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JOURNAL OF NORTHWEST ANTHROPOLOGY

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TALES FROM THE RIVER BANK: AN IN SITU STONE BOWL FOUND ALONG THE SHORES OF THE SALISH SEA ON THE SOUTHERN NORTHWEST COAST OF BRITISH COLUMBIA

Rudy Reimer, Pierre Friele, Kenneth Fath, and John Clague

ABSTRACT

Archaeologically, stone sculptures offer intriguing insights into past. On the Northwest Coast many artifacts carved, pecked, ground and incised are known, but few are well reported or are found in clear in situ contexts. This article concerns the chance discovery in 2012 of an in situ stone bowl along the Squamish River southwestern British Columbia, Canada. Excavation and analysis dated a stone bowl and other artifacts to 1415–1554calBP. We present a combination of archaeological and cultural data in this study to speculate that the bowl was used in a First Salmon ceremony.

Globally the ethnographically recorded indigenous peoples of the Northwest Coast stand as renown cultures for their monumental wood working sculptures that include intricate bent wood boxes, complex grave markers, giant totem poles, multifaceted house designs, ocean going dugout canoes, tall interior house posts and many other items (Holm 1990:602–632). Collectively these impressive creations depict family crests, resource and territorial ownership and ancestral rights to a wide range of songs, dances and other customs (Carlson 1983, 1999:39–46; Holm 1990:602–632). Despairingly little of these massive works preserves in the archaeological record of the region. This leaves archaeologists with seemingly smaller and less impressive remnants of these traditions to interpret the past. One-way archaeologists can interpret the origin and development of this incredible and ancient art tradition is through the unique artifacts that do preserve in the archaeological record, notably the portable artistic pieces that are manufactured from stone. In the Salish Sea region of the southern Northwest Coast, ancient artistic items appear approximately by 4500BP and demonstrate Coast Salish stylistic attributes. By 3500BP, 14 artistic objects are known to occur in the Locarno Beach phase and by 2500BP a large increase is noted (albeit Coast wide) to 108 objects, with 48 of those coming from the famous Marpole site (Ames and Maschner 1999:219–248).

In this research we describe a new stone bowl discovery in the Salish Sea and relate it to local and regional contexts. We assert that archaeological and Indigenous perspectives can offer similar and new insights that are complementary and enhance our understanding on the role of these implements (Watkins 2011:46–62). For example, archaeologists can come to understand these items in what they view as being depicted on an item and classify it as anthropomorphic, zoomorphic and other forms that fit into an archaeological worldview (Carlson 1999:39–46). Over fifty years ago Wilson Duff wrote that, “we have almost no information regarding detailed and exact provenience and association of stone bowls” (Duff 1950, 1956:15–151). Archaeologically this situation still partly applies today. We now know that many stone bowls associate with archaeologically recorded village sites or along salmon bearing rivers, while others in remote and isolated places (Hannah 1996:36–38). Nevertheless, most suffer from poor stratigraphic and exact temporal associations (directly associated 14C dates) since they are not well documented finds or occur in locations not well suited to standard archaeological inquiry (Hannah 1996:35–36; Keddie 2003:174). Another way to understand these "pieces of the past" is to closely examine and consider the values of their local cultures and living traditions. We present both an archaeological view of this find in combination with a Squamish Nation cultural perspective. This is a clear way to increase the archaeological interpretive resolution of stone bowls and other unique items on the Northwest Coast and elsewhere. By doing so with the find of this bowl we can gain a clearer understanding of the Indigenous cultural knowledge and the archaeological perspectives of landscape and how “pieces of those places” fit into the broader record (Bradley 2000). These synergies between cultural and scientific perspectives allow for a holistic use and understanding of multiple lines of data, offering insights about stone bowls that may not have been considered before (Atalay 2006:280–301; Colwell-Chanthaphonh et al. 2010:228–238; Nicholas and Andrews 1997; Watkins 2001, 2011:46–62). We present a systematic path of the various lines of archaeological and cultural data present to us to gain both a regional and local understanding of this find. It combines datasets related to geoarchaeology, radiocarbon dating, X-ray fluorescence (XRF) of lithic materials, and archaeobotany as a complement to Squamish Nation place names, oral history, cultural geography and ethnozoology. Collectively we wish to present the importance of considering multiple perspectives on one unique find that is of great importance to the Squamish Nation community.

Previous Research Related to Stone Bowls on the Shores of the Salish Sea

Ethnohistorical accounts regarding the role and use of stone bowls are limited (Boas 1890:90; Hill-Tout 1899; Smith 1907; Hannah 1996:7–14). The earliest reference to the use of a stone bowl is by Boas (1890:90) where he was told of a description of how a Seated Human Figure Bowl that was used in a female puberty ritual in the interior of British Columbia in Secwepemc territory[1]. At the end of a woman’s seclusion, a shaman carrying a carved steatite bowl called *tsuqu’n* led her back to the village. He noted that the bowl related to women giving birth. Correspondingly, Charles Hill-Tout (1899) also recorded a stone bowl in use during a female puberty ritual but this bowl may have been the same one mentioned by Boas and how he came to this information is not clear (Hannah 1996:9). Later, Harlan I. Smith (1907) defined Seated Human Figure Bowls as a distinctive type but did not fathom their role and use. Several decades later both Wingert (1952) and Galloway (1956) catalogued the unique forms and

[1] Boas was informed by the Indian Agent of the Kamloops district and believed this practice originated in coastal areas.

representations found in Northwest Coast stone sculpture but did not offer substantial interpretations regarding their use.

Wilson Duff was the first to define three bowl types in his catalogue of the Prehistoric stone sculpture of the Fraser River and Gulf of Georgia (Duff 1956:15–151). Type A bowls are basic in design, with occasional animal features added to their surface. Type B bowls are more detailed than Type A, with manufacturing and decorations including head, body wings, and limbs. Duff speculated a relationship between Type B and the most detailed, Type C, Seated Human Figure Bowls as an important step in development and design. Type C is the most ornate, depicting humans intertwined with animals. During his studies, Duff presumed that the more complex designs dated to later periods and that these types developed over time. Unfortunately he lacked direct dates to prove this as radiocarbon dating was a recent invention and had not yet come into use in BC archaeology (Libby 1955).

While exceptions occur in bowl depictions and the material used to make them some general patterns hold. Geographic variation exists in the representations on Seated Human Figure Bowls, with bird figures predominating along the Lower Fraser River and the Salish Sea while turtle forms are more common upriver and into the Interior Plateau (Duff 1956, 1975). Bowls made of steatite are more common in interior regions, whereas coastal bowls are made of igneous rock. Whether these patterns hold for other bowl types is unclear; many examples come from contexts that are under reported in academic reports or in difficult-to-access grey literature of cultural resource management.

Despite their unique representation and important role to the indigenous cultures of the region, few stone bowls or any stone sculptures have been directly dated to in-situ contexts (Hannah 1996:34–35; Keddie 2003:165–174). Currently only seven stone bowls come from published and securely dated archaeological contexts (Table 1). Again, it is unfortunate that all other stone sculptures come from undated and often dubious, under reported or accurately examined contexts. On the other hand, some of the contexts where bowls are recovered are not in typical locations that archaeologists examine, posing interpretive challenges.

Perhaps the oldest stone bowls in the region were found at the Locarno Beach site (DhRt 6), where two bowls reported by Duff (1956) lay in unclear contexts that spanned the site's entire 3000-year sequence (Williams 2013). Nearby at the Marpole site (DgRs 1) three bowls recovered by Harlan Smith (1903) occur in association with human burials (Table 1). Charles Borden (1983:131–166) cross-dated them with associated artifacts and radiocarbon dates to the past 2500 years. At the Point Grey site (DhRt 5) another bowl had an age (2401–1949calBP to 1870–1353calBP; Table 1) confirmed through radiocarbon assays (Coupland and Unfreed 1988; Coupland 1989, 1991:73–96) from an earlier excavation by Borden (1947). These results offer evidence of stone sculpture antiquity at this spring village site at Point Grey. Near the modern town of Sechelt, Wilson (2000:7–16) reported on a directly dated stone bowl at DiRw 16 but the dates (2702–2051calBP to 2125-1620calBP) are on associated clamshells (Table 1). These dates require a marine reservoir correction of 840 years (McNeeley et al. 2006) (See Table 1). On the northern tip of Galiano Island at the Dionsio Point site (DgRv 3) two anthropomorphic stone bowls excavated from within the remains of a plank house date to an average of 1500 years BP (Table 1). Based on their context researchers at this site interpret these finds as ritual implements, but give little application of local First Nations cultural knowledge (Grier 2003:178–183) (Table 1). Archaeologically the dates and sites from which stone bowls recovered still leave us with unanswered questions regarding their role. Overall, it is generally accepted by archaeologists in the Salish Sea region that stone bowls to date to the past 3000 years with most occurring during the Marpole phase and diminishing in frequency into more recent times.

TABLE 1. SITE AND 14C DATES OF STONE BOWLS IN THE SALISH SEA REGION. ALL DATES CALIBRATED USING OXCAL 4.2.

Site	**Radiocarbon Assay**	**Date Number**	**Calibrated Age@ 95.4%**	**Reference**
DgRs 1	None	n/a	n/a	Smith 1903
DgRs 1	None	n/a	n/a	Smith 1903
DgRs 1	None	n/a	n/a	Smith 1903
DhRt 5	2210±90 to 1690±120	WSU 3573 Gak 1480 WSU 3573	2401–1949calBP to 1870–1353calBP	Coupland 1989
DhRt 6	3280±70 to 1630±80	Beta 70603 and ?	3686–3371calBP to 1710–1354calBP	Williams 2013
DiRw 16	1930±100 *(1090+100) to* 2290±100 (*1450+100)*	AECV 11121114	2702–2051calBP to 2125–1620calBP OR 1257–795 calBP and 1560–1180calBP	Wilson 2000
DgRv 3	1770±70 to 1440±60	?	1865–1547calBP to 1520–1270calBP	Grier 2003, 2006

The discussion of individual bowls helps us to understand this cultural complex. For example, Boas (1890:17) mentions that stone bowls or flat stones saw use in First Salmon Ceremonies and cleansing ceremonies. Activities associated with the First Salmon Ceremony included the burning of plants and the use of red ochre and fresh bulrushes as offerings to the salmon people. Later, Hill-Tout (1907) mentioned that the Coastal and Interior Salish peoples used a wide range of stone bowls for different purposes. Some were used for mixing paints, medicine, or ceremonial purposes but all were connected to food procurement. The First Salmon Ceremony is important to this discussion. Gunther in her analysis (1926) of this ceremony finds its extent from Tsimshian territory in British Columbia, south to the central coast of California and east to edge of the Rocky Mountains. The reverence of and dependence on salmon as an important resource linked to other cultural factors such as first fruit ceremonies and maintaining relationships with plants and animals (Gunther 1928).

Before contact with Europeans, stone bowls are believed to be hereditary items that carried social privileges within family and cultural groups on the coast (Keddie 1983:2–4). Bowl design was linked to the ancestor of the person in possession of the bowl. Other researchers state that stone bowls played roles in ceremony (Hannah 1996; Carlson 1983:201, 1999) but there is no specific mention of a known or recorded ceremonial event linking direct contextual cultural knowledge to any individual bowl. Earlier Boas (1890:90) and Duff (1950:63, 89) noted that one had to train spiritually away from villages or in the mountains for a time and that only spiritually powerful people could use bowls for grinding up pigments. These observations led Duff

(1956:16–19, 56–59) to draw upon several accounts to interpret stone bowls. Duff viewed stone bowls as items of spirit power and divination. People with the appropriate cultural knowledge could use them as items used to help see what was happening "far off" and help predict the future, an interpretation later echoed by Burley (1980:58). Barnett (1935–1936:36–40) informed by Sechelt people that stone bowls similar to the one discussed by Wilson (2000:7–16) were used in important feasts leading to a conclusion that the bowl from DiRw 16 (near Sechelt) was purposely broken.

Description of the Bowl

It is essential to note that the Squamish River freshet was eliminating the archaeological deposits as we were ascertaining the bowl's context. This limited our capacity to establish the context within the larger archaeological site that it occurs in, as we did not have the funding and time to accomplish a broader investigation. We acknowledge that this restricts some of our interpretations. Our views about the material culture rely on the contextual information gained through this study and are considered within the broader contexts of that documented in earlier research (cf. Duff 1950, 1956, 1975, 1983; Hannah 1996; Grier 2003; Keddie 2003). The Squamish bowl was found on the Squamish River, approximately forty linear kilometers northwest of Vancouver (Fig. 1). It is made of a coarse grained, pinkish-red rock common to the Garibaldi volcanic belt, (Munsell color 5Y 3/4 to 5Y 3/2) basalt (Mathews 1952:552–565), with numerous plagioclase phenocrysts (Figs. 2–5). The bowl is ovoid in plan, being 18.4 cm long, 15.5 cm wide, and 9.1 cm high and weighs 2.505 kg.

This bowl can be situated between Duff's Type A and Type B bowls, since it shows features of other bowls of the Lower Fraser River and the Salish Sea (Duff 1950, 1956, 1975 1983; Borden 1983). The form, besides the obvious central depression created by pecking and grinding, displays four features in 1 cm relief along its perimeter (Fig. 2). Two side features are horizontally oval with rounded edges; of the front/back features, one is horizontally oval and the other vertically rectangular and both have rounded edges (Fig. 3–5). Two decorative rings in low (<1 cm) relief finish the rim of the bowl (Fig. 2). It is carved from a round cobble and its base is relatively flat with no obvious manufacturing features. The surface is coarse grained and somewhat rough and evidently has been weathered by the leaching action of acidic groundwater. The design elements are simple and leave open what the intended (and finished) representation was to its creator and user. This makes any initial interpretations difficult and ambiguous. One impression is that the bowl represents a bird, with wing and tail elements and a vertically oriented beak, with the beak end being slightly higher than the tail when sitting flat. Other impressions can view the bowls design elements as a frog, turtle or even a seal.

With the decorative aspects of the Squamish bowl not finished, comparing it to other zoomorphic bowls in published accounts can offer a clearer determination of what it might represent (Duff 1956, 1975, 1983; Borden 1983; Carlson 1983; Ames and Maschner 1999). Review of sculptures in these works show that frogs, turtles and seals possess different facial features typically with separately pecked, carved and incised eyes and mouths. Additionally, the side elements could represent flippers or legs, but these elements on other bowls are more elongated; this bowl's side features best resemble the oval shape of bird wings. The frontal features can represent a face of almost any animal including humans, but best resembles other bird or owl bowls found in the Salish Sea region.

To the people of the Squamish Nation many birds are symbols of spiritual power and often provide connections to the realm of the ancestors (Bouchard and Kennedy 1976a: 83–85). While many birds are well known to occur in Coast Salish/Squamish Nation art, only owls have rounded faces. In Squamish Nation culture owls are associated with spirits. *Shayu* or Screech owls represent “the ghost of a dead person” or Squamish people who after death, transformed into owl form. Their screeches were messages (sometimes ominous) from the land of the dead to the land of the living. Similarly the larger *Chiyetmixw* or Great Horned Owl was a deceased Squamish Nation person. They visited the land of the living to offer different kinds of messages and might serve as guardian spirits. High in the mountains of Squamish Nation territory lived *Xamalhkwu*, the Snowy Owl, a rare and powerful bird that came to the aid of those seeking spirit powers. *Sawwhet* or the Pigmy Owl is more common in the low elevation regions of Squamish Nation territory. The smallest of all owls in North America, it occupies a unique ecological niche and was widely recognized by the Indigenous peoples as the messengers of ancestors and in the case of the Squamish Nation family-specific ancestors (Bouchard and Kennedy 1976a: 83–85).

