Tobacco Smoking in Northwestern North America
Synthesizing the Results of Organic Chemical Residue Analyses

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Introduction

Smoking—as evidenced by the presence of stone smoking pipes in the archaeological record—has been a part of the traditional practices of indigenous peoples in Northwestern North America for thousands of years. Popular conceptions of these practices have often assumed tobacco to be an exclusively introduced smoke plant, replacing other, native plants in use before the arrival of Euroamerican trade goods in the region. Evidence from the earliest ethnohistoric records shows clearly that indigenous species of tobacco were used—and frequently cultivated—by Native peoples in many parts of the region. Until recently it was only possible to speculate as to the depth into antiquity of tobacco use in region. However, a series of chemical residue analyses on stone smoking pipes and pipe fragments by the authors of this poster and others has provided new insights into the spatial and temporal limits of indigenous tobacco use.

Ethnohistoric Background

- The Native peoples of the Pacific Northwest incorporate a wide variety of plants in their smoking practices (Table 1).
- Kroeber (1941) identified tobacco as a central smoke plant in the on the southern Coast and Inland Plateaus but indicated that not all groups preferred tobacco or had access to it (Figure 1).
- Not all groups who traditionally smoked used stone pipes, some coastal groups used plant or other perishable materials as pipes, meaning some past smoking practices may be nearly invisible archaeologically.
- In the early nineteenth century, David Douglas (1914) noted indigenous tobacco gardens and collected samples which were identified by later researchers as Nicotiana quadrivalvis (Hammet 2000).
- Tobacco is often considered to be a sacred plant and frequently plays a role in ceremonial and other important events among Interior Northwest peoples (Keddie 2016; Turner 2014).

Figure 1. *N. attenuata* (left) and *N. quadrivalvis* (right). Image courtesy of the artist, Emily Hull.

Table 1. Some Traditionally Smoked Plants

Scientific Name	Common Name
Artemisia ludoviciana	silver wormwood
Arctostaphylos uva-ursi	bearberry/kinnikinnick
Cornus sericea	red osier dogwood
Gaultheria shallon	salal
Nicotiana attenuata	coyote tobacco
Nicotiana quadrivalvis	Indian tobacco
Rhus glabra	smooth sumac
Taxus brevifolia	Pacific yew

Smoking in the Archaeological Record

- Stone pipes and pipe fragments appear as an uncommon artifact class in sites across the region (Figure 2). Almost exclusively limited to Inland sites.
- Steatite, an easily carvable talcose schist, was a preferred material type. Pipes were also commonly constructed of ground sedimentary rocks (e.g., siltstone) and harder rock (e.g., basalt; see Figure 3 for examples).
- Collected pipes range in age from as old as c. 4,500 cal BP to Post Contact. Pipes artifacts are more commonly associated with Late Period contexts, however.
- Figure 2 omits pipe artifacts from the southern coast, including a culture on the Oregon coast of the use of clay pipes for smoking tobacco.

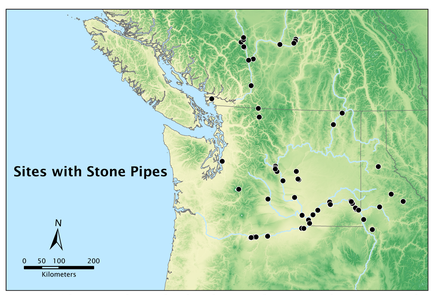

Figure 2. This map shows the distribution of stone smoking pipes in the Pacific Northwest. Most of the sites sit along the major rivers of the region, reflecting a bias in the overall identification of sites.

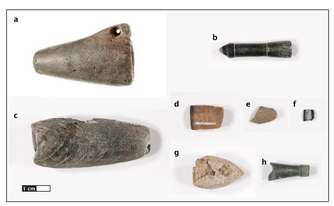

Figure 3. Pipes in the Northwest take a variety of forms through time and were constructed of a variety of materials. a) 45GR27.116, basalt pipe bowl; b) 45GR30, steatite stem; c) 45DO172, steatite pipe; d) 45GA61, siltstone bowl fragment; e) 45CO1, basalt stem fragment; f) 45GA61, steatite bowl fragment; g) 45PI43, pumice pipe bowl; h) 45WW6, steatite stem fragment.

