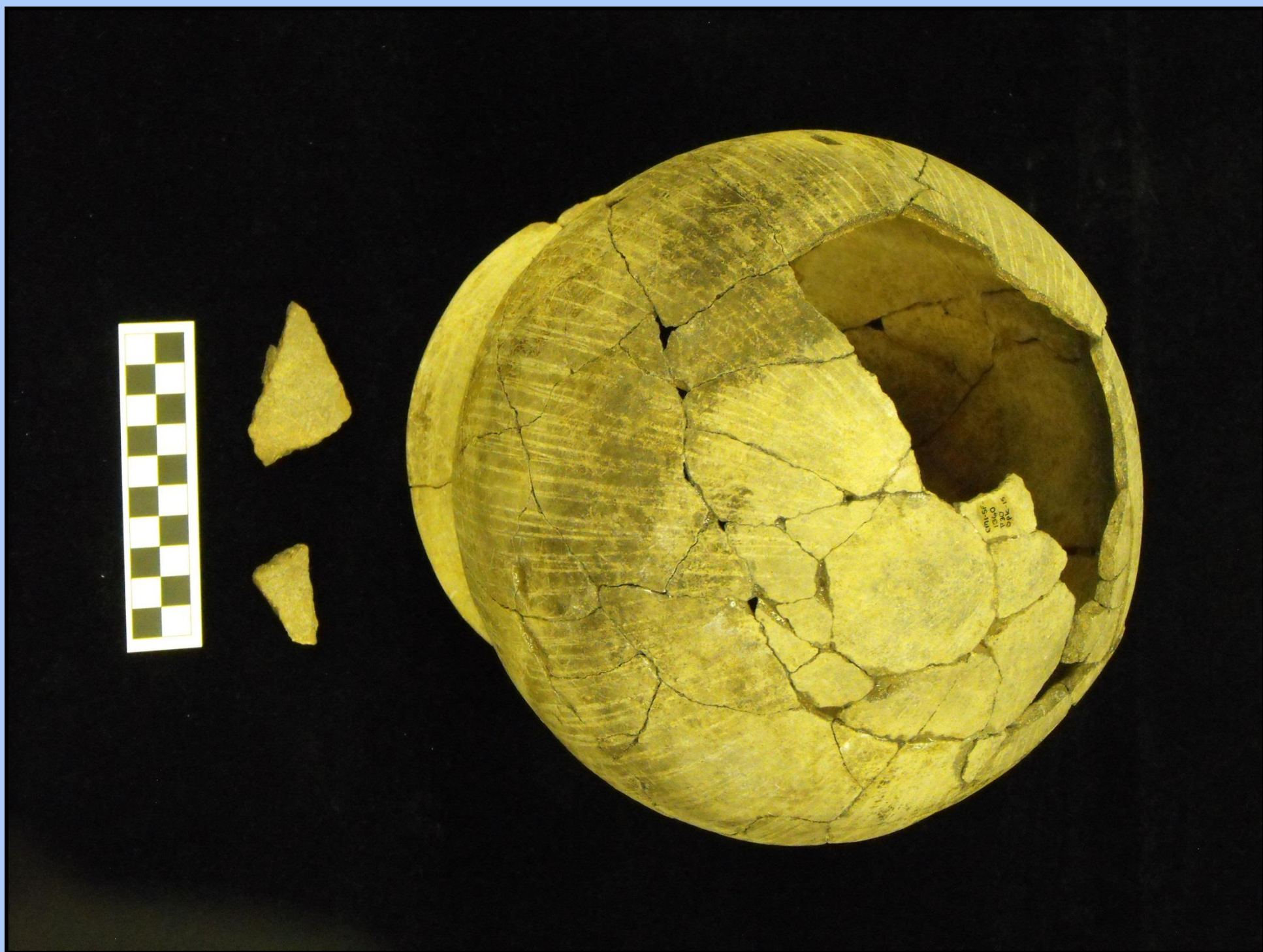
Food Preparation