Geoarchaeological Context

Geomorphologist Pierre Friele found the bowl in May 2012 while investigating the nature of the changing channels of the Squamish River as part of Jared Fath’s Earth Sciences thesis research at Simon Fraser University. Initially the bowl was seen, partially exposed in a river-cut section on the east bank of Squamish River some fourteen kilometers north of the present estuary (Fig. 6). The bowl was pulled out of the lower sections of the river cut bank and was not formally excavated. This choice occurred as the waters of the Squamish River can rise quickly. Our geomorphic research on the late Holocene evolution of the Squamish River between the confluence with the Ashlu and Cheakamus rivers provides insight into the geoarchaeological setting of the bowl (Fig. 6). The Cheekye fan, a large alluvial feature immediately downstream from Cheakamus River confluence, prograded across the proto-Howe Sound fiord some 7000 years ago and formed a lake upstream (Hickin 1989; Friele and Clague 2005). The Squamish River delta gradually advanced downstream infilling the lake and between 3400 and 2300 BP when only a shallow remnant of the original lake remained. Reduced sediment supply to Cheekye fan and its subsequent down cutting by the Squamish River resulted in the eventual disappearance of the lake by 2100 BP. By the time the site was in use some period after 2100 BP a shallow wetland/riverine and forested environment had been established.

At the time of discovery, the river cut bank at the site was 6 m high with an overall pattern of coarseing upward from laminated silts at river level to bedded sands at the top of the section (Fig. 7). During investigation, one dark layer of charcoal and other organic matter was observed at water level. A radiocarbon sample dated this material to 2307–2117calBP. A second and similar layer occurred one meter higher than the first and yielded a date of 2106–1947calBP. Both of these lower charcoal layers could be cultural but we did not have the time or finances to investigate these relationships any further. We focused our efforts on the discovery context of the bowl. About 2 m above low water level just above the surface of the laminated silts

Fig 1. The Salish Sea, Squamish Nation territory and the location of the stone bowl. (Map based on Salish Sea & Surrounding Basin, Stefan Freelan, WWU, 2009).

Fig. 2. Above front view of the bowl. Dimensions 18.4 cm long, 15.5 cm wide, and 9.1 cm high and weighs 2.505 kg.

Fig. 3. Right side view of the bowl. Dimensions 18.4 cm long, 15.5 cm wide, and 9.1 cm high and weighs 2.505 kg.

Fig. 4. Left side view of the bowl. Dimensions 18.4 cm long, 15.5 cm wide, and 9.1 cm high and weighs 2.505 kg.

Fig. 5. Rear view of the bowl. Dimensions 18.4 cm long, 15.5 cm wide, and 9.1 cm high and weighs 2.505 kg.

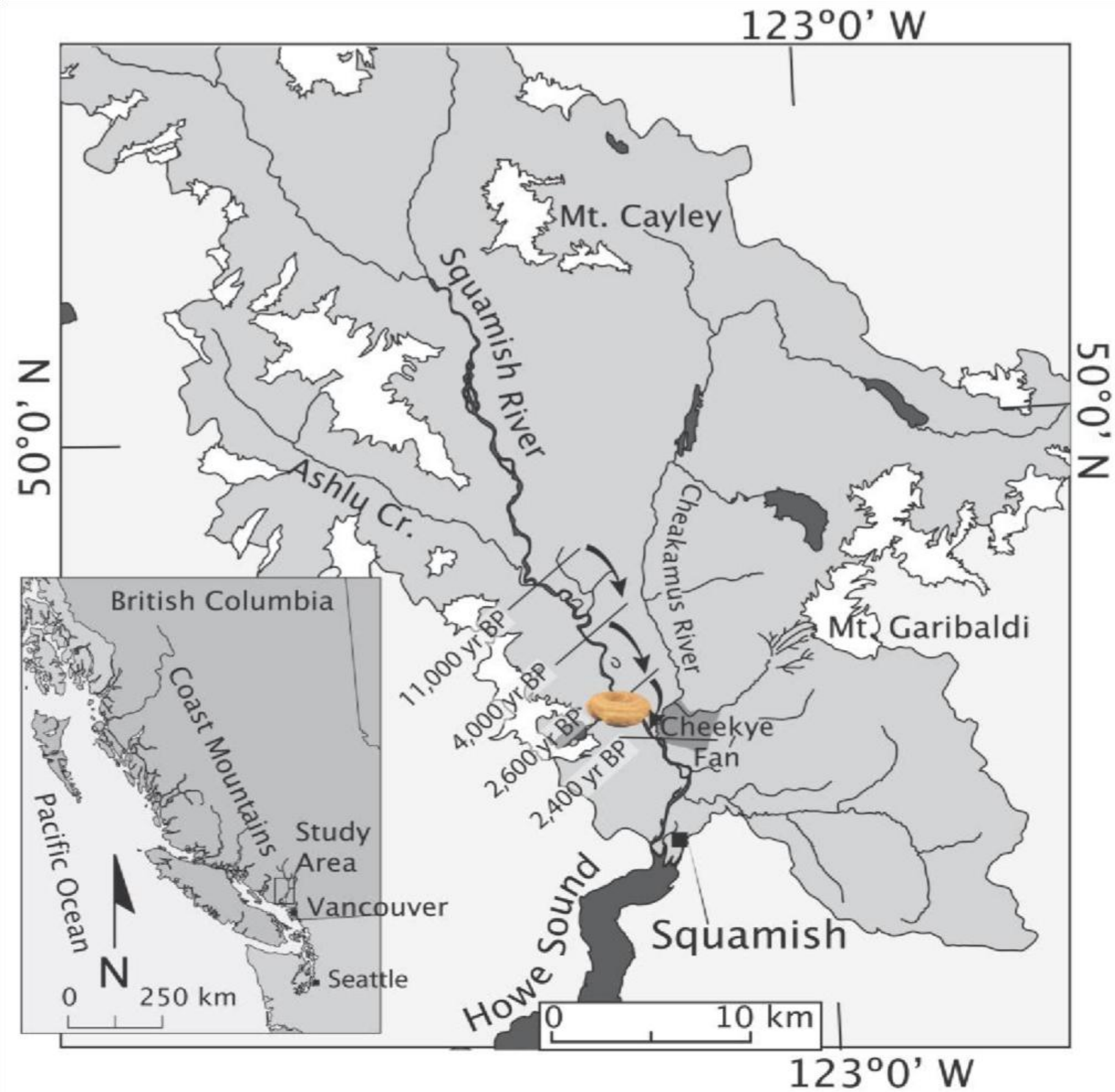

Fig. 6. Geographic and geoarchaeological context of the bowl.

is a series of four conspicuous layered black hearth deposits 5–15 cm thick. The bowl was found at the northern edge of the uppermost hearth layer. We shovel excavated the top four meters of overburden of this larger profile section to reach to top layer of the hearth feature. At the 18m ASL mark we formally excavated a 1x1 meter unit, hand troweling and screening sediments through 1/8th inch mesh screens revealing lithic materials and four small post/stake mould features surrounding the hearth. Samples from each of the four hearth layers date this feature, determining that it was indeed in situ within a dynamic geoarchaeological context in the uppermost hearth layer dating to 1545–1415calBP. Furthermore dark and greasy cultural deposits extend fifteen to twenty meters north and south along the riverbank that is indicative of a house, camp, or possibly a village. Further archaeological research is needed clarify this.

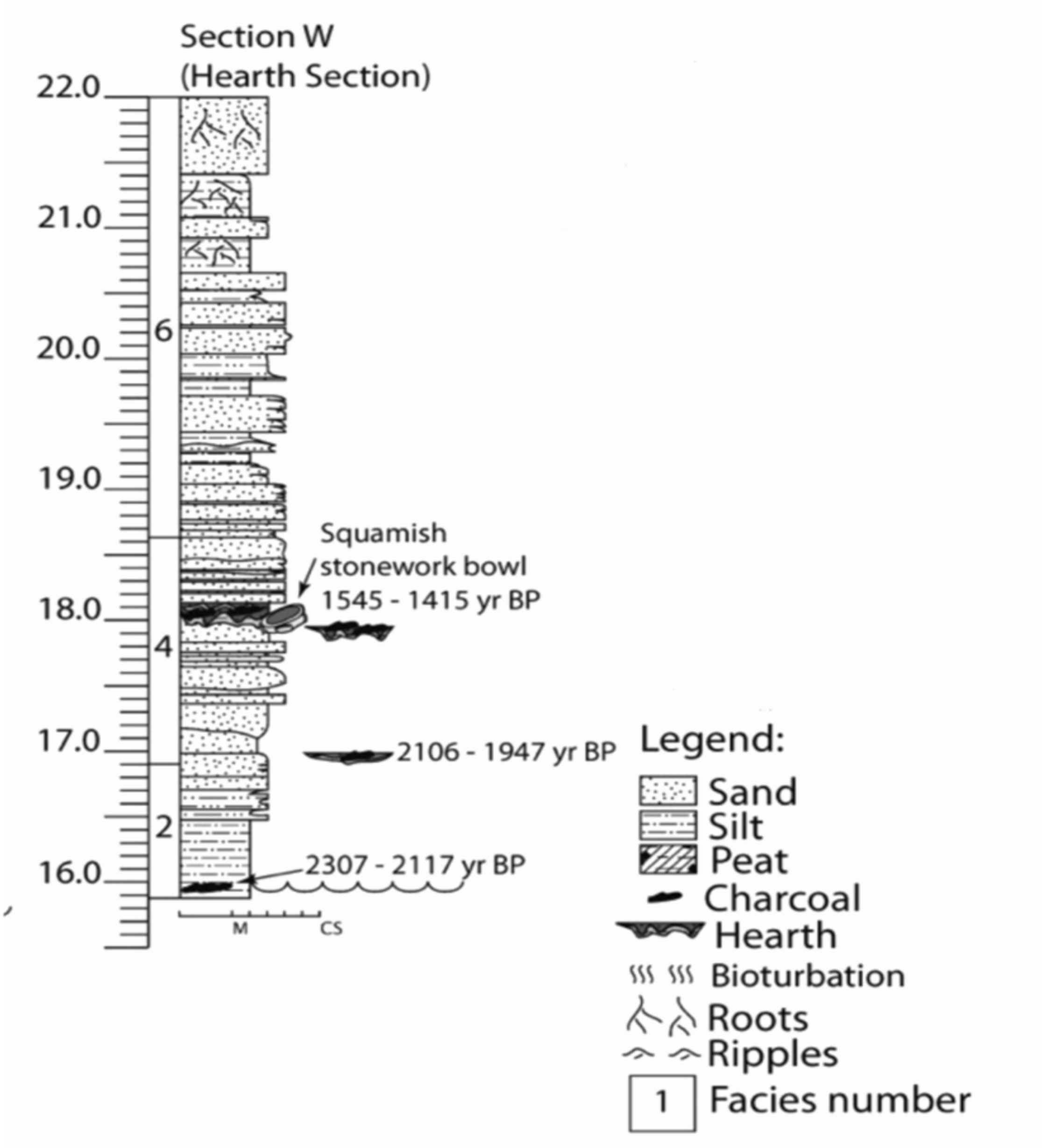

Fig. 7. Stratigraphic profile of the river cut bank where the bowl was found.

The site is located on a meandering reach of the Squamish River. Examination of air photos reveals meander scrollwork in plain view. A well-developed meander formerly extended to the east of the exposure but presently the site is dissected and exhumed by a meander cutoff (Fig. 8). The river plan form has since evolved and the site context seen today is not representative of the time of deposition. Whether the site was deposited on a point bar or more distant from the river's edge is not clear. A feasible scenario is that the site was located on a point bar on the right bank; the site may have been abandoned as the meander extended eastward and occupation followed at the river’s edge. Eventually and within living memory, the meander became cut off exposing the old and long buried occupation site.

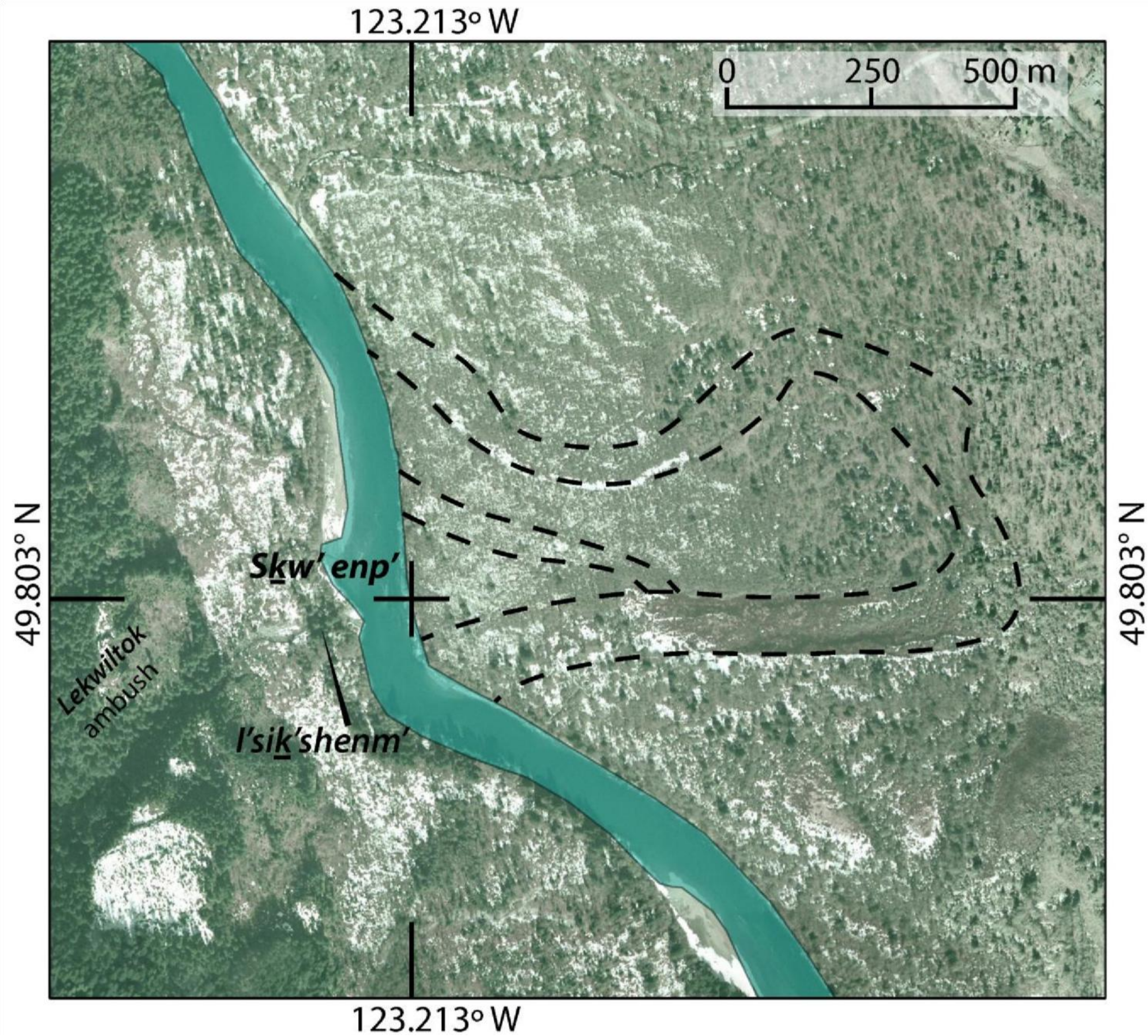

Fig. 8. Air photo view of the geoarchaeological and cultural context of where the bowl was found.

A Hearth Feature and Associated Lithic Remains

When cleaning the stratigraphic exposure for description, the first cultural objects detected were two lithic flakes. Two hammer stones followed these finds, all in association with a prominent hearth feature. The bowl was found in the profile and upside down beside the top rim of the hearth. Nine flakes and numerous pieces of fire-cracked rock found in the excavation of the hearth revealed that the bowl and associated materials were in situ. Three sediment bulk samples collected during excavation underwent particle size analysis (Table 2). One sample from below the hearth is dominated by silt and indicative of a very low-energy lacustrine depositional environment. Higher in the section, sediments consist of inter bedded fine to medium grain sand and silt indicative of an increasingly variable riverine floodplain environment.

TABLE 2. RESULTS OF SEDIMENT ANALYSIS OF MATERIALS ABOVE, AROUND AND BELOW THE BOWL.

