Sourcing Volcanic Glass Temper in Potsherds from the Va'oto Site

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Petrology 2010

Project Goals

- **Identify** and **source** volcanic glass found in *6 potsherd* samples from **Va'oto, Ofu**
- Differentiate between additional **inclusions** and **temper**
- *From this, we can better our understanding of:*
- Ancestral Polynesian **craft specialization**
- **Resource acquisition**
- And ULTIMATELY, ancestral Polynesian **colonization** and their **origins**

Methods

- Petrography
- Scanning electron microscope
- X-ray analysis

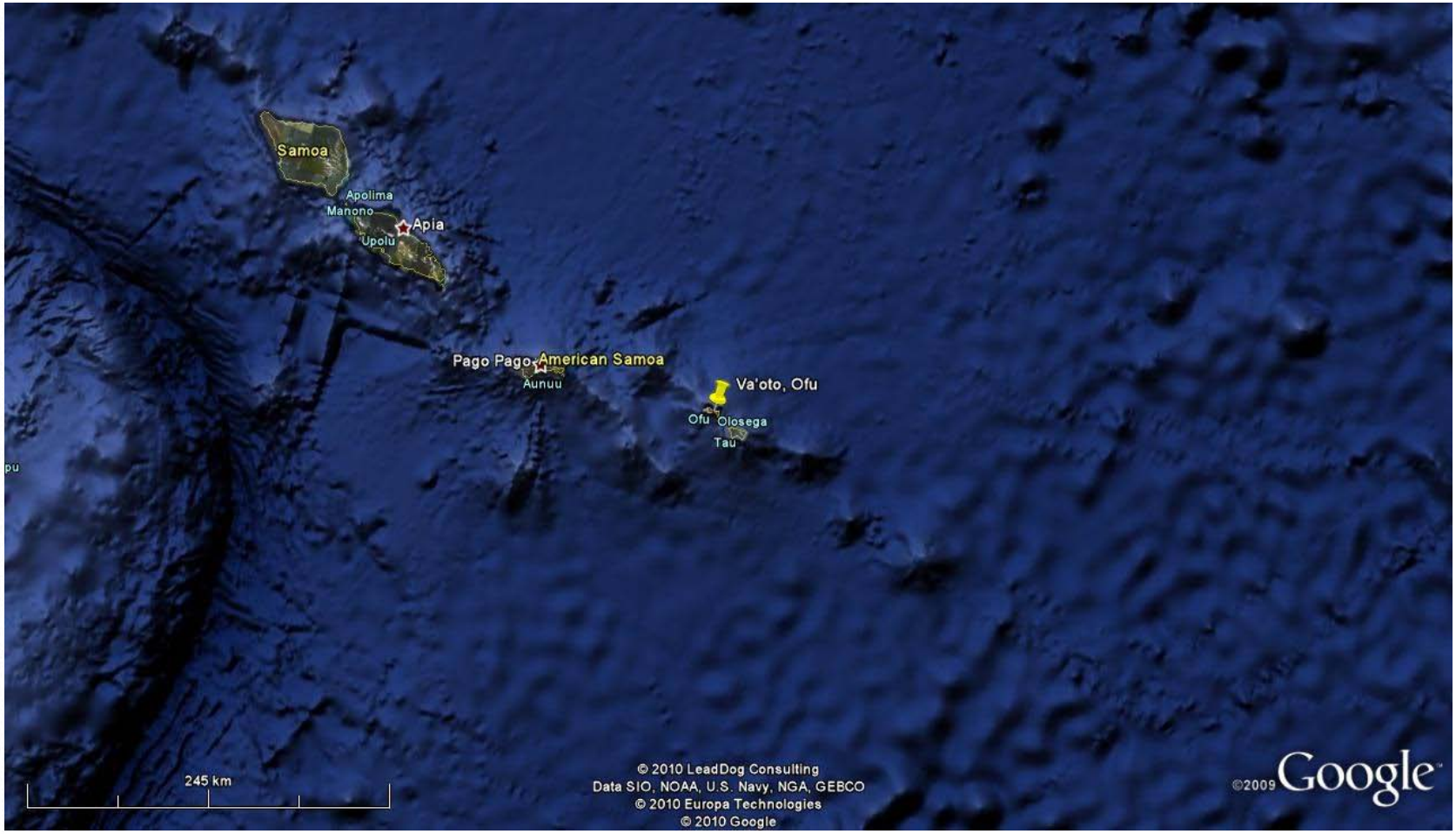
Terminology

- **Temper** modifies clay workability by making the clay less plastic and less sticky
- Decreases shrinkage
- Allows for a clay's vitrification temperature to decrease during the firing process
- Can determine color and increase porosity or strength of the pot
- Ranging from various types of igneous, metamorphic and sedimentary rocks, grog, salt, sand, ash, blood, bone, shell, coral, dung, and plant material
- **Temper** choice is made based on what the potter wishes to achieve with the final product