Tools
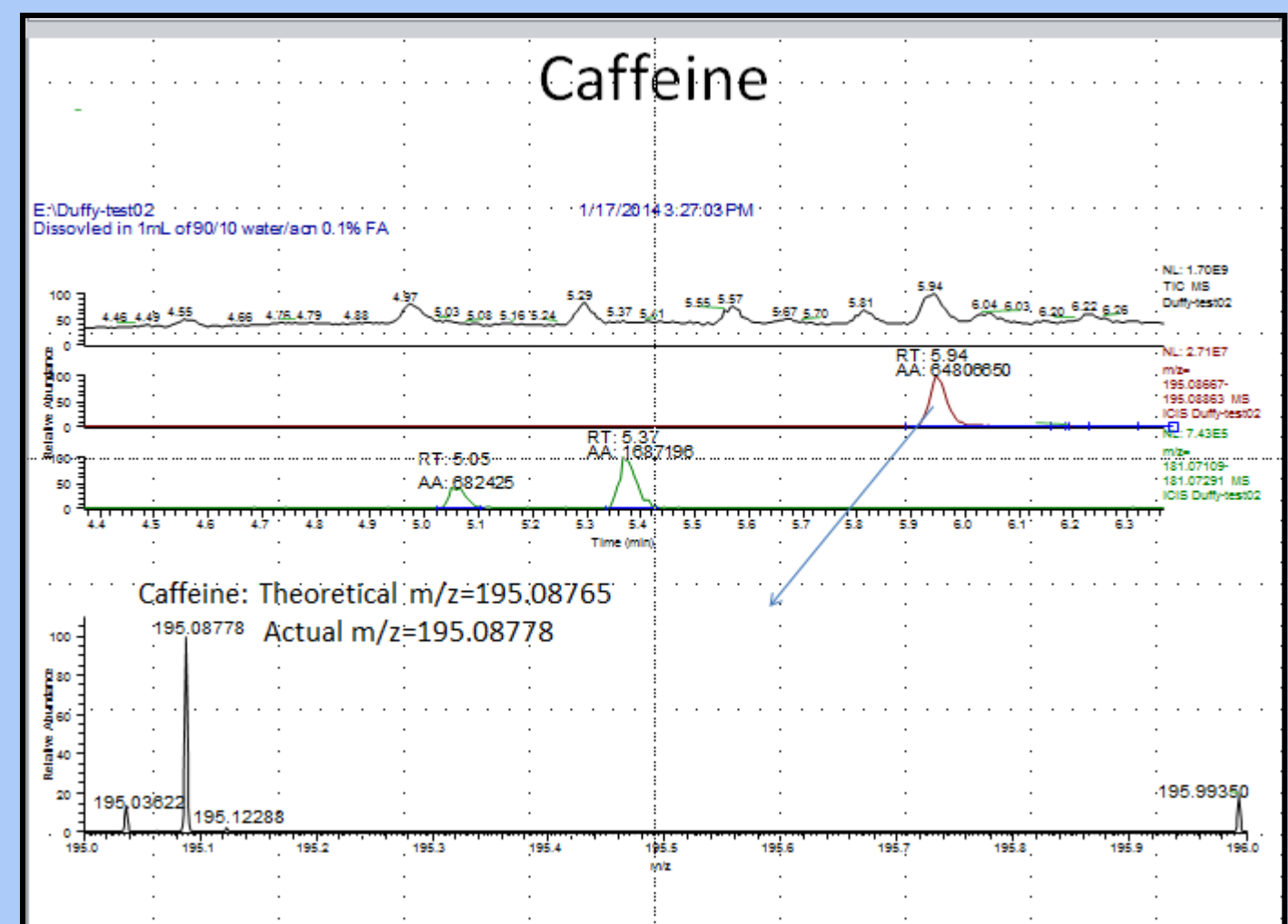