Particle Size	**Below Hearth**	**Hearth Fill**	**Hearth Top**
% Gravel (>2mm)	<0.10	<0.10	<0.10
% Sand (2.00mm – 1.00mm)	0.15	<0.10	<0.10
% Sand (1.00mm – 0.50mm)	0.23	0.67	0.64
% Sand (0.50mm – 0.25mm)	0.43	1.45	1.40
% Sand (0.25mm – 0.125mm)	5.21	17.1	42.0
% Sand (0.125mm – 0.063mm)	7.99	19.8	30.4
% Silt (0.063mm – 0.0312mm)	26.9	27.0	15.3
% Silt (0.0312mm – 0.004mm)	49.8	31.5	9.30
% Clay (<4um)	9.24	2.61	0.98
Texture	Silt	Silt loam	Loamy sand

Four charcoal samples one from each layer of the hearth feature provided the age by association with the bowl (Table 3). The youngest sample indicates the best minimum age of the hearth at 1545–1415calBP. The three oldest samples are statistically similar, and may represent the combustion of a single piece of wood. Eleven pieces of lithic debitage, all surrounding the edge of the hearth were subject to non-destructive X-Ray Fluorescence (XRF) analysis (Fig. 9 and Table 4). All identified as matching a known dacite tool stone source, High Falls Creek twelve kilometers up river from the site, a quick half day's travel to and from the site and source (Reimer 2012:70–73; Reimer and Hamilton 2015). The fire-cracked rock was all local granitic rock, similar to that forming the adjacent alluvial fan from Lovelywater Creek to the west.

TABLE 3. RESULTS OF 14C DATES FOR THE BOWL. ALL DATES CALIBRATED USING OXCAL 4.2.

Radiocarbon Assay	**Date Number**	**Dated Material**	**Calibrated Age@ 95.4%**
1610±20	CAMS109491	Charcoal	1415–1554calBP
1765±15	CAMS109490	Charcoal	1617–1718calBP
1775±15	CAMS109489	Charcoal	1619–1733calBP
1785±20	CAMS109488	Charcoal	1622–1810calBP

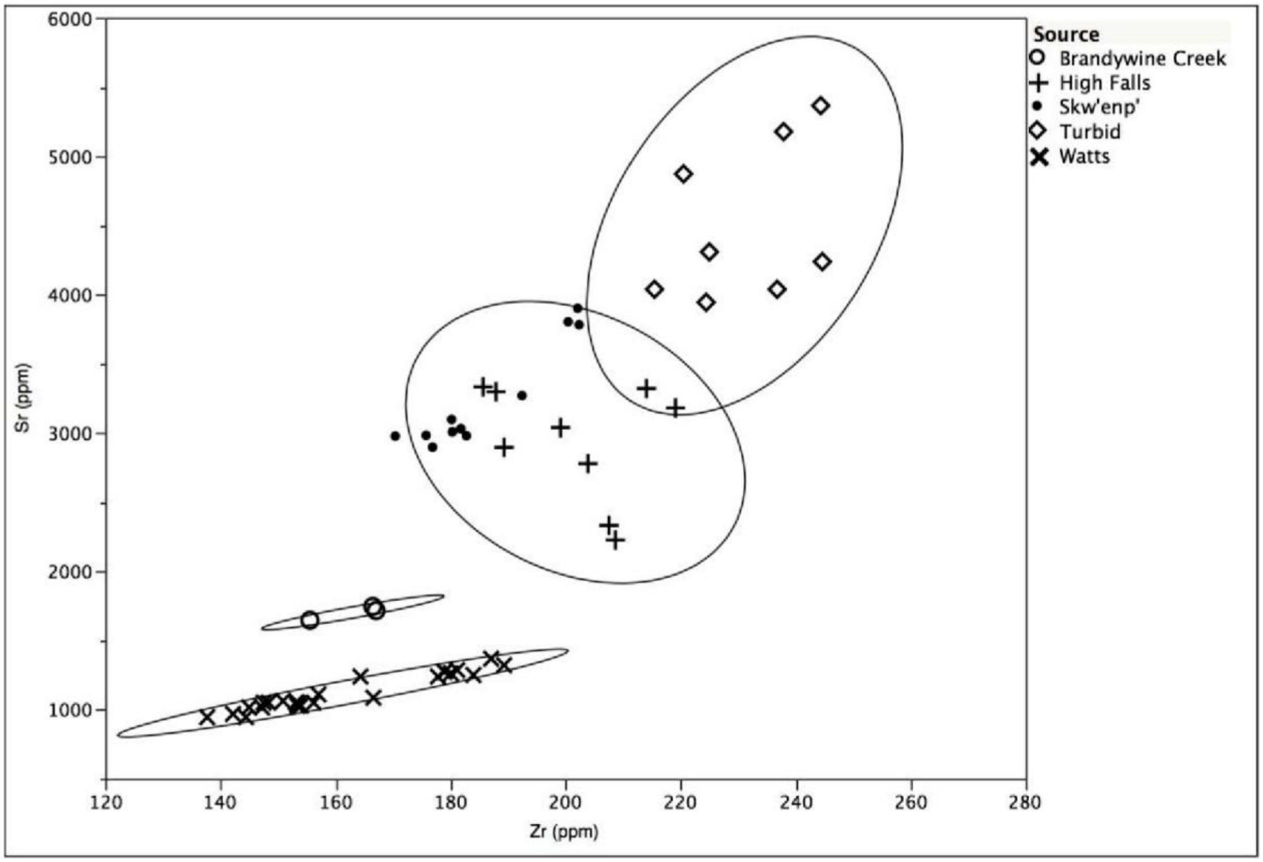

Fig. 9. Results of XRF analysis of lithic debitage found in association with the bowl.

TABLE 4. XRF RESULTS OF LITHIC DEBITAGE ASSOCIATED WITH THE BOWL. ALL VALUES IN PARTS PER MILLION (PPM).

Sample	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb
Skw'enp' 1	755	34222	106	12	8	28	3803	15	200	4
Skw'enp' 2	729	33177	98	13	5	26	3009	11	180	4
Skw'enp' 3	642	31861	100	14	3	23	2899	12	177	2
Skw'enp' 4	905	31717	99	10	0	29	3031	12	182	4
Skw'enp' 5	887	32880	108	13	7	27	3269	14	192	2
Skw'enp' 6	725	32689	94	14	3	29	3096	14	180	0
Skw'enp' 7	834	33674	111	14	8	25	3781	16	202	2
Skw'enp' 8	818	31688	100	14	5	26	2985	13	176	6
Skw'enp' 9	827	34122	90	9	8	26	3900	15	202	4
Skw'enp' 10	779	32114	91	13	5	24	2982	13	183	3
Skw'enp' 11	551	33453	116	14	5	29	2979	13	170	3

Floral Remains

A single two-liter sediment sample collected from the horizon containing the bowl underwent archaeobotanical analysis (Endo 2012). Simple "bucket" flotation separated the light and heavy fractions of the sediment. Since sediments were fine-grained, ten millimeters of baking soda added to the water acted as a deflocculent. This produced 41.47 grams of light fraction containing identifiable plant remains. The plant remains included nineteen seeds (ten taxa) and three specimens of charcoal, identified through needle and wood charcoal analysis. The seeds of Red Elderberry (*Sambucus racemosa*), Saskatoon Berry (*Amelanchier alnifolia*), Black Raspberry/Thimbleberry (*Rubus parviflorus*), and Bitter Cherry (*Prunus emarginata*) represent edible fleshy berries. Other herbaceous species identified from seeds are: Grass (*Poaceae sp.*), Stinging Nettle (*Urtica dioica*), Mustard (*Brassica sp.*), and Lily (*Lilium sp.*). Tree species identified from needle and wood charcoal included Western Red Cedar (*Thuja plicata*), Spruce (*Picea sitchensis*), and Hemlock (*Tsuga heterophylla*). Other wood charcoal pieces recovered were relatively small indicating that they had been subject to wetting, drying and trampling which over time commonly breaks down carbonized samples.

Ethnobotanical knowledge of the Squamish Nation provides insight into the role of the plants found at the site. In the early spring Stinging Nettle comes back to life and was traditionally and still is used by Squamish Nation people to manufacture fishing nets. Young shoots of this plant pounded to a pulp covered the body to provide spiritual protection (Turner and Bouchard 1976:125–127). Red Cedar and Spruce that split easily and burn quickly were used to start fires while Hemlock served as a good shoulder season wood to provide heat or cook food (Turner and Bouchard 1976:23–32, 33–34, 36–37). Red Elderberry an important spring and summer plant was cooked and mashed into a pulp and stored for winter use (Turner and Bouchard 1976:79–83). Saskatoon and Thimbleberry both ripen in the summer and were eaten fresh while Bitter Cherry served as a medicinal to aid in digestion (Turner and Bouchard 1976:103, 107–108, 111–113). Lastly and of possible significance Chocolate Lily was pit-cooked in combination with salmon heads and considered a cultural delicacy (Turner and Bouchard 1976:51).

Summary of the Bowl's Archaeological Context

The bowl's environmental context suggests that the Squamish River was close to salt water and positioned similar to where it is today. The people who used it sat beside a hearth at this site between 1415–1554calBP. Plant remains indicate the site was used from late spring into early summer, as all the species recovered ripen at this time. Hence people ate a variety of berries, used fire and perhaps gathered or traded for lithic materials from an up-river source. Unfortunately the site yielded no faunal remains.

Archaeologically we know how old the bowl is and can compare that age to the few others in direct datable contexts. This find fits well other in-situ finds on the southern Northwest Coast that date to the past 1500–2000 years. Accordingly we can give a geographic location tied to a site designation code (Borden site number) and associate it within well-established contexts. Without additional analysis, we cannot speculate on links to other nearby lithic sources and villages through visual or elemental examination of associated lithics and flora, or explain how they and this bowl came to rest. While the bowl's role and function are unclear from a purely scientific perspective, we can still turn to cultural data for further insights.

The Cultural Context of the Bowl

Along the Northwest Coast, a rich ethnographic record provides researchers with a solid foundation to build associations with archaeologically observed phenomena. This allows researchers to construct cultural history and understand ancient cultural behavior (Carlson 1983:27–39; Matson and Coupland 1995; Ames and Maschner 1999; Moss 2011; Sassman 2004:238–243). Nonetheless we must be cautious when new and unique discoveries such as this bowl occur, as it is easy to over-rely or extend the local and regional ethnographic record. This only results in indirect associations or homogenization of the past (Grier 2007:284–308). The goals of Indigenous archaeology offer paths that are local and amenable to nuanced interpretations of unique finds such as this bowl. In a broader academic context McCall (2011) and Miller (2011) offer perspectives regarding the reliability and validity of oral history, traditions, narratives, ethnographic accounts and ownership of voice (Hulan 2012). McCall's stance is followed here, where a meaningful collaboration between researchers and Indigenous communities is needed to understand cultural knowledge. It is also useful to consider Miller's concerns regarding the use and application of cultural knowledge in both published and unpublished literature. Both of these perspectives can be addressed through examination of texts pertaining directly to the Squamish Nation place name for the site- *Skw'enp'* and the surrounding landscape (Hill-Tout 1897, 1900, 1978; Mathews 1955; Kuipers 1967 Bouchard and Kennedy 1975, 1976a and b, 1986; Squamish Nation Dictionary 2011). We also surveyed current Squamish Nation community language speakers and leadership agree with previous definitions and interpretations of the meaning of *Skw'enp'* and surrounding places (Khelsilem 2014 per comm.). In total, these oral and text sources offer the insight of culturally knowledgeable community members from several families in the Squamish Nation and who span several generations.

To situate the bowl in a more precise cultural landscape we must consider the deep traditions of Indigenous knowledge. In keeping with the aims of Indigenous Archaeology, we follow the definition of its purpose as the archaeology done, by, with, and for Indigenous peoples (Nicholas and Andrews 1997; Watkins 2001; Atalay 2006). Linking reliable archaeological data with Indigenous perspectives and recorded knowledge, allows us to explain the ancient past in a meaningful way to scientific and to be culturally relevant communities (Watkins 2011; White 2011:75–90; Reimer 2012). We now draw from the place names, oral history, and direct accounts of a Squamish Nation First Salmon ceremony to suggest that this bowl and the archaeological context it was discovered in offer synergies on how it can be understood within an Indigenous worldview[2] and indirectly provide clues for understanding other stone bowls from coastal British Columbia.[3] We apply Squamish Nation cultural knowledge to the bowl and its surrounding landscape in an attempt to determine its function.

[2] Squamish Nation culture dose not separate the physical and spiritual realms (Reimer 2012:18–30).

[3] The Squamish Lil'wat Cultural Centre has this and other stone bowls on exhibit. Data and presentation partially developed by Reimer and Ewing 2011. < http://slcc.ca/experience/featured-exhibits/>

Instead of using conventional archaeological culture history to place this find within a temporal context we use terms from the Squamish Nation language to place the bowl's age within an Indigenous sense of time (Reimer 2012:45–47). The last several thousand years, a time encompassing the use of the bowl, is known in Squamish Nation cultural knowledge as *Syets*, or history that "is easily remembered" (Bouchard and Kennedy 1975; Squamish Nation Dictionary 2011; Reimer 2012:45–47). The bowl was found at a place that the Squamish Nation calls *Skw'enp*, which translates to English as "bent around" (Bouchard and Kennedy 1986:387–388; Squamish Nation 1992; Squamish Nation Dictionary 2011). This is in keeping with the historical position of *Skw'enp* on what was once a large bend on the east side of the Squamish River. George Moody, an elder of the Squamish Nation, mentioned that *Skw'enp* was a village in former times. He stated that specific people lived there with their families in the historic era: Jim Watson, Squamish Jim, and Pat Sells (Bouchard and Kennedy 1986:387–388; Squamish Nation 1992). All three men had traditional plank houses at this location, and Pat Sells had a trap line on the other side of the Squamish River (Bouchard and Kennedy 1986:387–388; Squamish Nation 1992). The existence of a historic village at this site fits our observations of dark and greasy cultural layers extending both up and down stream of the bowl's location. Every other stone bowl/sculpture with secure context has been found in either village or burial sites with the *Skw'enp'* bowl now a well-documented *in situ* example.

On the opposite side of the Squamish River from *Skw'enp* is another Squamish Nation place name, *I'sik'shenm'*. This place name applies to Lovelywater Creek and translates to "moving feet back and forth" or "switching feet" (Bouchard and Kennedy 1986:388; Squamish Nation 1992; Squamish Nation Dictionary 2011). Another Squamish Nation elder Louis Miranda recalled that the Squamish Nation people had a belief about the position of the mouth of this creek. If the creek current flowed upstream into the Squamish River, it would be a good salmon run year and if its current flowed downstream into the Squamish River, it would be a lean year for salmon (Bouchard and Kennedy 1986:388; Squamish Nation 1992). The flow of water out of this creek would vary on the amount of runoff during the spring to summer months and the degree of stone and sediment debris moving down the creek bed. These yearly differences make for changes in where and how this creek's water would drain into the Squamish River. Similar accounts were recorded by Matthews (1955) in his conversations with Chief August Jack Kahatsalano, but apply to other areas of Squamish Nation territory.

The links between *Skw'enp'* and other villages and locations across Squamish Nation territory are suggested by the elemental analysis of the flaked stone material. All eleven flakes recovered at the site originate at a known lithic source at *Skawshn* (High Falls Creek) sixteen kilometers up the Squamish River. *Skawshn* is a well-known village as it is an important steppingstone for villages farther upriver. It is not surprising that the lithic material at *Skw'enp'* is close to this source (Squamish Nation Dictionary 2011; Reimer 2012).