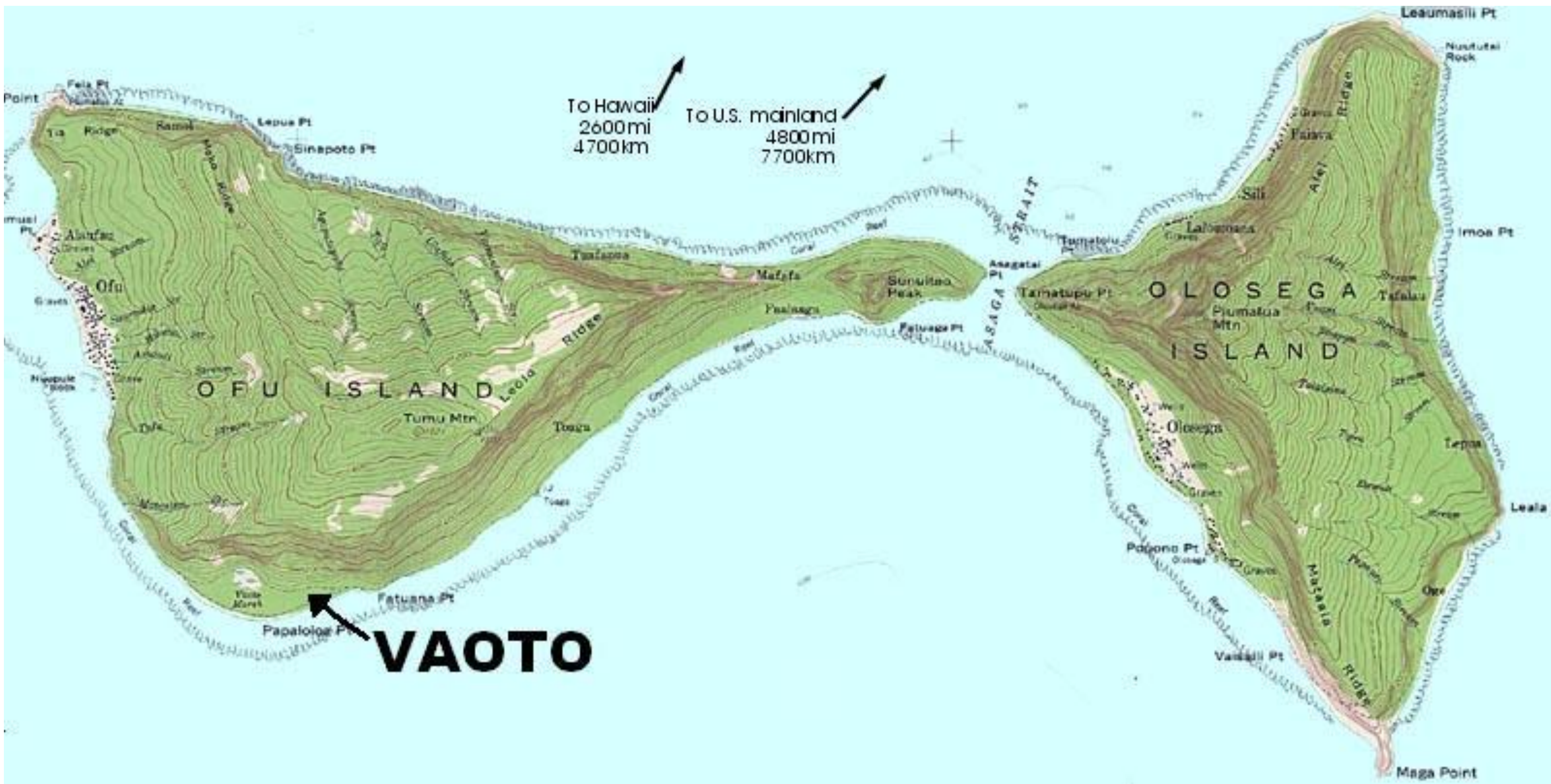
Oceania

- West Polynesia
- Samoan Archipelago

Samoan Archipelago



Va'oto, Ofu


To Hawaii
2600mi
4700km
To U.S. mainland
4800mi
7700km
OFU ISLAND
OLOSEGA ISLAND
Tumu Mtn
Leaumasili Pt
Imoa Pt
Maga Point
Vailasili Pt
Fatuana Pt
Papaloloa Pt
VAOTO

Background Information

- Geological Context
- Cultural Chronological Context
- Archaeological Record

Geological Context

- The chain of islands is situated on the **Pacific Plate**
- North of the western **Tonga-Kermadec Trench**
- Each island is composed of **lavas** and **pyroclastics** from basaltic shield volcanoes
- Volcanism is recent in the east
- Older towards the west
- In the east, Ta'u is less than 100,000 years old
- In the west, Savai'i dates to 2.52 MYA
- Formed by a **hotspot**, 150 kilometers east of Ta'u, moving westward along with the Pacific Plate

Cultural Chronological Context

- Modeled on the basis of cultural remains including **artifacts** and **features**

The West Polynesian ceramic sequence (Green 1974 and Kirch 1984)