"Chili Grinder" sherd from Cerro Maya, Belize

"Beer Mug" from Cerro Maya, Belize
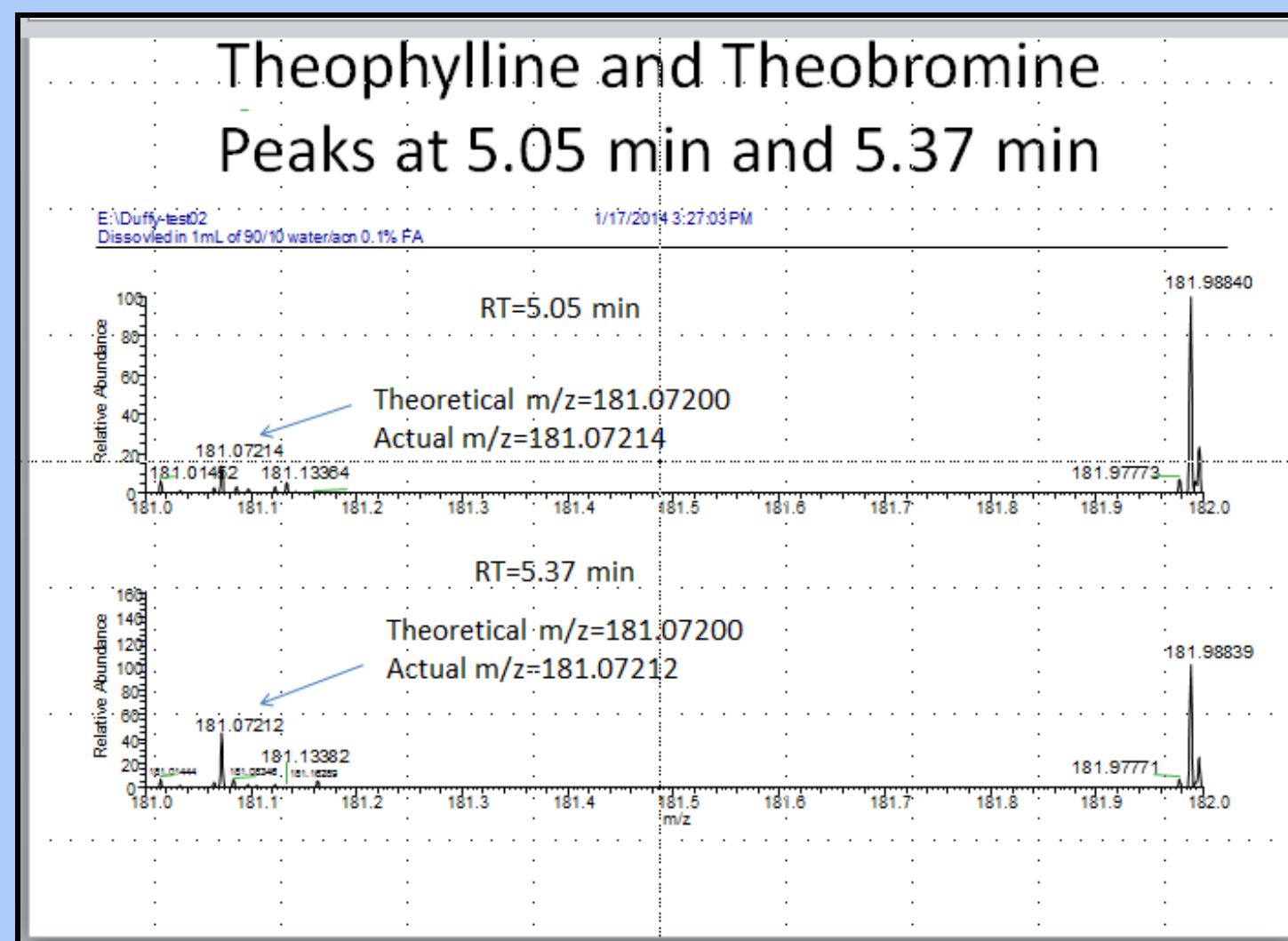

Cooking Pot from Cerro Maya, Belize

Collecting Residue from Tripod Cup

UHPLC-HRMS Chromatogram Indicating Caffeine
(Testing performed by UF Biomedical Mass Spectrometry Lab)