Even now the reach of river north and south of *Skw'enp'* is excellent for salmon fishing, particularly for Spring and Chum. Several Squamish Nation families still rely on this important reach for subsistence and ceremonial use of salmon. Squamish people prize the second run of spring salmon, harvested in mid-July as it offers fresh food; but before this fishery could begin, the individuals who hold the spiritual power to forecast future events, known as *Asyew*, held important ceremonies (Hill-Tout 1900; Mathews 1955:40–41; Bouchard and Kennedy 1975:23–30; Bouchard and Kennedy 1976:9–22; Squamish Nation Dictionary 2011). *Asyew* thank the spiritual provider for the past year's harvest of salmon. After this celebration the people pray for plentiful runs of fish for the year. The anthropologist Homer Barnett recorded an instance of this ceremony in his unpublished 1935–1936 field notes. He recorded an account by a Squamish Nation man named Jimmy Frank concerning a ceremony that took place at *Sk'wenp*, where Frank's:

> …father was an Indian doctor and caught the first salmon in a net—he did this alone—not everybody could do this—….Jimmy Frank (as a small boy) with another or other took branches and made slings to carry fish up from the beach—one sling for head, one for tail—no down on fish or boys. Jimmy Frank's mother cooked salmon (roasting) but before she started the boys went to the beach and yelled, "We're going to break head off" up river (head was broken backwards an all salmon to take it off). Then it was cooked and all ate. No dance and no "talk" by Jimmy Frank—in fact, according to Jimmy Frank, little ceremony at all. This was done for all first salmon—no sockeye here.

Conclusion

When this bowl was discovered we were fortunate to have the time and resources to quickly respond to the potential of flooding of the site and loss of archaeological context. This allowed the discovery of the *Skw'enp* bowl to be placed in a firm archaeological context by:

1. Radiocarbon dating of several cultural and potential cultural deposits at the site to provide a firm age of this bowl and associated materials.
2. Geoarchaeological examination of the exposed Squamish River cut bank sediments and archaeological deposits to demonstrate that the bowl was purposely deposited at the edge of a hearth in-situ.
3. Archaeobotanical analysis that relates the finds of plant food and technological materials that were used for a variety of purposes.
4. Establishing connections of this site to other known sites and lithic sources further north along the Squamish River valley by using XRF.

We are also fortunate to have a rich cultural record to draw upon and refine our understanding of the *Skw'enp* bowl, including:

1. Ethnographic sources dating to the late 1800's and early 1900's that pertain directly to the Squamish Nation and other First Nations groups across British Columbia.
2. More recent Land Use and Occupancy Studies that document Squamish Nation place names and how people and places are linked.
3. Living community members (including the lead author) who have had the privilege to receive cultural knowledge from elders, community leaders and knowledgeable relations.
4. A growing interest of Squamish Nation youth who are interested in living and learning about their ancestors.

The archaeological and cultural data presented here allow us to meet the goals of Indigenous Archaeology that is defined as "the archaeology by, with and for a First Nations community." All field and lab work was planned, carried out and analyzed by members of the Squamish Nation. These people also worked with academic and consulting scholars and professionals to establish the data presented here. Most importantly the results of this research are already being used in the Squamish Nation education curricula where community youth and others can rediscover the ancient links that they have to their territory and as a result revitalize Squamish Nation culture and language.

The synergies found between the cultural data relating to salmon at *Skw'enp,* in combination with related contextual, circumstantial, or tenuous data, suggests a connection between the *Skw'enp'* bowl and Squamish Nation ceremonial life. Three types of specialists in ritual and ceremonial life served different roles: the *Si-yoh-win* (a person with guardian spirit power); *Swhi-ome-tun* (a person with great spiritual powers, derived from times of seclusion, fasting, and bathing); and *Asyew* or prophet (a person with rare and unique spiritual power). *Asyew* received prophetic messages from the Provider. For example, the *Asyew* would warn people of an approaching hot summer or harsh winter. The authors' opinion is that the role and use of the stone bowl found at *Skw'enp* fall within the realm of the *Asyew*, who also predicted the abundance, condition, and make up of salmon runs on the Squamish River (Mathews 1955:40–41; Bouchard and Kennedy 1975:23–30). In ceremonies, bowls such as this might be filled with medicines, roots, herbs, bark, water, pigment (ochre), oil, spirits or even perhaps the soul of an ancestor. We believe it likely that the *Skw'enp'* bowl played a role in many rituals and ceremonies, but its last use in ancient times was likely in a Squamish Nation First Salmon ceremony. We encourage other archaeologists and Indigenous communities to examine and or reexamine finds such as stone bowls and other unique items that occur across the Pacific Northwest in a similar way that we have.

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LOCALIZED RITUALS AND INDIVIDUAL SPIRIT POWERS: DISCERNING REGIONAL AUTONOMY THROUGH RELIGIOUS PRACTICES IN THE COAST SALISH PAST

Bill Angelbeck

ABSTRACT

In anthropological accounts, scholars often present the religion of a culture—their ceremonies, rituals, and beliefs—as one bounded system, suggesting coherency and conformity. Such treatments do not apply for the Coast Salish cultures of the Northwest Coast, however, since these groups exhibit a conspicuous degree of local preferences and styles in their ritual practices. Here, in this essay, the intention is to consider the localized patterns of ritual practices from disparate Coast Salish areas, drawing on ethnographies and histories, and to discern their expression in the archaeological history. While there are practices that are prevalent among the Coast Salish—such as the first salmon ceremony or spirit dances (and even those have their qualifications)—there is a spectrum of practices that manifest at various scales. At the smallest scope, these practices anchor in the individual and the household, and households share rituals with affines or allied households in networks of shared interactions. In this way, related groups express particular identities through the rituals they practice, and they convey how particular spirits—those grounded in their territories—empower them. In so doing, they convey how power wrests from their own sources, rather than from sources available to all.

Introduction

In several respects, Coast Salish peoples of the Pacific Northwest exhibit an ardent degree of identity and autonomy. This is expressed in their oral traditions and in how anthropologists have treated them in their research. Commonly, Coast Salish individuals self-identify at local scale of their band, whether Penelakut, Soowahlie, Klahoose, or Upper Skagit. Then, they will usually next identify at a larger scale such as a tribe or nation, such as Ts'elxweyeqw, Stó:lō, or Hul'qumi'num. Further, many will first self-identify with their given ancestral name and their family or village even before identifying with the band. This is a bottom-up form of identity reckoning, and the emphasis here is that such local forms of identity should manifest ethnographically and archaeologically. For this essay, the focus will be on how religious practices indicate the local expressions of Coast Salish identity. Many ritual items or features exhibit localized patterns, ethnographically and archaeologically. One key point from this is that no ritual practice exhibits a distribution throughout the entirety of the Coast Salish area. Furthermore, it is also apparent that even with the more common practices—those with the greatest areal ranges—there are always significant local variations from the general style. And, where there are broader patterns, these can be usefully viewed from a bottom-up perspective as to how such larger-scale forms of interaction come about.

In the following, first is a discussion of the general approach, which concerns autonomy, providing examples of how Coast Salish groups exhibit a strong degree of local identity and independence. This is expressed in their oral traditions and in how anthropologists have treated them in their research. Next, the discussion draws upon ethnographies concerning ritual practices along with their geographic extents. This will set a basis for an examination of archaeological manifestations of items that are often interpreted as linked to spiritual or religious practices, such as rock art, mortuary features, and certain artifact types, including stone bowls and etched stones. In closing, an ethnohistoric case illustrates the dynamics that emphasize local autonomy in the case of Slabebtikud, an Upper Skagit prophet and spiritual leader in the early 1800s. Throughout, the attempt is to show that there's a continuing emphasis for local practices, rather than those that are common to all Coast Salish.

In a sense, the scale of this is necessarily overarching, requiring some degree of generalization, as the intention is to use numerous avenues to convey an overall common pattern, one that illustrates how Coast Salish spirituality is locally anchored, even while those spirit powers and symbols, spiritual practices and paraphernalia, are shared with affines and allies throughout the Salish Sea.

Autonomy of Coast Salish Groups within the Culture Area

Coast Salish traditional territory occupies and surrounds what is now called the Salish Sea (Fig. 1). The Coast Salish exhibit remarkable cultural and linguistic diversity within the region. Perhaps because of this cultural diversity, ethnographers typically have been more comfortable providing ethnographies of localized Coast Salish groups—such as the Puyallup-Nisqually (Smith 1940), Twana (Elmendorf 1992 [1960]), Lummi (Stern 1934), Saanich (Jenness 1934), Upper Skagit (Collins 1974), or Straits Salish (Suttles 1951)—rather than providing discussions of the Coast Salish culture overall, as is more commonly found with other Northwest Coast groups. For instance, for other Northwest Coast groups, such as the Haida, Tlingit, Nuu-chah-nulth, or Kwakwaka'wakw, ethnographies predominantly concern whole cultural groups (e.g., Swanton's (1911) *Haida*, Boas and Tate's (1909) *Tsimshian Mythology*, Drucker's (1951) *The Northern and Central Nootkan Tribes* or Walens' (1981) ethnography of the Kwakwaka'wakw). Indeed, in the primary anthropological handbook about Northwest Coast cultures (Suttles 1990), only the Coast Salish are treated in four sub-groups rather than as a whole cultural area. And, even when overall treatments have been provided—such as Wayne Suttles' (1987) *Coast Salish Essays*, Charles Hill-Tout's posthumously collected *The Salish People* (Maud 1978), or Homer Barnett's (1955) *The Coast Salish of British Columbia*—those ethnographers routinely discussed various cultural aspects partitioned by local cultural groups, forefronting the regional variability. This shows that, when studying Coast Salish communities, ethnographers have been cautious in how far they cast their generalizations. Anthropologists have noticed that the practices that they record are limited in extent and they have restrained the scope of their ethnographies to those local communities. As emphasized by Suttles (1983:68–69), in cautioning that "one might easily get the impression that … the whole Coast Salish area was culturally homogenous," however, "within this continuum there were some pretty clear cultural differences, seen especially in the distribution of ceremonial activities."

So, the way Coast Salish have been treated anthropologically provides an example of this key point for this study, in that Coast Salish peoples exhibit high degrees of local diversity.

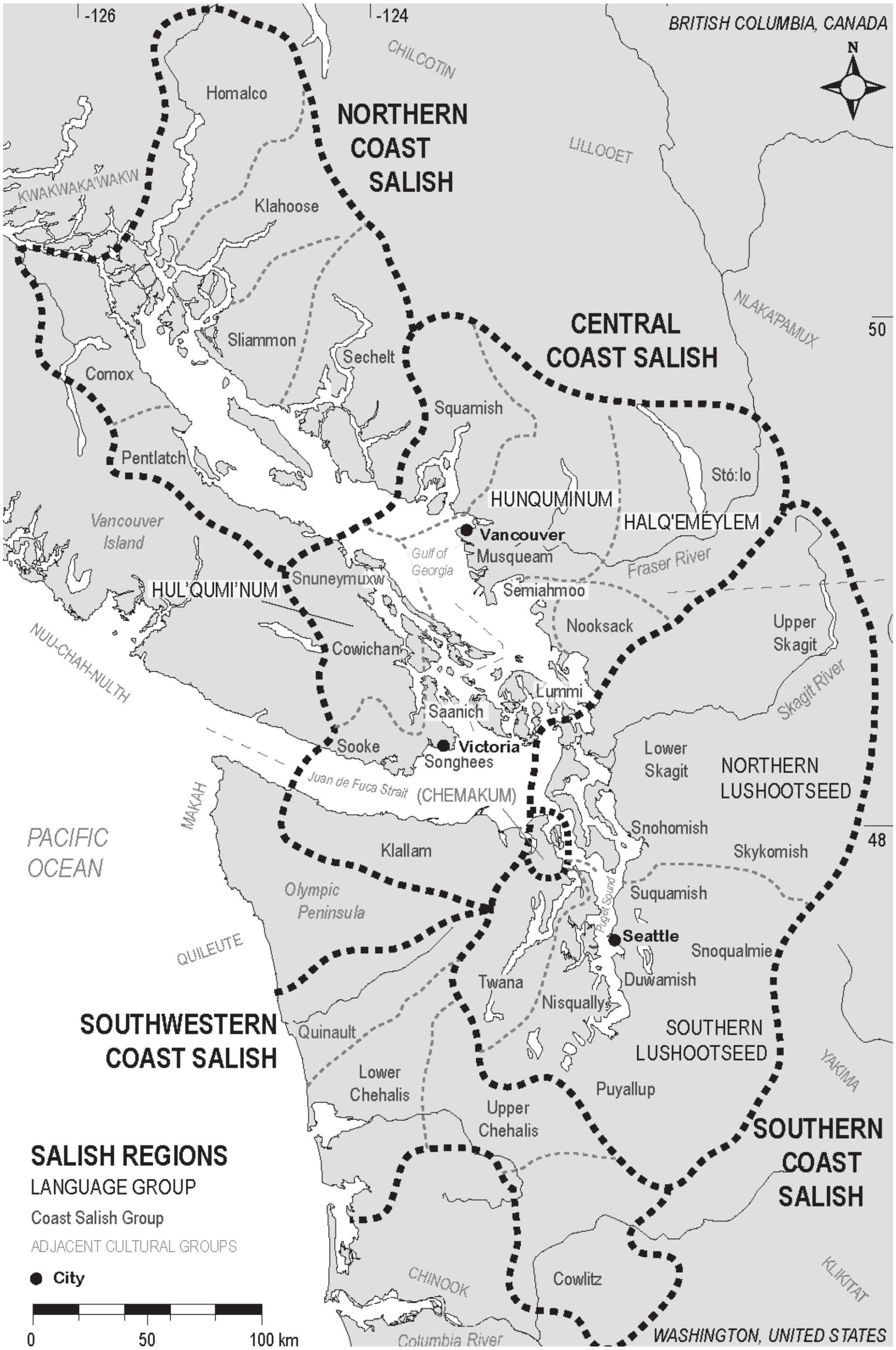

Fig. 1. Map of the Coast Salish area.

Multiplicity in Oral Traditions

One expression of localization comes through in their origin stories. Coast Salish cosmologies emphasize multiplicity in their origins since the “Time of Transformation.” Multiplicity indicates that there is not one common origin, but manifold origins. A main example of this is that commonly there was not one Transformer entity, but four original Transformer siblings, or the *Xexá:ls*, consisting of three brothers and one sister (e.g., McHalsie, Schaepe, and Carlson 2001:6). While some recordings, such as Old Pierre’s “The Katzie Book of Genesis” (Jenness 1955), have identified a single deity, researchers have shown this to reflect Christian missionizing influences, as noted in the use of the term *Xá:ls* (McHalsie, Schaepe, and Carlson 2001:6). Even founding ancestors for some groups involve multiple individuals. For the Ts'elxweyeqw (Chilliwack), there is not one founding ancestor, but four (Carlson 2010:117–118). Such cosmological views of their origins of the landscape and their lineages certainly are reflection of multiple powers in the world. In this way, the original transformers that created the world consist of a heterarchy, or an array of authorities rather than a pyramidal hierarchy towards one supreme deity or leader. This makes sense as it also is consistent with how there was generally a heterarchy of leaders in their communities, not one leader. These were variously called *siems* or *siyams*, which has often been translated as “chief” but the Western term carries more hierarchical notions than the Salish one implies.[1] Typically, there were multiple leaders within a village, not one. And, the authority of such a leader generally was restricted to their household, only with possible influence beyond, not command, based upon their respect. Thus, Coast Salish sociopolitical organization mirrors the structures in their oral traditions.

Indeed, Crisca Bierwert (1999) made such an argument, that Coast Salish oral histories revealed multiple vantage points, reflective of numerous local positions. In discussing Coast Salish epistemology, Crisca Bierwert has noted that a “heterological” approach, after de Certeau (1986), is appropriate, as these are “antithetical to the premises of master narratives”:

> They are fluid more than fixed; develop a dynamic more than static structure; emphasize multiplicities more than unity; are composed of episodic relations more than cohering parts. Heterologies are even more diverse than disjointed narratives, in that their parts are characterized by different modes of thinking, not just a mixture of similar narratives from different positions. (Bierwert 1999:267)

In this way, with her emphasis on fluidity, multiplicity, and the temporariness of relations, Bierwert considers such epistemologies “antihegemonic”; that is, by their very decentered structure they resist concentrations of power, or hegemonies. She pointed out that the “decentered organization of Coast Salish epistemologies has derived from resistance to the grip of the state or transnational empires’ hegemony,” yet she acknowledges that these appear to have a long history among themselves as “richly contested antecedents of intellectual histories” (Bierwert 1999:269). By portraying their history and epistemology in this heterological manner, Bierwert aimed to accurately portray the multifaceted aspects of Coast Salish culture on its own terms. Here, we should extend such a heterological approach in considering their ethnographic practices as well.