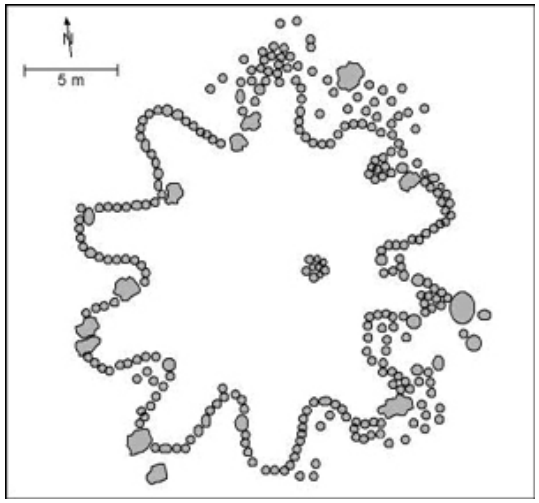
Period	Date Range	Material Traits
Ceramic Periods		
Early Eastern Lapita	3100-2700 BP	Decorated vessels: Dentate stamped, jugs, plates, and shouldered pots
Late Eastern Lapita	2700-2300 BP	Decoration limited to rims and shoulders, Dentate stamping, notching incised decoration
Polynesian Plainware	2300-1700 BP	Undecorated pottery, Bowls
Aceramic Periods		
Dark Ages	1700-1000 BP	Absence of pottery

Archaeological Record

- What is **not** preserved:
- Canoes
- Houses
- Weapons
- A **significant** amount of material

Archaeological Record

- Adzes
- Fish hooks
- Tattooing Tools
- Stone features
- Pottery



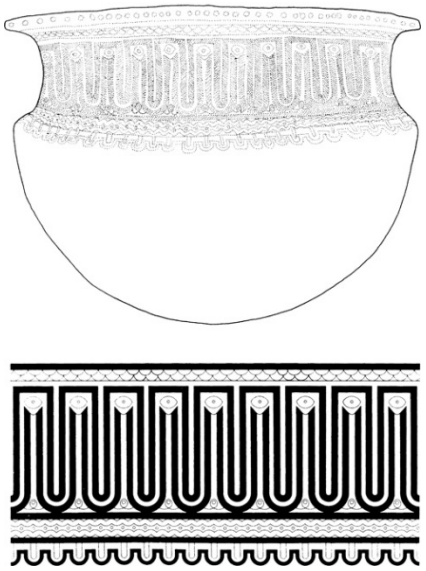
http://www.nma.gov.au/cook/images/collection/detail/206.jpg
http://www.samoanarchaeology.org/default.asp?s_page=sampre

Pottery

- Lapita
- Polynesian Plain Ware

Lapita Pottery

- **Dentate-stamped**
- Trade ware
- 3100 to 2300 BP

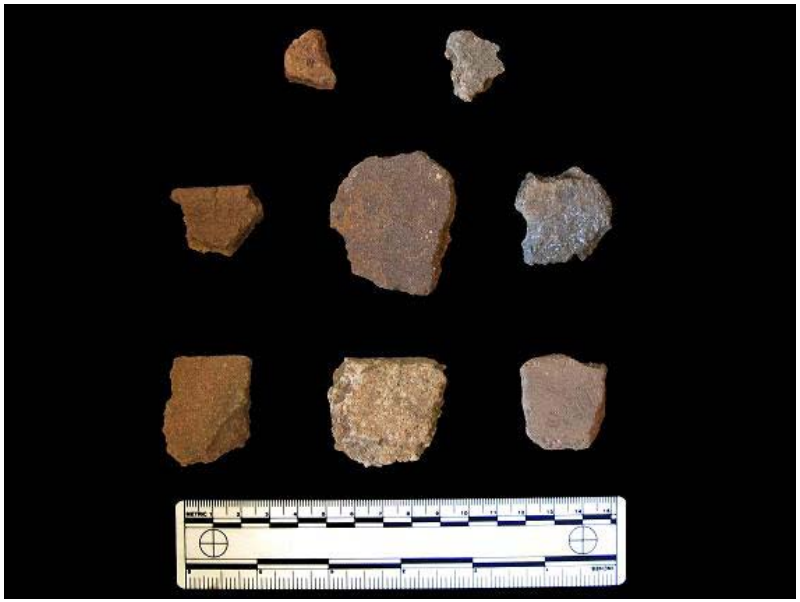


http://www.vanuatuculture.org/site-bm2/vchss/20060706_lapita_pot_exhibit.shtml

http://epress.anu.edu.au/austronesians/austronesians/images/c06f001.jpg

Polynesian Plain Ware

- **Lack** of dentate-stamping
- Simple vessel forms and sizes
- Simple bowls and flat-bottomed dishes
- 2300 to 1700 BP



Decline of Pottery

- Still **widely** utilized from **2000 to 1500 BP**
- After **1000 BP**, pottery became **uncommon** in Samoa and **absent** from many areas
- **Rare** around **700 to 400 BP**
- **Abandoned** throughout the islands by **400 BP**
- Possibly due to change in **cooking methods**
- Raised-rim ovens, or *umu ti*