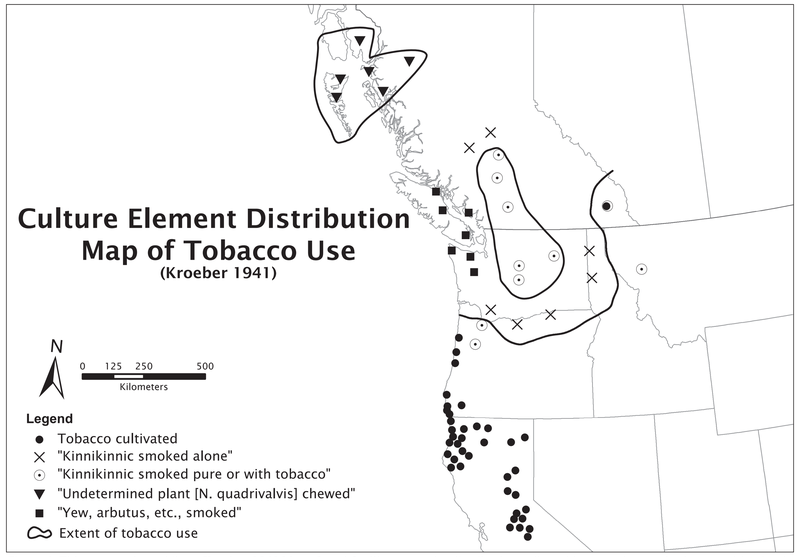

Figure 1. This map—adapted from Kroeber 1941:Maps 8 and 9—illustrates the distributions of smoking practices and tobacco cultivation in the Pacific Northwest as determined by Culture Element Distribution surveys. Note in particular that the use or disuse of tobacco in the Lower Columbia identified by the survey does not match with our results, which were positive for the presence of nicotine in pipe fragments from the area dating to over a thousand years old. However, the ethnohistoric data represented here match with the results of our residue studies in the Mid-Columbia, Fraser Valley, and Southern Coast.

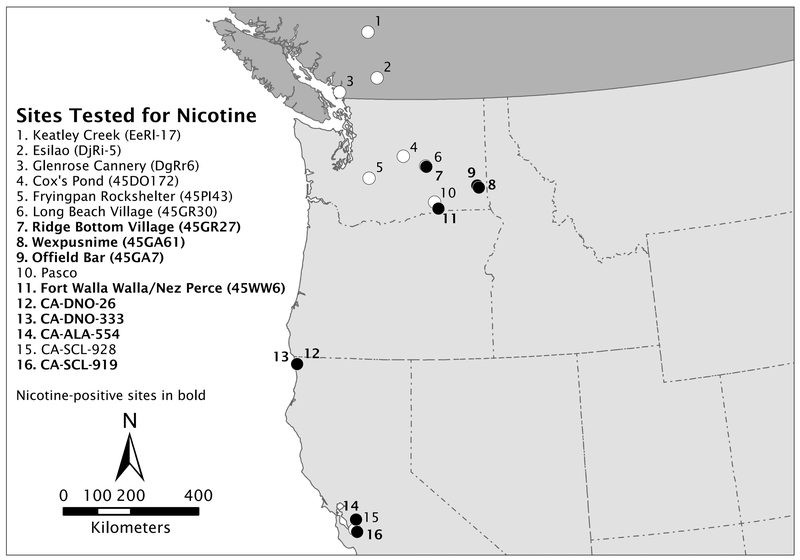

Figure 4. This map shows all Northwest sites that have had artifacts tested for the presence of nicotine (a biomarker for tobacco). Black dots indicate positive results while white dots indicate negative results. Hayden (2000) tested the artifacts from Keatley Creek.

Chemical Residue Studies

Previous Research

- In the earliest such study in the region, Hayden (2001) tested the contents of pipes collected at Keatley Creek (EeRl-17) for nicotine with negative results.
- Tushingham et al. (2013) detected nicotine in two pre-contact pipes from sites on the northern coast of California.
- Eerkens et al. (2018) detected nicotine in dental calculus from two sites in the San Francisco Bay area.

Recent Studies

We have completed several studies utilizing ultra-performance liquid chromatography–mass spectrometry to test residues extracted from the matrix of stone smoking artifacts. The presence or absence of nicotine was used as a proxy for tobacco use while arbutin was used as a biomarker for kinnikinnick. A metabolomic analysis was also performed, testing the entire chemical fingerprint of the samples against smoke plants.

- ***Fraser Valley Study:*** Esilao (DjRi-5): 35 pipes, pipe fragments, and blanks; mostly steatite. Glenrose Cannery (DgRr-6): 1 siltstone pipe bowl.
- ***Mid-Columbia Study:*** Ridge Bottom Village (45GR27): 1 complete bowl for composite pipe (Figure 3a) and 1 fragment, both basalt. Long Beach Village (45GR30): 6 steatite pipe fragments.
- ***Lower Columbia/Snake River Study:*** Tushingham et al. (2018) detected nicotine on pre-contact pipes from three sites in the Lower Columbia region.
- ***Mt. Rainier Pipe:*** Fryingpan Rockshelter (45PI43): 1 pumice bowl for composite pipe (Figure 3g).
- ***Pasco Pipe:*** Unprovenienced figuratively carved steatite pipe found near Pasco, Washington.