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[1] As Suttles (1987:254) noted, the term [*siem*] implies “respect of others, leadership in nearly any kind of activity, and, probably, ownership of important property.” The point is that it indicates respect for another person due to skill, ability, knowledge, wisdom, wealth or status, all of which generally were intertwined and undergirded by their connection to spirit powers.

Ethnographic Examples

Anthropologists have documented a wide variety of ritual practices among the Coast Salish. While some of these treatments might suggest that they apply to the Coast Salish overall, the patterns tend toward localized practices. Moreover, there are certain aspects underlying Coast Salish epistemologies that favor local and individual expressions to be effective, whether through various dances, masks, or ceremonies; this is seen in the spirit powers that inhabit their territories and conduct or manifest themselves through individuals or particular ritual items. An important feature that is common throughout these expressions is the emphasis on spirit powers, the spiritual capital that underlies all signs of success for Coast Salish communities, whether in leadership, warriordom, oration, negotiation, healing, weaving, carpentry, or artistry (Angelbeck 2009:129–136). Yet, a common aspect is that spirit powers are locally acquired and individually expressed.

Spirit Powers and Spirit Dancing. Spirit dancing is common ceremonial practice conducted at winter gatherings. During these events, Coast Salish peoples assemble often for long series of nights throughout the season to display the spirit powers they have acquired, through particular songs or dances that their spirit has given them. These powers have been sought individually, often involving great trials of training in isolation—although spirits also could seek and possess those even not seeking spirits at the time (Kew 1970; Amoss 1977; Jilek 1982). Ethnographies are replete with categories of powers, most of which relate to animal spirits—raven, woodpecker, bear, seal—but also insects, aspects of nature, or simply named but imprecisely known spirits. Only some powers were available year-round, such as shaman's spirit powers or those of a warrior (Collins 1974:118); for most others, they displayed their powers during the winter at spirit dances.

While spirit dancing is common to most groups, Barnett (1955) detailed these by four main types of winter dancing, by subareas; and he was mainly covering just Northern and Central Coast Salish groups, those in British Columbia. In this way, there was a range from "unorganized" spirit dancing, where anyone who had the spirit powers could express them, to those that involved particular dances that were inherited and followed family lines, or involved initiation into the spirit dance ceremony. In spirit dancing, with its emphases in revealing and concealing powers, the people unite together on the longhouse floor and those in attendance, yet each person displays not a collective power, but the singularity of one's individual power. Spirit powers are the individual's alone; the community of the ceremony involves each displaying and sharing songs with each other.

The aspects of spirit dancing, has principles that embue their other approaches to ritual, wherein local autonomy is expressed in a manner that creates links with other groups.

> In their settings and actions the Musqueam ceremonies stress community of interest.... It is as if the domestic family unit were enlarged to incorporate a broadly constituted range of participants. In speeches which compliment the sponsors of spirit dances, metaphors often stress this aspect: 'The *syə'wan* brings the Indians together as a family,' 'Our old people (the Musqueam and Squamish) used to be like one family in the same house,' and the like. (Kew 1970:326)

Pamela Amoss (1977:131), in studies of winter dancing and spirit powers, noted "the double-edged task of creating ties that bind individuals together and at the same time providing devices of separating them from one another." The concept of spirit power as private yet symbolized amorphously to others creates a space for individual autonomy: "This traditional secrecy surrounding individual power creates for each person an imponderable center to his personality that cannot be penetrated by all community knowledge of his comings and goings, his family history, and the full range of his associations" (Amoss 1977:135). These powers were so individualistic, that these allowed someone a defense against "manipulative relatives," since one could simply say "what [power] I have doesn't like that," and no further explanation was needed to not participate in some activity. It was a way of maintaining independence that was respected by others, a way to create an "inviolable private sphere around a person" (Amoss 1977:134).

Further, people were afraid to offend those perceived to have strong spirit powers as not only might that person be offended, but their spirit powers might also take umbrage, which would be even worse. This explains why shamans and warriors, who had very ambiguous powers, were given social distance. But, it applied to any individual with spirit powers. As Amoss emphasized:

> The concept of power protects the individual's right to separateness, privacy, and autonomy by keeping other people away from the secret center of his being. (Amoss 1977:137)

Suttles (1983) also highlighted how secrecy was central to their notions of connections to spiritual powers and places. He noted that this was inherent to Coast Salish art forms, which created an ambiguity in how spirit powers were portrayed. He referred to this as "productivity and its constraints." Similar to what Amoss (1977) described for spirit powers in dancing, Suttles detailed that Coast Salish art was also based in a connection to spirit powers through questing and visions:

> In theory, although not always in practice, the exact nature of the vision experience is something one ought to keep secret, perhaps until old age. The vision experience inspired a unique individual performance in the winter dance, but its nature was only hinted at by the words of the song and the movements of the dance… Any other representation of the vision experience we might expect also to be vague, ambiguous or covert. (Suttles 1983:69)

Among the Stó:lō, secrecy was an important component of power areas as well as places in which to renew one's relationship to spirit powers, as in "swimming" or "bathing" areas. Many Stó:lō individuals continue to seek solitude in the forests and mountains in clear pools along streams at spots known individually or passed down through families. For instance, one noted that there are "areas around Chilliwack, areas up behind Cheam, areas up in Chehalis…there's different areas that people go for swimming." Others confirmed some of these same general areas as questing sites, although more often the sites were kept secret, especially the specifics. As one noted, "They don't reveal the areas." People do not like to reveal their personal spots, due to keeping their power secret as well as to simply to keep the place private to better ensure solitude (Angelbeck 2003:22). In this way, the spirit powers there, inherent to the location, involve connections that are passed down over the generations, and the knowledge was kept within the family or local community.

Sweating Rituals. Sweating was another ceremonial practice for cleansing, but was typically done closer to the village, creating a cultural space near residences or camps for a spiritual practice, rather than seeking it out in the solitude of forests. Unlike the large sweat lodge of the Plains that could accompany a dozen or more people, Coast Salish groups typically built small domed structures, with enough room for one or two, indicating that it was a more private activity (Duff 1952:50). As Barnett (1955:39) remarked, "sweating was indulged in according to private needs," and therefore was not predetermined by time as a regular ritual for several people. Barnett (1955:39) was careful to note the variety of practices implemented throughout the Coast Salish area. Instead of domed, as among the Stó:lō, he described structures as small A-frames, with two sets of crossed posts and a cross-post (see also Kennedy and Bouchard 1983:47). These were "small permanent structures" (Barnett 1955:39) set near streams, so those undergoing a sweat could readily plunge into the cold waters afterwards. On Vancouver Island, he detailed that no structures were used. Rather, women heated rocks covered with a bed of sand and mats and laid on them (Barnett 1955:39). While often a regular cleansing practice, individuals in training for spirit powers practiced sweating more intensively in combination with bathing (Duff 1952:50), and brushing with cedar boughs. Duff (1952:50) further emphasized that sweating was much more practiced among the Stó:lō than adjacent groups, indicating a localization and emphasis for the practice. This would also appear to be case for their neighbors to the south in the Cascades, meaning the Upper Skagit (Collins 1974:64, 180), where sweating is often conducted as a part of spirit questing. Both groups also happen to have relations with Interior Salish groups, where such sweating rituals are common as well.

First Salmon Ceremony. The First Salmon Ceremony is one ritual that has broad distribution throughout the Salish Sea. It involves an acknowledgment of the offerings of salmon as food, and is conducted with the first salmon catch of the year or season. Yet, even with this prominent ceremony, local variations were present. For instance, Gunther (1926:608–609) noted that among the Cowichan and Chehalis, the ceremony is quite elaborate. Conversely, in Puget Sound, as with Snohomish, the ceremony is rather simple, in that the person who makes the first catch holds a feast and allows others to eat it, in that they give it all away.

And, there were exceptions, with groups claiming not to practice the ceremony, such as the Klallam, near Dungeness Spit, since they did not have "first salmon" of the year, as their territory had fish essentially all year long (Gunther 1926:610); one could see that this is a boast of local power, to claim such natural capital in salmon was always available to them.

Sxwayxwey. The Sxwayxwey dancers involves a purification ceremony performed in conjunction with other events, such as marriages, naming ceremonies, or funerals. Masked dancers displayed elaborate headresses and attire and they carried scallop-shell rattles. As McHalsie (2001) summarizes, stories of its origins date to the late 1700s, involving purification of disease, likely in association with smallpox epidemics.

Suttles' (1983) believed that the weight of traditions indicated prominence of this tradition in the Lower Fraser Valley; he referred to it as the "Halkomelem sxwayxwey" (Suttles 1982). Bierwert (1999:184) made note of this tradition as a "privilege of some Salish families in the Halkomelem area," and she further added that it was "not [a practice] in the Lushootseed area to the South." The point here is that this a common ceremony, yet it is more restricted to Eastern Vancouver Island and predominantly associated with the Lower Fraser. These are not common in the southern Coast Salish area, for instance.

Secret Societies. Secret Societies were also present among some Coast Salish. The Comox in the northern Salish Sea have traditionally practiced the *hamatsa* of the Kwakwaka'wakw. Klallam communities also had secret societies, called the *xūnxanī'te* (Gunther 1927:281-288). The Quinualt were regarded as the "southern limit" of the secret societies of the Northwest Coast. These were called the *tsa'djak* and the *klo'kwalle*, the latter meaning "Black Tomanawus" or black spirits. Among the Twana, initiation into the society insured future acquisition by the initiate of an individual guardian spirit, especially a powerful tutelary, one of the wealth powers (*s'iya'lt*) or one of the strongest shaman powers (*swddac*)" (Elmendorf 1948:631). Notably, these secret societies are found in areas bordering Wakashan groups to the West and North, where such societies are more commonly practiced (Olsen 1936:120).

Skedelich. Skedelich boards are another ritual ceremony exclusive to some Coast Salish groups. These were unique in that spirits conducted themselves through cedar or vine maple boards, and the boards were animated and could shake wildly when held—although only certain people had the power to handle the boards. Upper Skagit peoples considered it the most powerful of the lay (or non-shamanic) spirits. One informant described these as "all head and no body," that the skedelich "knows what people are thinking about." It was used to enhance or ensure fishing success, and people called upon the skedelich power to find lost things. This power knew where things were, where the fish were, where lost things were, and people used it to determine the truth in a contested matter. This is primarily documented as an Upper Skagit ritual item, although neighboring groups also used them, such as the Snoqualmie and Snohomish (Haeberlin and Gunther 1930:70), and some Lower Skagit (Collins 1974:160). An example is also found among the Katzie, although Jenness (1955:63) notably remarked that: "Indians on the Fraser River and on Vancouver Island were not eligible for this guardian spirit except through intermarriage with Indians of the State of Washington, where the skʷədi'ləc dance originated."

Thus, this important ceremony and spirit power is even more restricted in scope than other practices discussed above, and while others outside of the core area could gain the power, it was necessary to have local connections to the original area in which that ritual is practiced, and from which that power originates. These local connections generally worked through familial connections (e.g., Kennedy 2007).

Each of these spiritual practices illustrate that none are distributed throughout the entire Coast Salish area. Many of these practices are restricted in practice to particular areas. Indeed, the underlying commonality in the seeking of spirit powers concerns the individual expression of those powers. This especially is indicated in spirit dancing, where many communities of dancers come together, but they each express their individual powers that they have gained. Even with a widespread phenomena and cultural practice of spirit questing and spirit dancing, the expression of it is local and individual. Given this regionalization is apparent ethnographically, such patterns should also be present archaeologically.

Archaeological Examples

Archaeologists typically associate some archaeological features and artifacts with spiritual practices, and those within the Coast Salish area tend to exhibit localized patterns, meaning that such practices or artifacts do not extend to the whole of the Salish Sea. In the following, the discussion concerns such items that archaeologists do associate with spiritual practices (even while some may argue for other associations for such).[2]

Archaeologists typically point to what are otherwise non-utilitarian items as marking ritual in the archaeological record. This is with the understanding that many items in a Coast Salish assemblage is likely to have some ritual significance, from even certain projectile points or materials used to make them that are used for hunting. With that acknowledgement, I will focus on items or practices explicitly oriented towards ceremonies in the Coast Salish area, and these include mortuary ritual in burial cairns and mounds, rock art, and forms of portable art.

[2]Here the discussion is limited to spiritually related items, although the localization that is explored here is also expressed in the distributions of non-spiritual items as well, meaning that the argument applies whether particular archaeologists consider such artifacts or practices as related to spirituality or not.

Burial Mounds and Cairns. Mortuary behavior is one the main manifestations of spiritual or religious behavior as ancestors are properly prepared for the afterlife. Burial cairns and mounds, as above-ground earthen or stone mortuary structures, are predominantly associated with 1500 to 1000 BP in the Coast Salish area (Thom 1995; Mathews 2014), according with Late Marpole, which is a time of contestation followed by the Gulf of Georgia or Late Period, ca. 1600 BP.[3] Prior to that period, burials were largely subsurface within shell middens adjacent to villages, generally only encountered through excavation. After Marpole, the predominant form shifted to above-ground mortuary structures involving carved boxes and poles, forms that generally are less likely to last archaeologically. For the Late Marpole Period, these above-ground cairns and mounds are the most readily identifiable mortuary features.

Sometimes these are less clear in their differentiation, as noted by Mathews (2014), wherein burial cairns can exhibit a wide variety of construction forms. In general classification, mounds refer to those of largely earthen construction, even while there may be stone arrangements within (e.g., Smith and Fowke 1901; Lepofsky et al. 2000). Conversely, layers of earth can be incorporated into the design of cairns (Mathews 2014). Even with these caveats, the basic distinction of stone-based cairns and earthen mounds holds more generally for the area, and are applied by archaeologists in the region. Since these are the basis for how such features are classified archaeologically in site form documentation and reports, here I will use the classifications available in the literature and site records. When plotted separately as cairns and mounds, there is a distinction in the geographic array of such features. Clark (2013:187–188) offers a similar observation, providing a map to show that southern Vancouver Island, the southern Gulf Islands, and the San Juan Islands consist predominantly of cairns. On the other hand, the Fraser River exhibits the practice that is predominantly of earthen mound construction. His map, as well as the first map provided here (Fig. 2), both show differing practices in the islands versus the mainland.

When both practices are plotted, there is considerable overlap between the two. However, when plotted as sites with greater than 25 cairns or mounds, the patterns are clear (Fig. 3). Five main cairn sites are concentrated in the islands, while five mound sites are located on the mainland, along the Fraser River, with the main concentration in the Stó:lō or Halkomelem region. This indicates that differing mortuary practices were in use locally in the central Coast Salish area within the same period.

Rock Art. A similar pattern is apparent with rock art practices. Rock art also has a wide distribution throughout the Salish Sea. These are often generally interpreted as having spiritual associations (e.g., Hill and Hill 1974:283–290; Adams 2003). Today, many Coast Salish peoples often regard these as sacred sites or sites with spiritual associations, often depicting supernatural or non-human entities, and relationships with non-human entities.