Decline of Pottery and the *Umu*

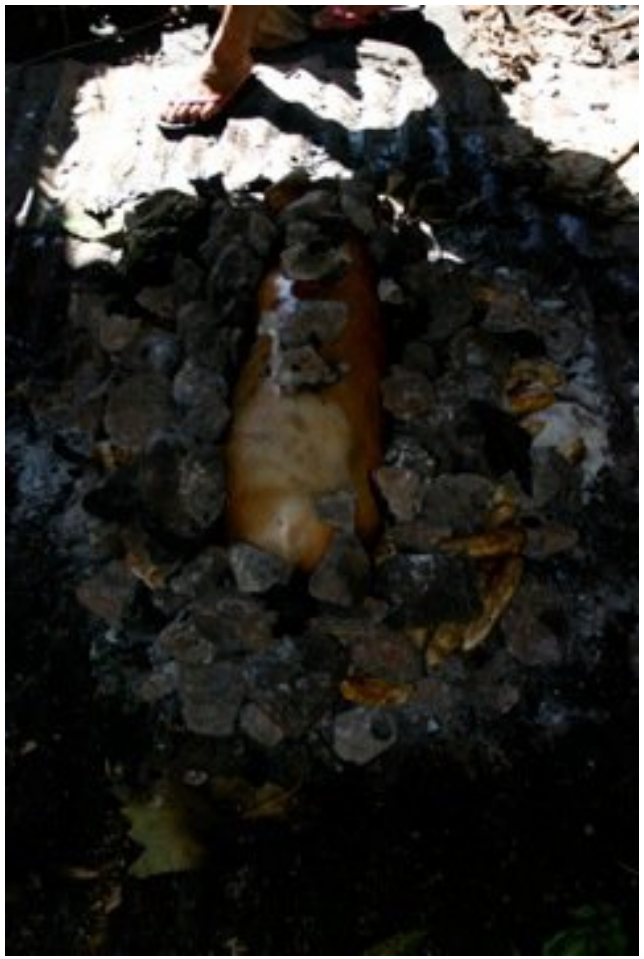
- An *umu* is a ground oven
- Appears in the archaeological record with the absence of pottery

Decline of Pottery and the *Umu*

- First a fire is built
- Stones are placed on top of the fire
- When the fire is down to embers, pig, breadfruit, taro, or fish are placed on top

Decline of Pottery

- Items to be cooked are covered with banana leaves and left to cook

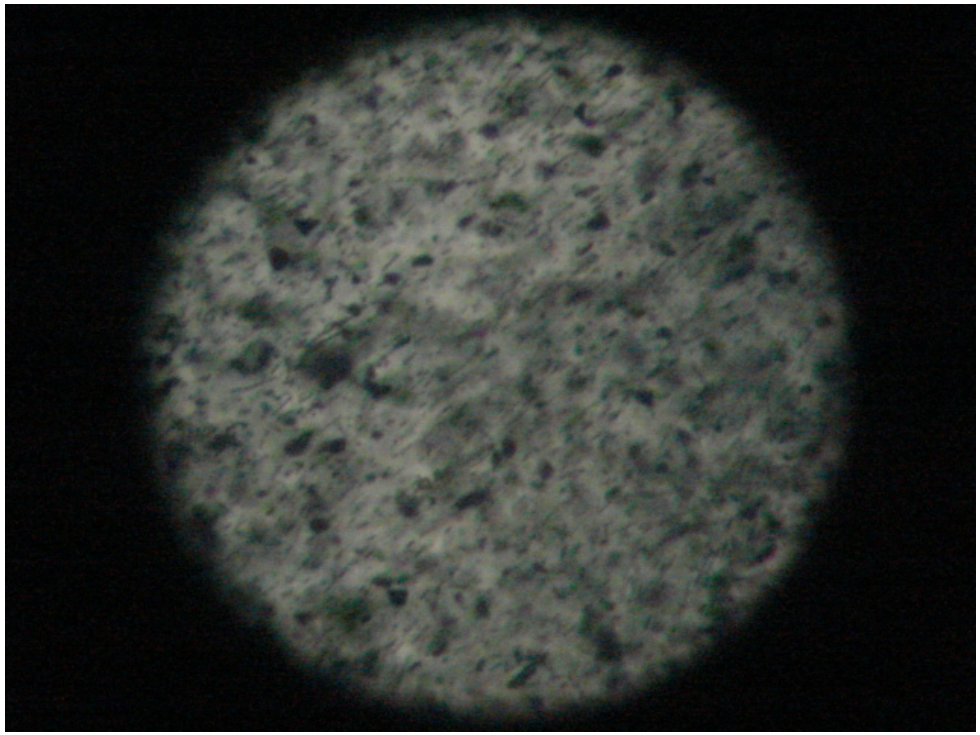


Petrographic Analysis

- Potsherd samples (n=3) from lower strata layers (97 to 191 cm below depth)
- Samples (n=3) from upper strata layers (0 to 97 cm below depth)
- Samples are radiocarbon dated to Polynesian Plain Ware period (2300 to 1700 BP)
- Volcanic Glass Nodule (n=1) from the same context used as control