Results

- All specimens tested negative for the presence of arbutin (Table 2).
- The Fraser Valley artifacts all tested negative for the presence of arbutin and nicotine.
- In the Mid-Columbia study, only 1 specimen of 12 tested positive for the presence of nicotine.
- In the Lower Columbia/Snake Study (see Tushingham et al. 2018) 7 of 11 tested pre-contact pipes contained nicotine.
- The Mt. Rainier and Pasco pipes were both negative for nicotine and arbutin.
- Metabolomic analyses point toward the use of *N. quadrivalvis* in the Mid-Columbia. In the Fraser Valley study the metabolomics suggest the use of *C. sericea* and a species of salvia.

Table 2. Results of Analysis by Region and Site

Region & Site	Nicotine	Arbutin
Fraser Valley		
DjRi-5	–	–
DgRr-6	–	–
North Cascades		
45PI43	–	–
Mid-Columbia		
45GR27	+	–
45GR30	–	–
45DO172	–	–
Lower Columbia[a]		
45GA7	+	–
45GA61	+	–
45WW6	+	–

a. see Tushingham et al. 2018

Conclusions

- Arbutin was evidently not in use in the areas that we have tested before contact. It is possible that the compound degrades over time, preventing detection using our methods.
- The nicotine-positive pipe bowl from 45GR27 is the northernmost and oldest (1334–1524 cal BP) artifact to be positively associated with tobacco use to date.
- The positive results from southeastern Washington contradict the expectations set by Kroeber's (1941) survey as do conversations with present-day Nez Perce.
- The low proportion of nicotine-positive results in the Mid-Columbia study (1 of 12) contrasts with the relatively high rate in southeastern Washington (7 of 11). We interpret this to indicate that the Lower Columbia formed the frontier of tobacco use in the mid Late Pre-Contact Period, with its use decreasing northward.
- We have made progress on attaining a region-wide picture of past tobacco use, gaps remain in areas where tobacco is traditionally used: e.g., 1) Coastal Oregon, 2) further inland in B.C..

Acknowledgments

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References Cited

Brownstein, Korey J., Shannon Tushingham, William J. Damitio, Tung Nguyen, and David R. Gang
2019 A metabolomics-based method to distinguish closely related plant species in ancient residues. Manuscript in preparation.

Eerkens, Jelmer W., Shannon Tushingham, Korey J. Brownstein, Ramona Garibay, Katherine Perez, Engel Murga, Phil Kaijankoski, Jeffrey S. Rosenthal, and David R. Gang
2018 Dental Calculus as a Source of Ancient Alkaloids: Detection of Nicotine by LC-MS in Calculus Samples from the Americas. Journal of Archaeological Science: Reports 18:509–515.

Hammet, Julia E.
2000 Out of California: Cultural Geography of Western North American Tobacco. In Tobacco Use by Native North Americans: Sacred Smoke and Silent Killer, edited by Joseph C. Winter, pp. 128–140. University of Oklahoma Press, Norman.

Hayden, Brian
2000 Prestige Artifacts at Keatley Creek. In The Ancient Past of Keatley Creek. Volume II: Socioeconomy, edited by Brian Hayden, pp. 189–202. Archaeology Press, Simon Fraser University, Burnaby, British Columbia.

Keddie, Grant
2016 Aboriginal Use and Context of Pipes, Tobacco, and Smoking in Northwestern North America. In Perspectives on the Archaeology of Pipes, Tobacco and other Smoke Plants in the Ancient Americas, edited by Elizabeth Anne Bollwerk and Shannon Tushingham, pp. 157–181. Springer, Cham.

Kroeber, A. L.
1941 Culture Element Distributions: XV: Salt, Dogs, Tobacco. Anthropological Records 6(1).

Turner, Nancy J.
2014 Ancient Pathways, Ancestral Knowledge: Ethnobotany and Ecological Wisdom of Indigenous Peoples of Northwestern North America. McGill-Queen's University Press, Montreal.

Tushingham, Shannon, Dominique Ardura, Jelmer W. Eerkens, Mine Palazoglu, Sevini Shahbaz, and Oliver Fiehn
2013 Hunter-Gatherer Tobacco Smoking: Earliest Evidence from the Pacific Northwest Coast of North America. Journal of Archaeological Science 40(2):1397–1407.

Tushingham, Shannon, Charles M. Snyder, Korey J. Brownstein, William J. Damitio, and David R. Gang
2018 Biomolecular Archaeology Reveals Ancient Origins of Indigenous Tobacco Smoking in North American Plateau. Proceedings of the National Academy of Sciences 115(46):11742–11747.