The distributions of rock art exhibit a similar islands-versus-mainland distribution, with the island groups inscribing petroglyphs into rock and the mainlanders painting pictographs on bluff walls with red ochre (Fig. 4, Table 1). These are much more clearly differentiated than the mound and cairn distributions. A total of 122 pictograph sites are present in eastern or northern Coast Salish groups, those mostly mainland in orientation. In turn, a total of 189 petroglyph sites have

[3]In some accounts (e.g., Angelbeck and Cameron 2014), the Late Period or Late Pacific (Ames and Maschner 1999) is demarcated as beginning circa 1600 BP in the Coast Salish region, marked by the introduction of new weaponry in the bow and arrow, and the development of warfare, which may signal a need for a differentiation beyond Late Marpole, as the period exhibits numerous distinctions to possibly warrant such. It should be noted that a recent overview of the Marpole Period, Terence Clark (2013) provides a range of 2000 to 1100 BP, which excludes earlier sites extending back to 2400 BP as included in other classifications (Matson and Coupland 1995; Mitchell 1971; Burley 1980).

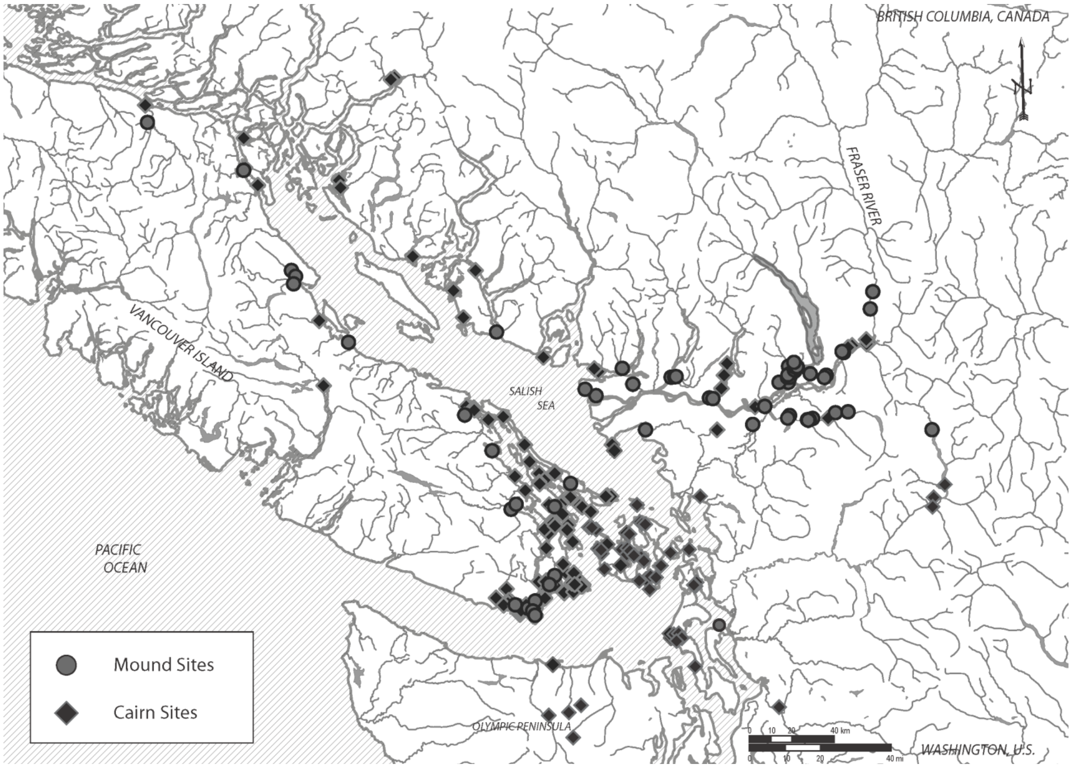

Fig. 2. Map of burial mounds and cairn sites in the central Coast Salish area.

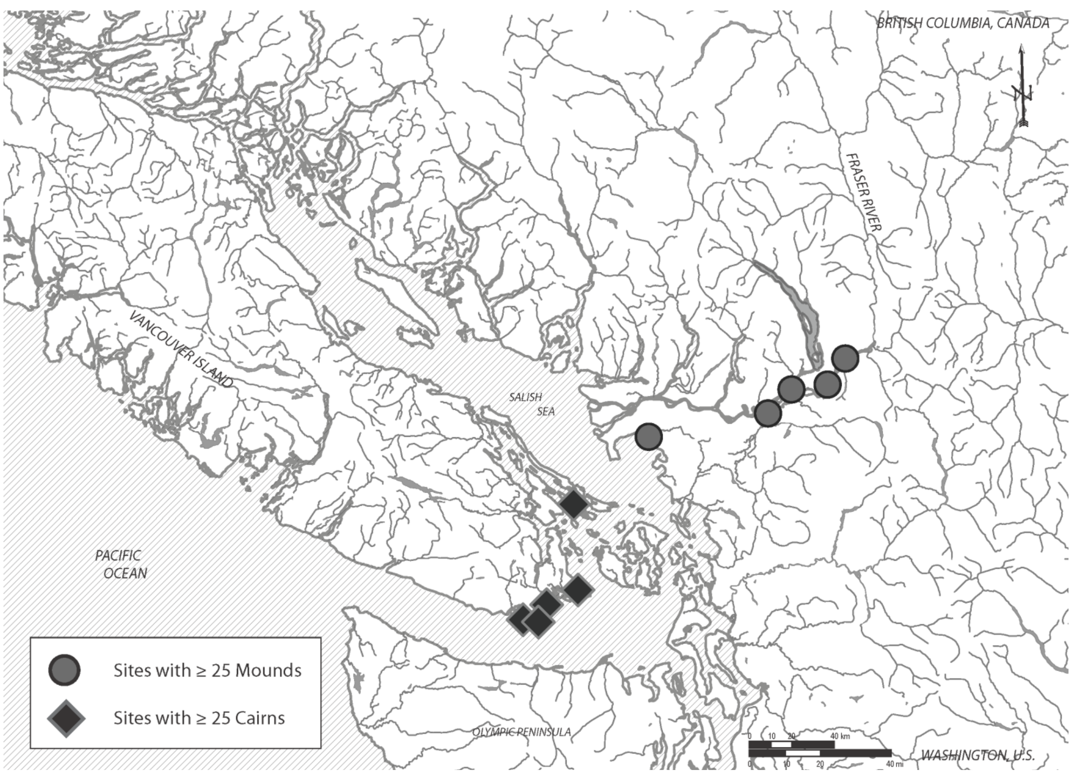

Fig. 3. Map of sites containing at least 25 mounds or cairns in the central Coast Salish area.

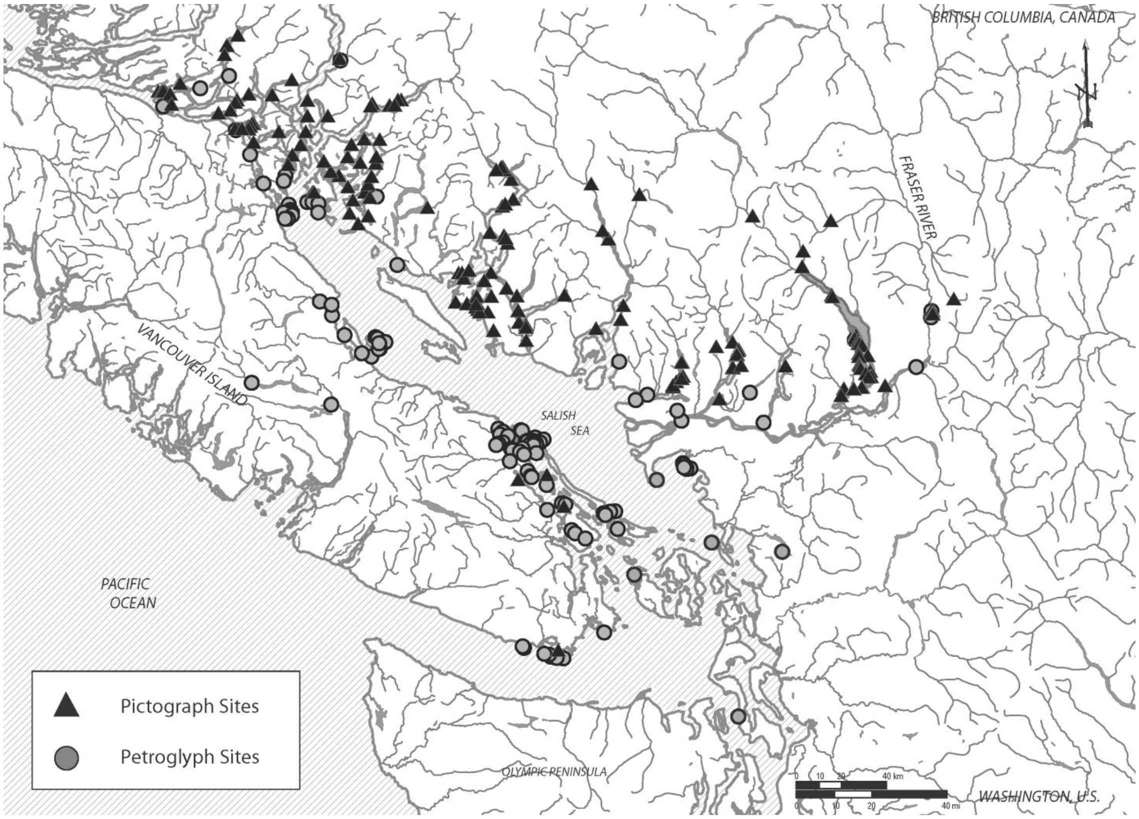

Fig. 4. Map of rock art sites in the central Coast Salish area.

TABLE 1. ROCK ART SITES CATEGORIZED BY PROMINENT CONCENTRATIONS, INCLUDING BOTH PICTOGRAPHS AND PETROGLYPHS.

Coast Salish Group	Pictograph Sites	Percentage		Coast Salish Group	Petroglyph Sites	Percentage
Klahoose / Sliammon	38	20%		Cowichan	51	60%
Chehalis	38	20%		Snuneymuxw	34	40%
Sechelt	45	24%				
Subtotal	**121**	**64%**		**Subtotal**	**85**	**70%**
Coast Salish Area	**189**	**100%**		**Coast Salish Area**	**122**	**100%**

been identified in the islands, predominantly in the Hul'qumi'num region. Thus, there existed differing practices within the Coast Salish area. Further, these practices are distinct to these regions even while the materials for both are generally present in both areas. That is, pictographs could have been applied with hematite-based ochre throughout the Coast Salish area; as well, sandstone or some other rocks could have been inscribed with greater frequency on the mainland. Instead, these groups exhibited particular practices, choosing to practices particular forms of rock art. Still, there may be environmental factors in general that contribute to the contexts that influence the choices that peoples make, with common rock surfaces that are easier to inscribe are more present in the islands than the mainland, or certain areas with bluff exposures with the coast mountains. Yet, all cultures work within the environmental options and constraints.

Further, these distributions also reveal even more local patterns than the general patterns of islands versus mainland. The results indicate that certain Coast Salish groups are more associated with rock art practices than their neighbors (Table 1). Nearly two-thirds of the pictographs (64%) in the areas of three groups, Klahoose and Sliammon, Chehalis, and Sechelt. These concentrations indicate that each of these groups contain between 20% and 24% of the total number of pictograph sites. Likewise, petroglyphs are practiced in the areas of predominantly Cowichan and Snuneymuxw groups of the Hul'qumi'num region (n=85), amounting to 70% of all petroglyphs in the Salish Sea. Concentrations are present in the Nanaimo region (n=14) and adjacent Gabriola Island (n=20) (see also Adams 2003). That is, the petroglyph and pictograph sites are not evenly distributed in either the islands or mainland, respectively, as they exhibit concentrations in the territories of certain groups.

Etched Stones. Etched stones indicate a particular artifact type that have been interpreted as likely having spiritual associations (Mapes 2009). In the excavations at č̓ixʷícən (Tse-whit-zen), archaeologists uncovered nearly a thousand (n=906) etched stones. These stones reveal thinly inscribed lines etched into the stone. Many in the community identified these as related to spiritual practices. When the stones were initially discovered, knowledge of this practice had been lost and many tribal members did not know what the stones were. These and many other artifacts are helping the Klallam people gain a better understanding of the ancestors and their life at č̓ixʷícən (Tse-whit-zen) (Mapes 2009; Phillips and Charles 2015). With such a high number of stones, it is the core area for such practices. Yet, other sites exhibit etched stones, if in smaller numbers. Morley Eldridge (1987) has investigated two sites in the Denman Island area in which one site contained over 100 such stones, indicating a second core area for such artifacts (Fig. 5). The site consisted of a rockshelter, interpreted as a space for specialized activities, very likely spiritual in orientation. Other sites contain much fewer instances of such etched stones, indicating areas of influence from those core areas. Yet, these two concentrations of such stones are localized to the Klallam area of Olympic Peninsula or Pentlatch territory of southeastern Vancouver Island.

One possibility is that these two main areas served as the centers for the distribution of these unique items. Astrida Blukis Onat (2008) proposed a similar possibility for the distribution of mobiliary figures carved from antler that appear concentrated in the Swinomish area, ca. 900 to 1,200 years ago. While concentrated at the mouth of the Skagit River, other examples were present at sites further distant, such as Sucia Island in the San Juans. She could have included other such figurines that are present at sites even further to the north in British Columbia, such as those from the Blue Heron Lagoon Site (DeRu-1), Montague Harbour (DfRu-7), or Valdes Island (Keddie 2009). Blukis Onat (2008:176–177) considers these items, due to shared design elements, as valuable markers are "remembrances of a specific event," essentially gifts to witnesses of a potlatch, feast, or ceremony. While she acknowledged that further investigations are needed, she suggests that the "context of the gifting traditions of the Salish area" can be a useful a framework for such analyses.

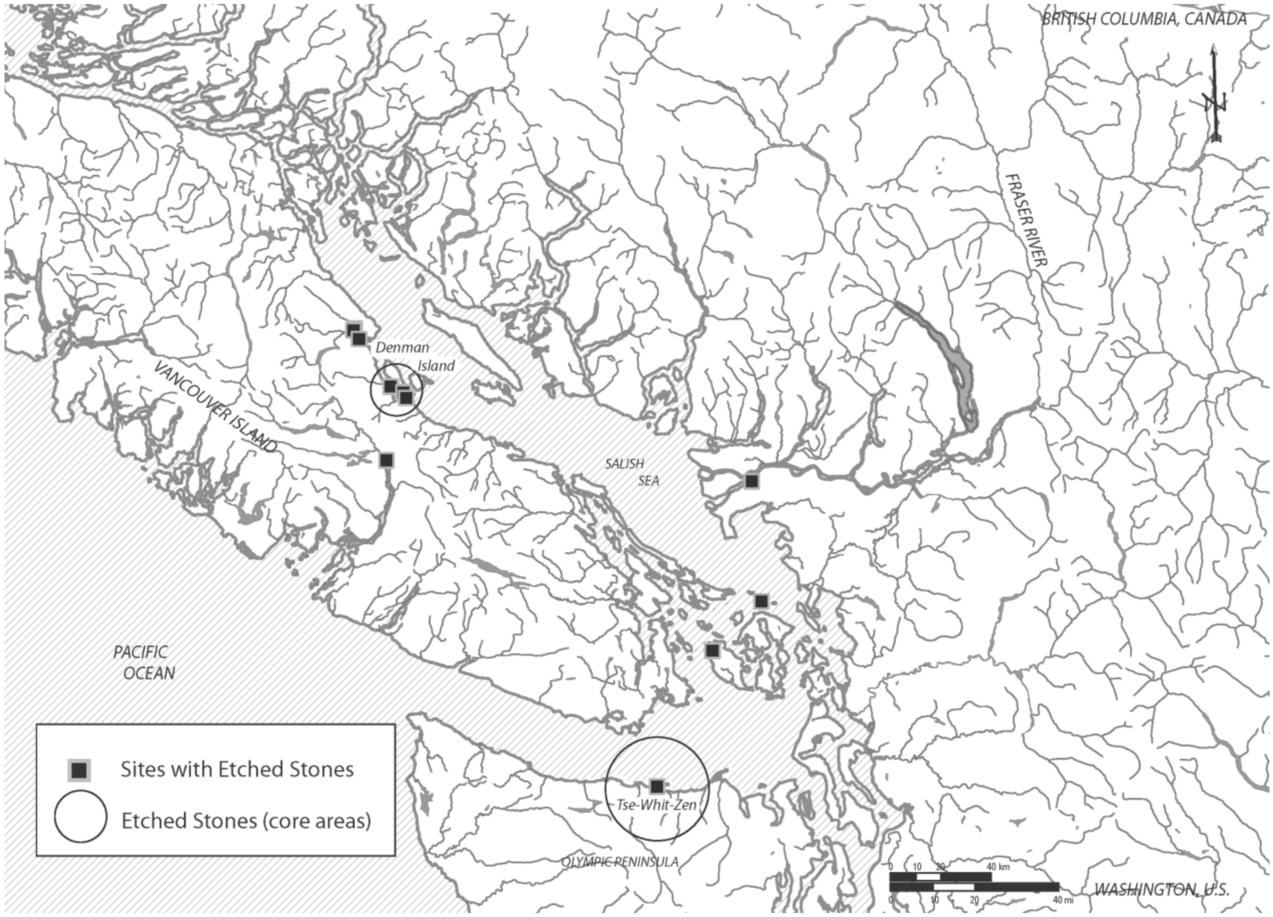

Fig. 5. Map of etched stone sites in the central Coast Salish area.