Volcanic Glass Nodule

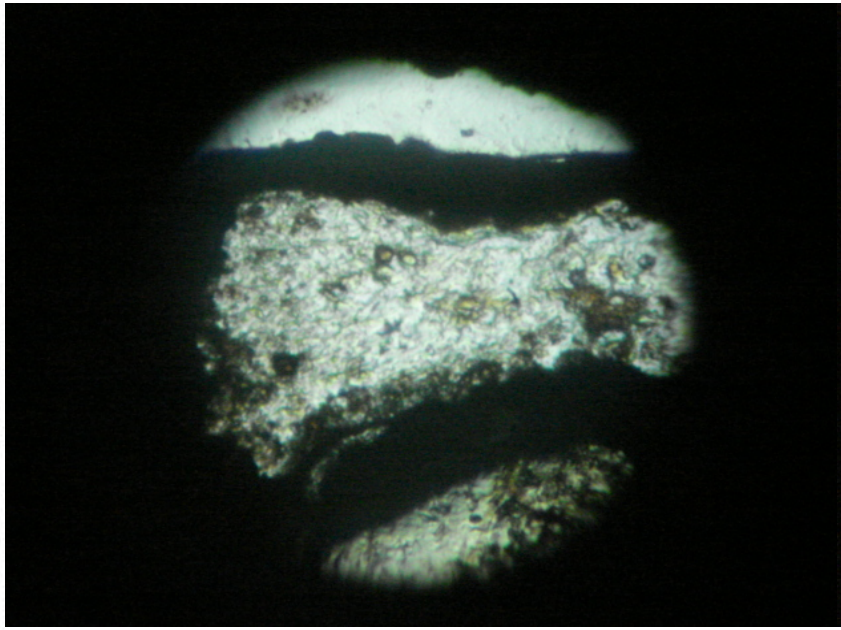
PP, 4x



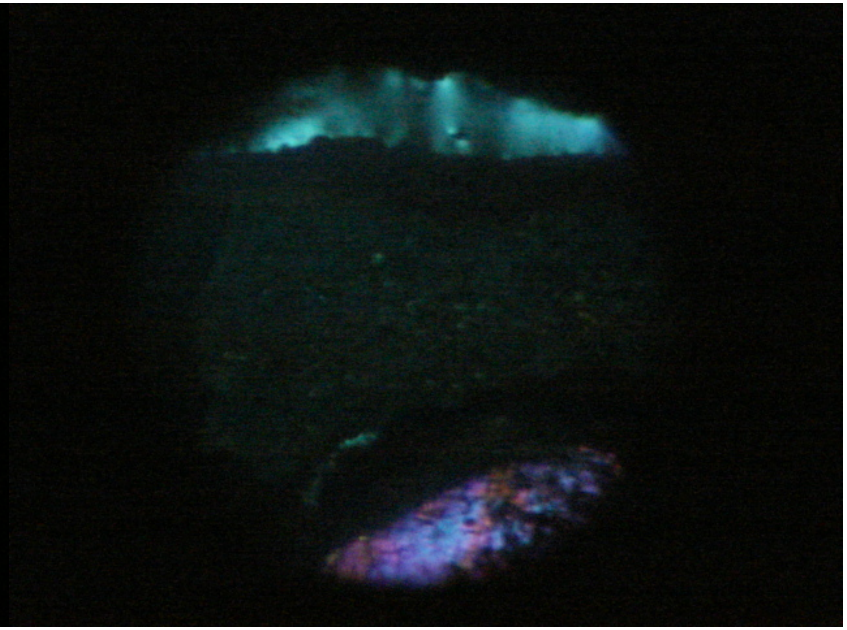
Volcanic Glass

- Samples 186, 206, 852, 32, 76, and 1306

PP, 4x



XP, 4x

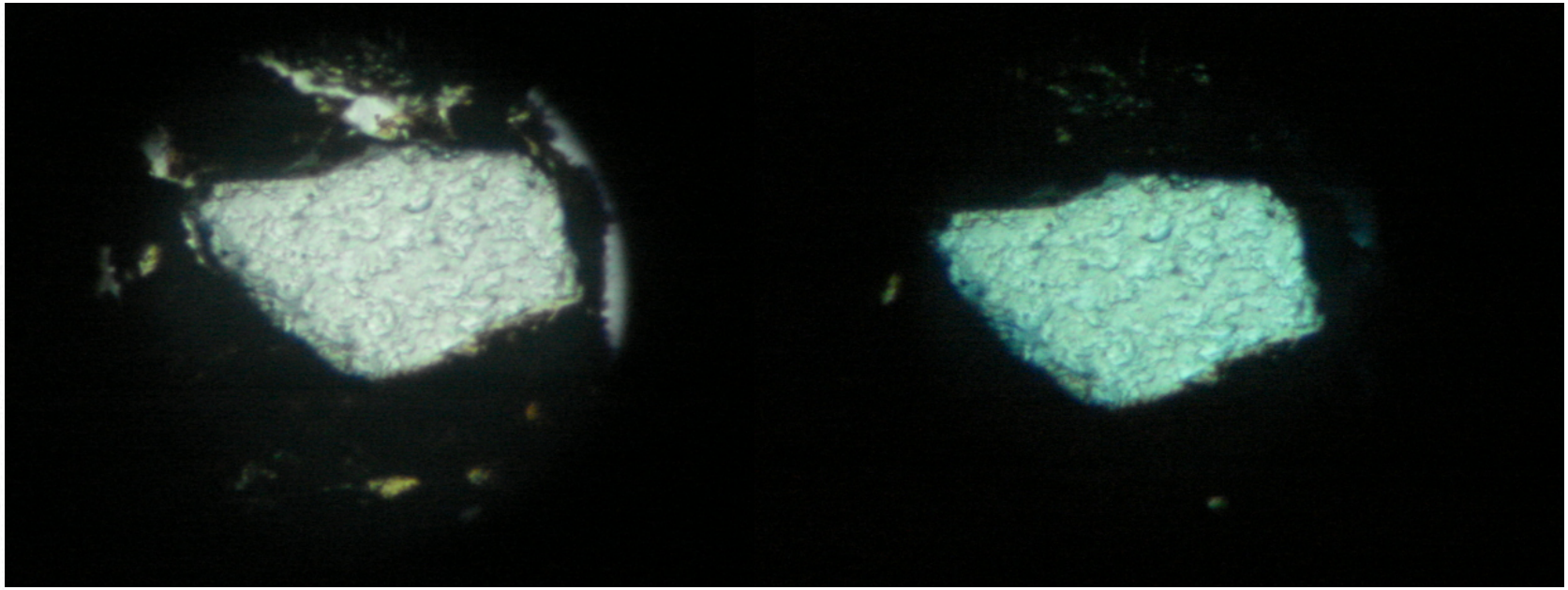


Quartz

- Samples 32, 76, 186, 1306

PP, 4x

XP, 4x

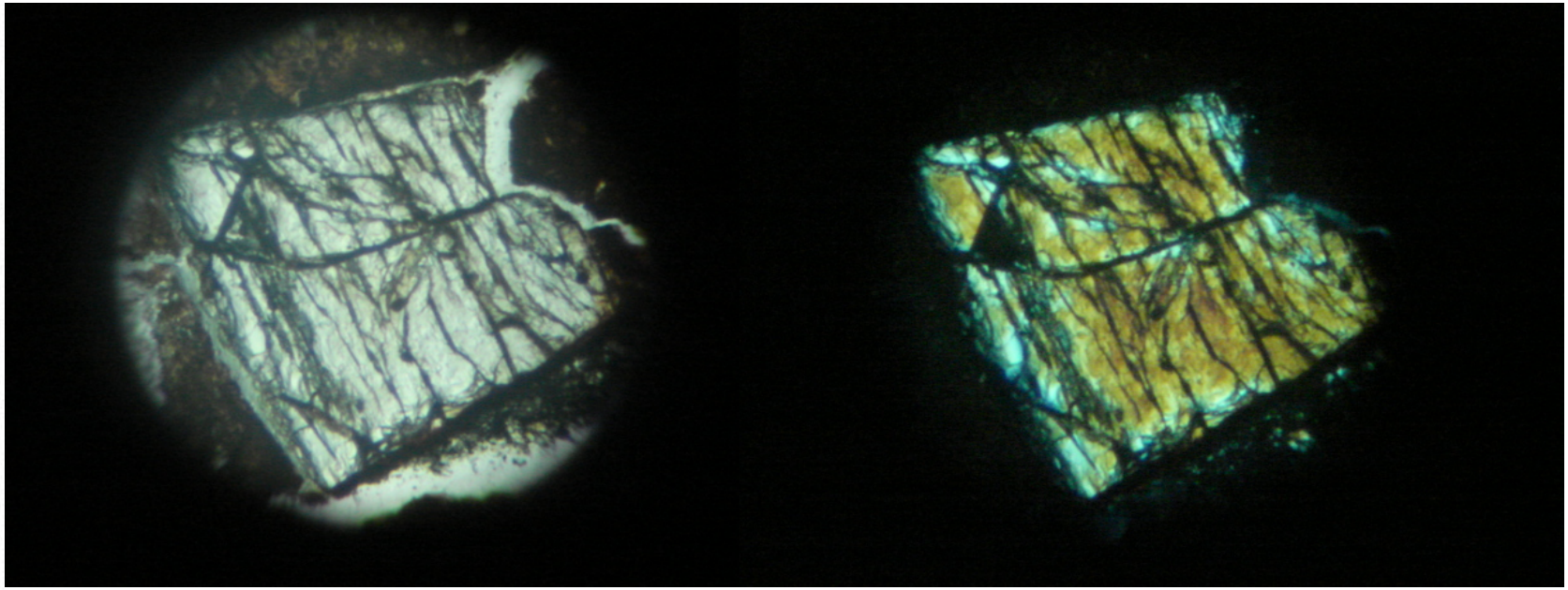


Olivine

- Samples 852, 32, 76

PP, 4x

XP, 4x

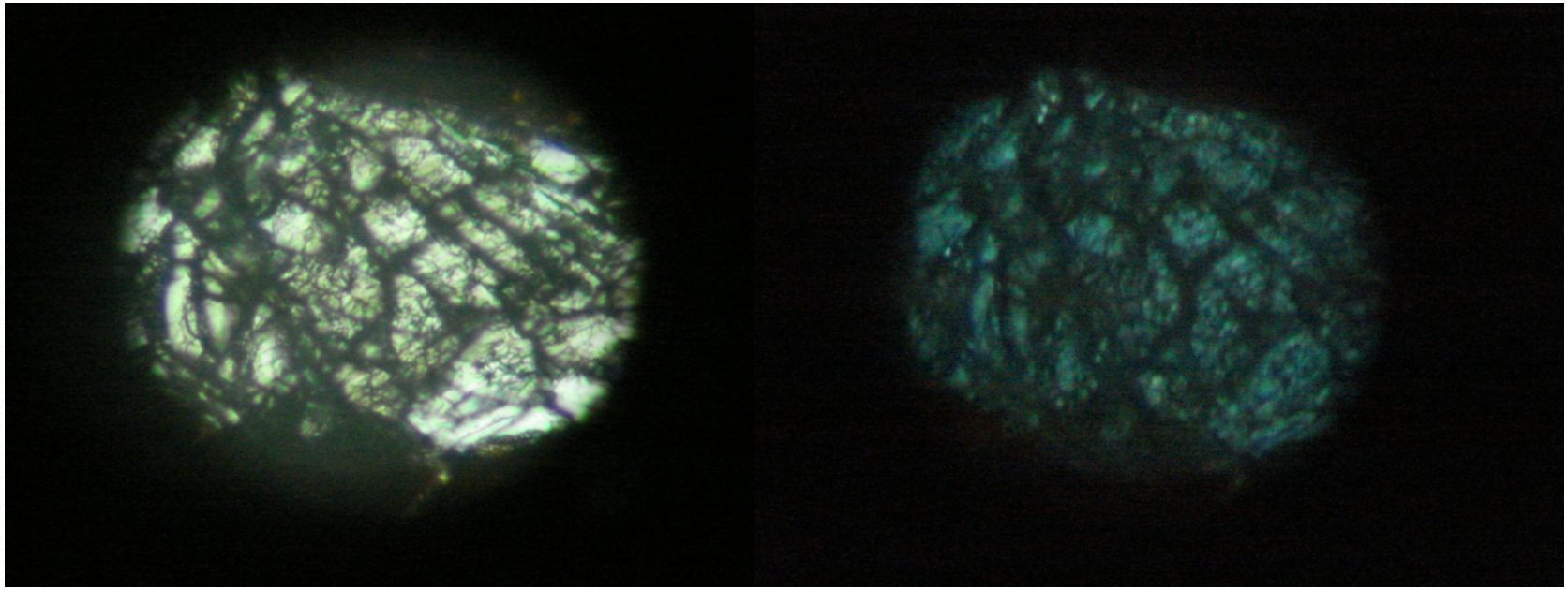


Hypersthene

- Samples 852, 76

PP, 4x

XP, 4x

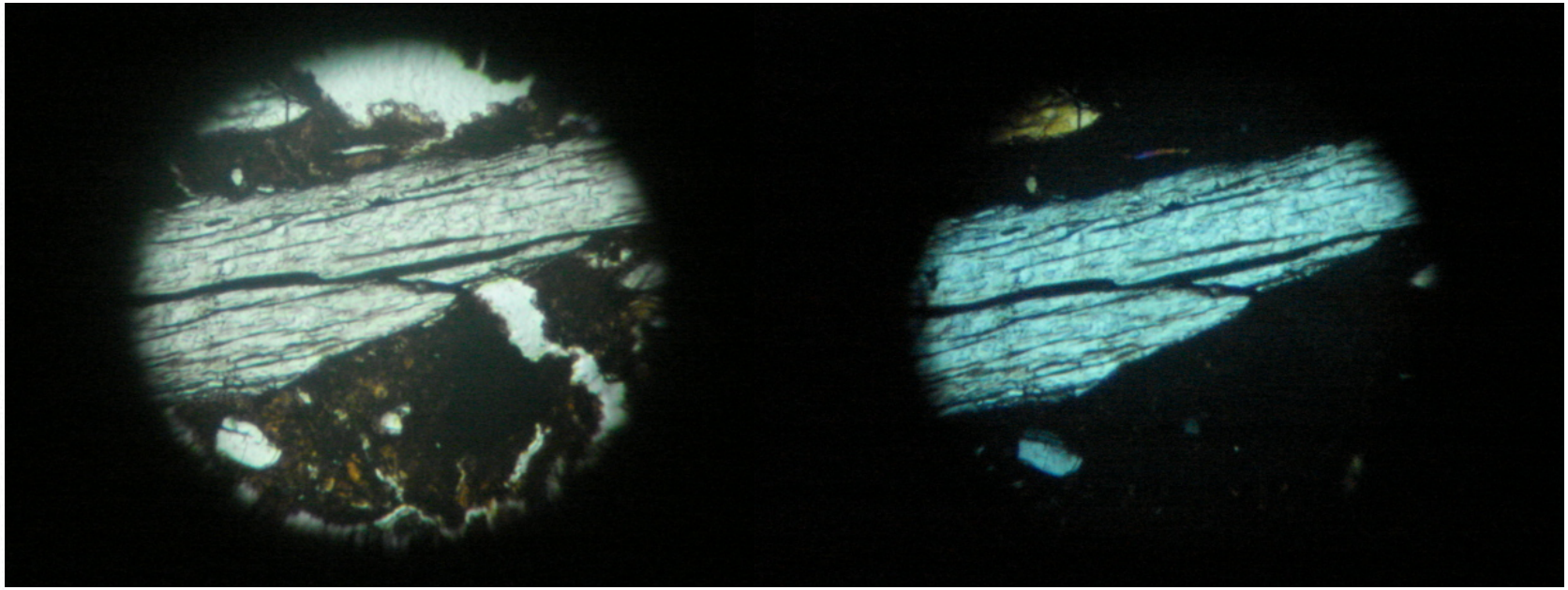


Pigeonite

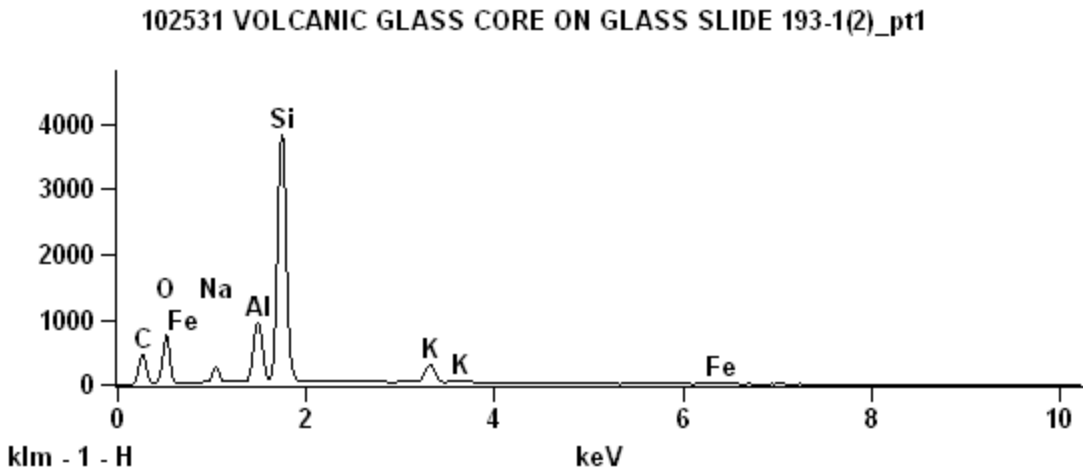
- Samples 32, 76

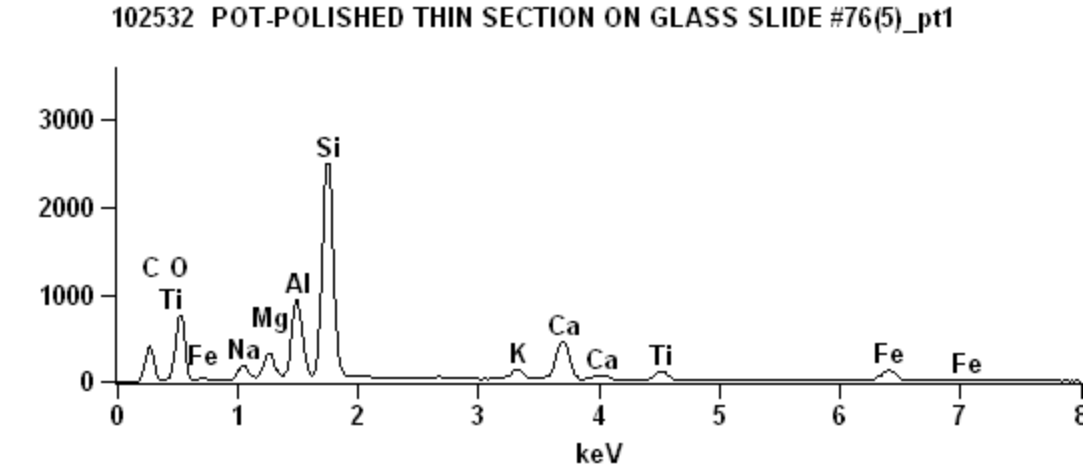
PP, 4x

XP, 4x



X-Ray Analysis





Results