Sample Preparation

UHPLC-HRMS Chromatogram Indicating Theobromine and Theophylline
(Testing performed by UF Biomedical Mass Spectrometry Lab)

Analysis

Four pottery vessels from Cerro Maya, Belize were selected for preliminary chemical residue analysis. Each of these items represented different time periods, preservation and curation contexts. Each specimen will undergo targeted analysis for specific compounds based on the most likely use of the vessel.

Tripod Cup (9401e-3): A small, complete, unslipped cup that is unwashed and from a Postclassic context (Circa A.D. 1300) This vessel underwent UHPLC-HRMS testing to look for the chemical markers of cacao and chili peppers, which are ingredients commonly used for beverages by the Maya. **Results** were positive for caffeine, theobromine and theophylline-compounds found in cacao.

Chili Grinder (CMI 17054): A fragment of incised, slightly curved footed bowl from a Terminal Classic/Sihnal phase deposit (A.D. 850-1150). Samples from this vessel will be tested by LC-MS for evidence of capsaicin, one of the active ingredients found in chili peppers.

Beer Mug (SF 029): A complete drinking vessel recovered from the Late Preclassic/Late Tulix phase (50 B.C.-A.D. 200) burial of a young child. This vessel will also be tested by LC-MS for evidence of cacao and chilies that may have been used to create beverages.

Cooking Pot (SF 1360): A reconstructed, round-bottomed pot with external fire-blackening indicating its use for cooking. It was recovered from a Late Preclassic/Early Tulix phase (200 B.C-50 B.C.) dedicatory cache in one of the village structures. This vessel will undergo lipid analysis by GC-MS to look for cholesterol and other fats.

Extraction Method: Samples were collected by scraping the interior of each vessel with a solvent-rinsed stainless steel dental scraper. Samples were placed in glass vials and taken to the Organic Geochemistry lab in the Geology department at UF. The samples were weighed, placed in filter canisters and extracted via an Accelerated Solvent Extractor using a heated solvent mixture of 2:1 chloroform:methanol. After extraction, samples were placed in solvent-washed vials and evaporated in a Turbo-Vap warm water bath under a flow of purified nitrogen gas. After evaporation, 250 µL of Hexane was added to each vial. Samples were stored refrigerated or frozen while awaiting testing.

Discussion and Future Directions

In trying to understand cuisine, food preparation and vessel function, we are also trying to understand the people and the society that produced it. Looking at the decisions affecting the use of pottery vessels and stone grinding tools through ethnography has helped in archaeological interpretation, as has experimental archaeology in understanding the physical and visual effects of different processes on ceramic vessels and stone tools. Building on earlier foundations, residue analysis has moved beyond simple (and not so simple) questions of what foods were present, and is asking more complex questions such as how food was procured, prepared, combined and served.

For many reasons, food preparation tools and vessels are good vehicles for archaeological inquiry when looking at cultural systems, change and interactions. Pottery and ground stone can be the product of one individual, and also an entire society. They can be local items or exotic trade goods, a routine household item, a finely crafted elite object, or an item of ritual importance. Some artifacts may serve more than one of these functions over the course of their use-life. This is certainly true at Cerro Maya where a humble, utilitarian cooking pot or metate can end up in a burial or a cache. As technology expands the reach of archaeology into more detailed approaches to material goods, such as residue analysis, the subtle traces of prior use become more apparent and give a more nuanced view of past lifeways.

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