Anthropomorphic and Zoomorphic Stone Bowls. Carved or ground stone bowls exhibit a much broader distribution than etched stones. These include large but shallow stone bowls carved with zoomorphic imagery or taller anthropomorphic statuettes featuring bowls, or what are known as human seated figure bowls (Duff 1956, 1975; Keddie 2003). Due to their imagery, as well as the value accorded in labour in creation, archaeologists have readily associated these with ceremonial practices, as "medicine bowls" (e.g., Hannah 1996).

These are strongly associated with Lower Fraser area, yet distributions extend upriver to the Mid-Fraser region of the Interior Plateau (Fig. 6). Some of the imagery upon many of these bowls even derives from the Interior, such as rattlesnake imagery. For instance, there is rattlesnake imagery on a bowl in Victoria (No. 30). In turn, there is seal imagery up in Yale (No. 28 in Duff 1975), many kilometres upriver from the coast at the entrance to the Mid-Fraser Canyon. These indicate the alliance or familial bonds that peoples were drawing upon, which signaled ties to regions well beyond their local territory.

In addition to symbolization of distant regions, there are also material associations as well, in that the materials to make the bowls were from distant sources. For instance, soapstone bowls, a material found commonly in the Mid-Fraser region, have been found in Victoria area (Duff 1975). Conversely, other sites, such as Dionisio Point, contain stone bowls that exhibit similar imagery and style, yet are made from locally available Gulf Islands sandstone (Grier 2003:182). Similarly, at the Point Grey site, three such bowls were found, two of which were in the process of

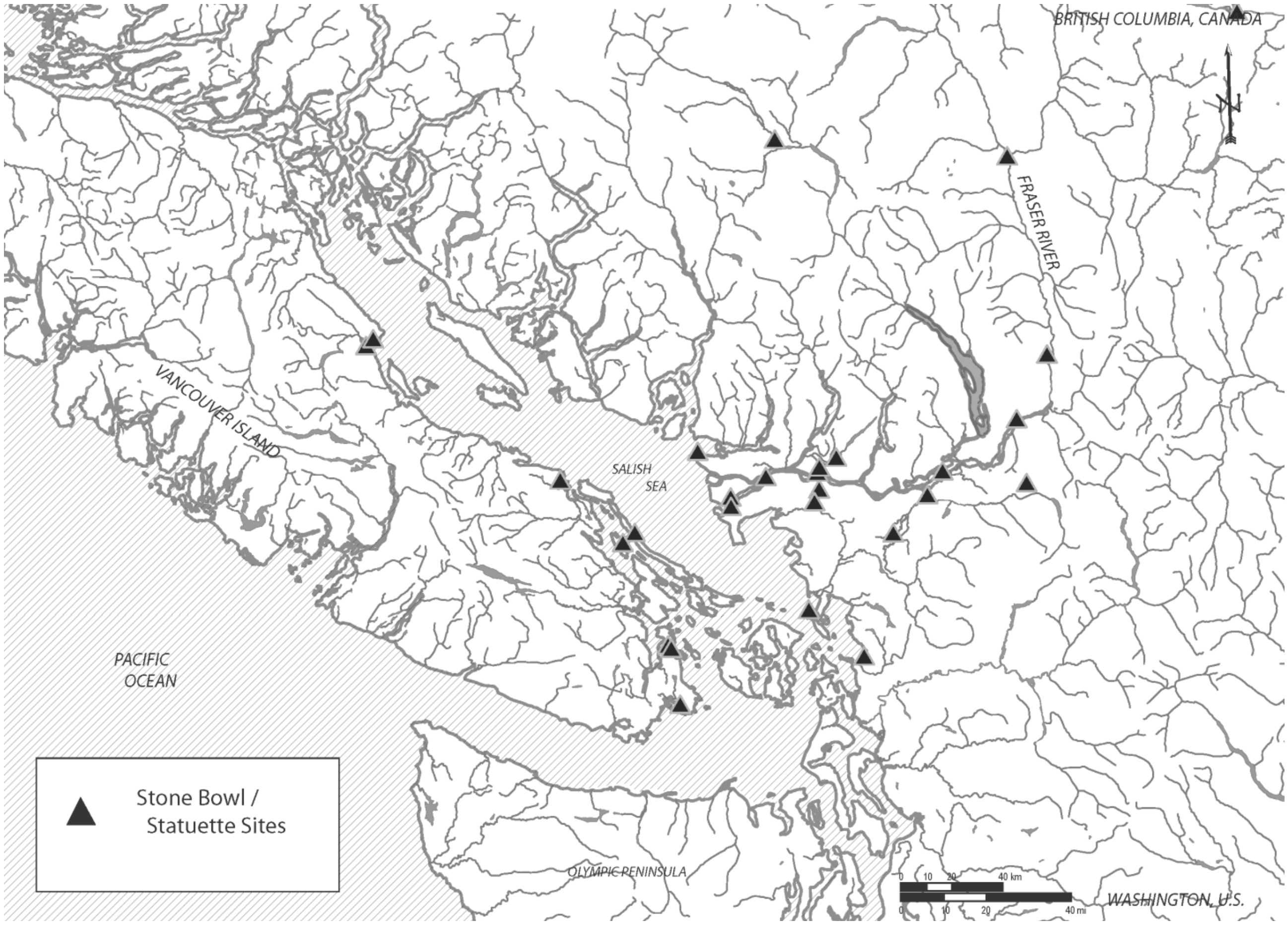

Fig. 6. Map of anthropomorphic and zoomorphic stone bowls in the central Coast Salish area.

manufacture, indicating their local origin and material (Coupland 1991). In either scenario, local or distant, these carved bowls likely represent through their material source as well as the imagery inscribed connections with their sources of origin, both naturally and culturally. In this sense, these are “pieces of places” that serve as mobile items but with lasting material connections to place, as detailed by Richard Bradley (2000). Archaeologists in the Northwest have applied his concept of pieces of places, such as Rudy Reimer/Yumks (2011) for the distribution of Garibaldi obsidian as important for the Squamish Coast Salish or Jesse Morin (2012:172-173) for the sources of nephrite from the Mid-Fraser region. As put by Morin (2012:173), the nephrite items served as the “materialization of social relations”. In this manner, this resembles the proposed archaeological manifestations for the carved antler figurines as raised by Blukis Onat (2008), discussed above.

While bowls are a broader archaeological phenomena, it is still predominantly a Central Coast Salish phenomenon, as Duff (1956) emphasized, with the greatest concentration along the Lower Fraser River. This is the area that is tightly associated with the Marpole period and territory. This concentration in the Marpole area indicates another example of localized phenomenom regarding ceremonial practices.

Clark (2013:183–184) has noted that another concentration of such carved and ground bowls occurs in the Southern Gulf. These exhibit their own style, using the locally available sandstones, as noted above for Dionisio Point. Clark (2013:184) notably remarked that "Artisans of the Southern Gulf area … [may] have used art to express social cohesion with the area and difference from their neighbours in other areas." His point regards the Straits Salish region and it relates to the overall discussion presented here, in that those communities emphasized local expressions, and this was the case within the broader phenomenon of ground and carved stone bowls. Even in being a broader phenomenon, again, stone bowls predominantly relate to the Central Coast Salish area and the Interior Salish of the Mid-Fraser Canyon, indicating that even large-scale cultural practices exhibit localized expressions and should not be regarded as extending to all Coast Salish groups.

To sum, the archaeological patterns for artifacts and features related to spiritual practices do not exhibit distribution throughout the entire Coast Salish area. Core areas exist for patterns that are widespread, such as with rock art or mortuary features, and even for limited distribution items, such as the etched stones. In this way, the material patterns for spiritual activities exhibits the localization (even individualization) and multiplicity of the religious worldview as indicated ethnographically. As Roy Carlson (1983, 2009) has suggested, the motifs commonly portrayed in rock art, mobiliary art, or monumental art have a long tradition, about four millennia. This indicates the continuity not only of symbols, ideas, and aesthetics, but also practices, concerning how such items are often gifted to others in the materialization of social connections.

Ethnohistoric Case: Exerting Local Autonomy Against the Prophet Slabebtikud

In the postcontact period, there was an upheaval in religious practices. Yet, Coast Salish groups also reveal a diversity of actions and practices in how they responded to colonialism, missionization, and the repression of traditional religious practices. One key case to consider illustrates that, while circumstances differed throughout the Salish Sea, certain principles that favored local autonomy ultimately result. This case concerns the Upper Skagit prophet, Slabebtikud.

Slabebtikud was a prophet among Upper Skagit peoples, partially influenced by Interior Plateau prophets (Collins 1950). There were Christian influences upon his views and practices, such as a weekly focus on religious activities and kneeling in prayer, but these coming indirectly from the Plateau prophets, who emphasized apocalyptic themes resulting from the influence of settlers. Upper Skagit communities viewed Slabebtikud as unusual among the communities for turning his plankhouse into a church during the summer months, a place of near-continual focus on religious activities, well beyond the usual winter emphasis for planhouses. And, during winter, spirit dances were held in his house. These gatherings at his plankhouse certainly involved other traditional activities as well, *slahal* gambling, wrestling, and feasting. But, involvement in this new religious fervor further entailed a form of obedience.

Slabebtikud was the chief authority, and he doled out punishments for those who did not follow the new order. His authority was heretofore unusual, as he exerted his spiritual authority beyond his own household. Traditionally, a *siem*'s authority was limited in scope to their household. In the first years of Slabebtikud's rise, Upper Skagit people favored his power. As a leader, he was instilling morality and leadership, especially during the changing times after contact. When the settlers needed to meet with the chief for treaty settlements, Slabebtikud embraced that for Upper Skagit. Later, when missionaries arrived in their territory, Slabebtikud's power strengthened (Collins 1974:35). He also extended his power not just to those beyond his house in the village, but he also extended it to other Upper Skagit communities with a series of sub-chiefs.

The first salmon ceremony, as discussed above, was an annual rite performed to honor the return of the salmon each year (Gunther 1926). Typically, Coast Salish groups performed the rite at their fishing camps, so as Collins (1950:340) described, “Each household held these ceremonies independently; the man in charge was the oldest of the sibling group comprising the core of the household.” After Slabebtikud gained prominence as a prophet, he aimed to control the first salmon ceremony for Upper Skagit peoples.

He demanded that he perform one first salmon rite for all the Skagit. As one informant told Collins, “he was kind of a dictator.” As Collins noted:

> Since authority in these realms had earlier been limited to the control of elders over younger persons within the family, this concentration of authority was a marked departure from former procedures. In the hands of Slabebtikud it aroused resentment, as did the irresponsible acts of certain war leaders. For Slabebtikud, this disapproval became strong enough eventually to cause his death, when members of one family ambushed and murdered him. (Collins 1950:340)

Thus, even in this case where an individual rises in prominence and spiritual power, the prophet is eventually undermined, and even murdered by his own tribal members, for concentrating and claiming too much power. He intended to control a common Coast Salish ceremony, to centralize how it was conducted. This was rejected, and Upper Skagit peoples returned to pursuing the practice of the rite in their own local fashion.

Discussion

The archaeological and ethnographic patterns discussed above might be considered as simply cultural differences, the presences of traits here and there, or their absences. This is the kind of work done that simply catalogued trait lists (e.g., Barnett 1939). Rather, the point of this discussion is to highlight the underlying Coast Salish cultural preferences that can inform us about how those archaeological and ethnographic patterns have come about. Part of the rationale for these patterns is found in their notions of relations with the spirit world, as the spirit powers available are seemingly infinite in origin and in the nature and the effect of their power. Another way to view this is simply that Coast Salish religion is reflecting their cultural protocols and preferences, that their religious worldview and the spirit powers that inhabit it mirror their own cultural tendencies toward the local places, emphases upon multiplicity and a heterarchy of powers and authorities. Indeed, it is more likely a recursive combination of both belief and practices.

Another aspect of this local autonomy of communities and individuals is that it allows not only for assertions of independence but also for the creation of wider spaces for the critique of another’s power as well. In fact, the constant presence of critique contributes to the preference for powers to be localized, and not to be overly concentrated in one space, as with centralization, as with the case of Slabebtikud, or to extend beyond one’s local domain. Such ever present community critique leads to other aspects of these spirit powers, involving a high degree of secrecy of spirit power among the Coast Salish as well as a well-treaded tradition of critique of spirit powers as well.

According to Pamela Amoss (1977:138), these spirit powers gave individuals creative expression and particular styles of being. They could be very particular powers, but often people speculated about the nature of one’s power. Here, she revealed that an artful balance must be kept in that the dancer must reveal that one authentically gained spirit powers, but they also must conceal many aspects of their spirit power, lest the source of their power unleash and they lose it. The unleashing can cause problems not for themselves but for others. These rituals help to channel the powers, express them, but control them. Therefore, it was necessary to conceal one's spirit powers in order to control them.

Indeed, Coast Salish people did not want to overtly express their spirit power, knowing they might be subject to criticism. Social critique of people's power was very common in oral traditions. Sally Snyder (1964:313) classed such stories as representative of the "bungling host" theme (see also Bierwert 1996:132). These are tales about people acting as elites, yet they do not really have power that they claim to have. In these stories, a person hosts a potlatch, but they repeatedly mess up—they give things away inappropriately, or they simply do not have enough gifts to hand out, or food to feed everyone, or other embarrassing things happen. These are satirical and humorous stories, but the point is that these hosts are expressing power, but they have overexpressed what power they actually have—and, in so doing, they've come up empty, appearing instead as fools, very publicly. These are the kinds of notions that lead to people to express only certain aspects of their power. Secrecy extends to practices overall. This was an inherent caution in both attempting to display one's power but also to balance that against showing too much.

Another aspect is that "a good power is controlled power, and people who receive power and fail to cultivate their control of it are a threat to themselves and the society at large" (Amoss 1977:138). Some spirit powers that people gained were, according to Puyallup-Nisqually, *ayáxaus*—dangerous, even malevolent spirits that could imbue great power. However, the powers it granted could cause one to pursue power and dominate others, even kill another without warning, and these could lead to the individual's own death (Smith 1940:73). Unlike other spirit powers, these were associated with "abnormal animal appearances," or shape-shifters, animals that when seen or hunted change from deer to snake, for instance, or animals grotesquely larger than normal, or bearing two heads. It is a form of trickster power, which the power one has gained may not appear to be as it is, that the one who holds such power has been deceived, or is masking the true nature of the spirit power. One might gain wealth and power, but others may charge that it derives from *ayaxaus*, and that the person was false in intention, a form of doppelganger—someone that should be opposed. This in a sense may have contributed to the growing critique of Slabebtikud, that he had gained a strong power, certainly, but that perhaps it was not an appropriate power. They had come to recognize it as a power that needed resisting.