- Volcanic glass was **identified** in 6 potsherd samples in lower and upper strata from **Va'oto, Ofu**
- These also match the volcanic glass nodule
- Additionally, 4 other temper types were identified by grain shape (angular)
- These include: Quartz sand, olivine, and pyroxenes (hypersthene, pigeonite)
- Quartz sand temper was identified in 4 of the samples, and these were distributed in both lower and upper strata
- Due to low sample size (n=6), difficult to determine olivine and pyroxene tempering
- X-ray analysis show chemical additions of Mg and Ca

General Conclusions

- **Craft specialization:**
- Va'oto potters utilized volcanic glass temper
- How intensive, unknown, more samples must be tested
- Va'oto potters also utilized Quartz sand temper
- Olivine and pyroxenes were left out in some of the final products
- **Resource acquisition:**
- Quartz sand is readily available from the potters location
- Volcanic glass, however, is not
- Only nodules, such as the control sample
- Therefore, volcanic glass nodules would require transportation from another island
- Olivine and pyroxenes may have been utilized unintentionally due to availability
- Tempering with volcanic glass and quartz sand prevents cracking of vessel during firing process

References Cited

- Clark, J. T., and M. G. Michlovic. 1996. An early settlement in the Polynesian homeland: Excavations at ‘Aoa Valley, Tutuila Island. *Journal of Field Archaeology* 23:151-167.
- Dickinson, W. R. and R. Shutler, Jr. 2000. Implications of Petrographic Temper Analysis for Oceanian Prehistory. *Journal of World Prehistory* 14:3.
- Freestone, I. C. 1992. Ceramic Petrography. *American Journal of Archaeology* 99, 111-115.
- Garrison, E. G. 2001. Physics and Archaeology. *Physics Today* 54:10, 32-36.
- Green, R. C. 1974. A Review of Portable Artefacts from Western Samoa. In *Archaeology in Western Samoa. Vol. 2, edited by Roger C. Green and Janet M. Davidson, pp. 245*-275. Bulletin No. 7. Auckland Institute and Museum: Auckland.
- Rice, P. M. 1987. *Pottery Analysis: A Sourcebook.* The University of Chicago Press, Chicago.

Thank You