Conclusion

All of these examples, ethnographic and archaeological, indicate that the Coast Salish peoples expressed the religious practices in ways tied to their local communities and territories. While ritual practices are multifarious, there are underlying principles common to all expressions, which lie in how they broadly conceive of spirit powers as affecting, even effecting, an individual's social and economic success. To ensure success, however, there is necessary balancing act between revealing that you have spirit power and concealing its precise source: to reveal too much is to lose it; to conceal too much is to not express your power. As argued here, this dynamic, which results from their conception of spirit power, leads to manifold expressions of ritual and supports each group in their effort to maintain autonomy, and this is marked both ethnographically and archaeologically.

In this way, they can express particular identities through the rituals they practice as well as make known the discrete spirits that empower them. They establish their own forms of spiritual power. As Darleen Ann Fitzpatrick (2004:221) noted about Cowlitz identity (and power), that it was “forged on an anvil of their own creation with one another as against tradition.”

Often, anthropologists can tend to focus on dynamics that are overly colored by state/chiefdom dynamics, the dynamics of centralized societies, the machinations of which the discipline is a part. Within centralized political formations, people are familiar with how individuals connive and beat down others in the fight for increasingly fewer positions in the higher ranks of society. But, with societies that are not centrally hierarchical, such as the Coast Salish, researchers need to think in different dynamics, those that are heterarchical (Crumley 1995). Among Coast Salish communities, peoples want leaders, and those leaders want to relate to other powerful chiefs. If their ally rises in power, they benefit from their connections. And, in the case of Slabebtikud, he came to be seen as violating those protocols for Upper Skagit peoples. One reason for his downfall was that he tried to implement a centralization of authority in controlling what had been a locally controlled practice in the first salmon ceremony. He apparently had crossed the boundaries of the permissible, and he met his end for it. This shows that power does not just flow from the top down, but that there is power in solidarity in how people ally together to resist the concentrations of authority, particular those that they view as unwarranted. Coast Salish religious expressions here provides a way to interpret such histories. The nature of power is subject to skepticism, to critique; one could view the case of Slabebtikud as having revealed himself to be a false prophet, a sort of *ayáxaus* power.

Each of these examples reveal that there are numerous centers for ritual practices. Even the most common practices reveal a diverse array of local distinctiveness. Most of these practices, and the powers associated with them, are tied to particular places and regions. While there are practices that are prevalent among the Coast Salish, such as the first salmon ceremony or spirit dances (and even those have their qualifications), these examples reveal that there is a spectrum of practices that manifests at various scales. Beliefs and practices are anchored in local places and regions, and this keeps power decentered and in control of local communities. Moreover, as the case of Slabebtikud shows, such regional diversity is actively maintained. As Alexandra Harmon (1998:23) has stated regarding Coast Salish power: “Power or strength was not so much a means to dominate others as insurance against domination.”

In this way, Coast Salish peoples can express particular identities through the rituals they practice as well as make known the discrete spirits that empower them. Not only do Coast Salish groups emphasize their local independence and autonomy, their religion provides a way in which to interpret and evaluate their sociopolitical dynamics. Power comes from local practices and is conducted by particular individuals, and they retain their social power through their ties to spirits in their local territories. In so doing, they convey how their power wrests from their own sources, rather than from those available to all. This cultural dynamic contributes to the distributional patterns that manifest ethnographically and archaeologically throughout the Salish Sea.

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ASSESSING THE NUTRITIONAL VALUE OF FRESHWATER MUSSELS ON THE WESTERN SNAKE RIVER

Jeremy W. Johnson and Mark G. Plew

ABSTRACT

Shell remains from two mollusk species *Gonidea angulata* and *Margaritifera falcata* are commonly found in archaeological sites along the western Snake River. There have been, however, no attempts to assess their nutritional value and dietary role. To further understand the role of mussels within prehistoric diets, the nutritional values of these species were compared with the values of other resources commonly found in riverine settings in southwest Idaho. Though the caloric value of mussels is relatively insignificant, these species do contain important levels of iron, carbohydrates, calcium, vitamin A, and ascorbic acid. A discussion of the life history of these species provides for consideration of possible seasonal use of mussels during the late winter and spring as a valuable source of nutrition during a time when other resources were scarce. Of particular note is the increase in protein, glycogen, and sugars during this time as well as the presence of polyamine compounds which have implications for use of mussels for their antioxidant and anti-inflammatory characteristics or as a seasonal appetite suppressant.

Introduction

Shell remains from the freshwater mussel species *Gonidea angulata* (Western Ridged Mussel) and *Margaritifera falcata* (Western Pearlshell) are commonly recovered from archaeological sites along the Western Snake River Plain which we define as an area along the Snake River between Ontario, Oregon and Twin Falls, Idaho. Archaeological data from sites adjacent to riverine systems in the Western United States indicate that the use of these two species as a food source has occurred for over 10,000 years (Haag 2012; O'Brien et al. 2013). Though shellfish remains are common in many archaeological sites, very little is known about their dietary role and importance to prehistoric groups on the western Snake River Plain. Although the nutritional value of freshwater mussels has been examined in other geographic regions (e.g., Paul W. Parmalee and Walter E. Klippel 1974; R. Lee Lyman 1980, 1984; Rebecca Stevens 2000), we know of no studies from the Western Snake River Plain.

This article addresses questions regarding the use of freshwater mussels as a food resource within the Western Snake River Plain. It compares the nutritional value of *G. angulata* and *M. falcata* to other riverine resources and assesses their general values with respect to seasonal harvest, physiological traits, reproductive life history, biochemical gametogenesis, and biogenic amine compounds of mussels—the latter suggesting a greater importance of mussels than often thought.

Most researchers argue that freshwater mussels were harvested year-around (Parmalee and Klippel 1974; Lyman 1980, 1984; Haag 2012), but have commonly specified two time periods as the most logical time for mussel harvesting in the northwestern United States. This includes use in late winter into spring as a "survival food" in winter camps along the Columbia River system (Ray 1933; Post 1938), a time when resources are believed to be scarce. This period has been reported ethnographically as one of the main times of harvest (Lyman 1984). The second time period suggested is in late summer, which aligns the harvest of mussels with the occurrence of salmon runs, a time when prehistoric groups would presumably be present at the rivers (*ibid.*). In southwestern Idaho the late summer and fall salmon runs have been described as critical for subsistence when Shoshone and Bannock groups were present along the Snake River (Steward 1970 [1938]; Murphy and Murphy 1986; Gould and Plew 1996).

Few ethnographic reports from the Snake River Plain describe the use of mussels. The mid-nineteenth century explorer John C. Frémont was one of the first to note the use of molluscs as a food resource within the Western Snake River Plain. Frémont describes some "Shoshonee" families as moving into the Upper Boise River Basin when winter snows started falling where

> . . . little smokes would be seen rising among the mountains, where they would be found in miserable groups, starving out the winter. . . . During this time families . . . are driven to any extremity for food, and eat every insect, and every creeping thing . . . *Snails*, lizards, ants—all are devoured with the readiness and greediness of mere animals. (emphasis added; Steward (1970 [1938]:173).

Similar reports exist for eastern Washington groups. Both Ray (1933) and Post (1938) note that families would aggregate toward rivers and streams, camping near mussel beds, and make use of the mussel beds to "stave off starvation" in the late winter and early spring when stored foods were in short supply (Lyman 1984). These Washington groups seemed to use mussels as a "starvation food" during the winter and early spring (Post 1938).

Methods

Mussel shell remains previously collected from 21 archaeological sites were analyzed and species noted, if known. The data were used to calculate the total potential kilocalories (kcals) at each site. To do this, an edible soft tissue weight estimate was needed. In the absence of relevant data, we used Parmalee and Klippel (1974) to estimate the soft tissue weight for both *G. angulata* and *M. falcata*. Their study analyzed 39 species of freshwater mussels, measuring the length, width, and thickness of bivalve shells. These authors also weighed the shell and soft tissue wet weight at harvest. With these data we conducted linear regression analysis using the Analysis ToolPak add-in for Microsoft Excel with shell length, width, thickness, and weight as independent variables and soft tissue wet weight as the dependent variable. It was determined that shell length was the strongest predictor of tissue weight ($R^2 = 0.824$ and $\sigma = 0.069$; p-value < 0.001). From the linear regression of shell length to soft tissue weight, we got Equation 1, {$y = 0.9032(x) * -39.407$}, where x is the mean shell length and y is the mean soft tissue weight.

We measured the lengths of 20 shell remains from three archaeological site collections housed within the Center for Applied Archaeological Science (CAAS) at Boise State University. The shell remains were identified as either *G. angulata* or *M. falcata*. Table 1 summarizes the specimens sampled at the CAAS. From the 20 specimens, we got an average shell length of 83 mm for *G. angulata* and 96.22 mm for *M. falcata*. Mean soft tissue weight was calculated using Equation 1 with resulting soft tissue weights of 35.56 grams for *G. angulata* and 47.5 grams for *M. falcata*. These weights were then used to calculate the nutritional value of the two mussel species per 100 grams of edible tissue. We then totaled the number of shells at each site and calculated the potential kcals for each site. We acknowledged the small sample size, but note that the specimens present within the CAAS collection are remains collected from archaeological sites that have been extensively examined. We did not estimate using regression analysis shell length or soft tissue weight for fragments. We considered each fragment to represent a bivalve given our inability to know from reported data the relative completeness of fragments. Future work should expand the sample.

TABLE 1. NUMBER AND SPECIES OF MUSSELS AT THREE SNAKE RIVER SITES USED TO CALCULATE AVERAGE SHELL LENGTH.

Site	*G. angulata*	*M. falcata*
10-CN-6	4	1
10-EL-438	3	10
10-EL-1367	2	-
Total	9	11

Nutritional values for calories, protein, and calcium for *M. falcata* were found in the Wenatchee River in Washington (Stevens 2000). Other nutritional values on mussels were calculated using USDA's National Nutrient Database for Standard Reference Release 27 values for blue mussels (United States Department of Agriculture 2014). All nutritional values for other food resources, wild game, and plants were derived from the USDA's nutrient database as well. These nutritional data were then used in conjunction with the estimated mean soft tissue wet weight from the regression model to calculate the all potential nutritional values at each of the 21 archaeological sites. Reported number of individual specimens (NISP) for shell remains for both mussel species were used. It is acknowledged that preservation plays a major role in the NISP present at an archaeological site, and as mussels are bivalves, we divided this number by two to indicate whole animals to provide a conservative base line of freshwater mussel resources present at the site during occupation.

Nutritional Values of Mussels

Table 2 shows the results of the analysis of potential total edible meat weight and caloric values of freshwater mussels for each site within the study. We used data as reported. In most cases this reflects the NISP. For purposes of this study we treated NISPs as representing whole bivalves. The table shows the total potential edible soft tissue weight and minimum calories that reflect the food value of mussels collected at each of the 21 archaeological sites in the study. The actual productivity probably varies somewhat depending upon the total number of whole bivalves represented. Site 10-CN-5 exhibits the highest total potential for shellfish calories. Even so, freshwater mussels could only provide daily caloric value for a group of five for little more than four days at a consumption rate of 2,000 daily calories per person per day. Archaeological evidence shows that 10-CN-5 is characterized by multiple occupations during the Middle and Late Archaic, a span of approximately 3,000–4,000 years (Plew 2008).

TABLE 2. ESTIMATED TOTAL FRESHWATER MUSSEL EDIBLE WEIGHT AND TOTAL CALORIES FOR 21 ARCHAEOLOGICAL SITES ALONG THE SNAKE RIVER.

Archaeological Site	Total Meat Weight (g)	Total kcals
Givens Hot Springs	35,559	14,223
10-EL-438	8,783	3,513
Cromwell	9,779	3,911
10-CN-1	44,448	17,779
10-CN-5	109,823	43,929
10-CN-6	51,911	20,764
Big Foot Bar	12,355	4,942
10-AA-306	5,227	2,091
10-AA-15	16,466	6,586
10-AA-12	16,175	6,470
10-AA-14	27,014	10,806
10-AA-188	36,068	14,427
10-AA-189	21,335	8,534
10-EL-392	21,897	8,759
10-EL-1367	16,902	6,761
10-EL-1577	27,700	11,080
King Hill Creek	6,105	2,442
10-EL-215	9,136	3,655
10-EL-216	65,366	26,147
10-GG-1	64,058	25,623
Three Island Crossing	7,434	2,973

Givens Hot Springs is another site with a large number of shellfish remains—an estimated harvest of 14,223 potential calories. It has been described as a fall and winter camp with multiple occupations (Plew 2008). The site exhibited evidence for eight pit house structures dating from 4,620 BP to 1,100 BP (Green 1993). Again, using the example of a group of five individuals, the calories produced could only account for a day and a half of the daily nutritional requirements over the course of the site's 3,520 years of periodic occupation of this location. This pattern is reflected across most of the 21 archaeological sites suggesting that although freshwater mussels were harvested at these sites, they were not likely the primary food source. Based on the estimated caloric returns, groups at sites along the Snake River appear to have utilized mussels in a secondary or supplementary way to other food resources. It appears that the occurrence of mussels at 10-CN-5 and Givens Hot Springs, and most probably other sites in western Idaho reflect single events associated with short-term occupations.

When compared to other resources found within a riverine setting (see Table 3), raw freshwater mussels have only 22%–35% of the caloric value and 32%–37% of the protein as do other raw prey resources (rabbits, deer, and fish) within the same habitat. However, freshwater mussels exhibit higher amounts of carbohydrates, fiber, calcium, sodium, and vitamins A-RAE, A-IU, B-12, and C than the other prey resources—Chinook salmon being the only exception for some of these values. When mussels are compared to cattail roots and rose hips (Table 3), mussels have lower values of the latter nutrients but higher levels of protein, fat, and iron. In this regard, freshwater mussels could provide a supplement to either group. When prey resources were scarce or had moved out of the riverine setting mussels could have been used to meet protein, fat, and iron needs. On the other hand, if the plant resources were not available for harvest, freshwater mussels could have filled the carbohydrate, vitamin, and mineral requirements.

Processing Food Resources

As is the case with many resources, nutritional values may be altered through processing and shellfish is no exception. When freshwater mussels are steamed, the caloric, protein, and fat contents become similar to those of other prey resources, with the drying of steelhead trout (and probably other salmonids) as an exception. Steaming of mussels is known ethnographically and many archaeological sites in the study are characterized by the presence of fire-cracked or thermally altered stones commonly associated with this activity (Ray 1933; Post 1938; Steward 1970 [1938]). Through the cooking of mussels, nutritional values increase per 100 grams of edible meat as they lose water mass, becoming more compact. In this regard the caloric values of the harvests data presented in Table 3 would probably increase if prepared. This has implications for transport and storage.

Life History and Seasonality

Freshwater mussels exhibit distinct seasonal life history pathways that could have implications for prehistoric seasonal use. *G. angulata* and *M. falcata*, like all freshwater bivalves, experience physiological changes prior to and during their reproductive cycle. Prior to spawning, both males and females experience gametogenesis, a process of gonad development and growth (McMahon 2001; The Xerces Society for Invertebrate Conservation 2010a and 2010b; Haag 2012; O'Brien et al. 2013). Two to four months prior to fertilization, freshwater bivalves display physiological responses to temperature (McMahon 2001; Haag 2012). The biochemical content of these bivalves changes with an increase in protein, glycogen, and lipid contents, peaking just before fertilization (McMahon 2001). Non-reproductive specimens contain twice as much biomass and greater non-proteinaceous energy stores than those that have already reproduced (*ibid.*). In the Italian freshwater mussel, *Lamellidens corrianus*, protein, glycogen, and lipid contents increase in the months prior to fertilization (Jadhav and Lomte 1982) (Fig. 1). This increase in protein, fats, and sugars for reproduction and development of glochidia translates into increased nutritional values for consumers of these bivalves.

TABLE 1. NUTRITIONAL VALUE OF RIVERINE RESOURCES, PER 100 GRAMS OF RESOURCE. [a]

Resource	kcal	Protein (g)	Carbs (g)	Fiber (g)	Fat (g)	Sodium (mg)	Iron (mg)	Mg (mg)	P (mg)	K (mg)	Calcium (mg)	Vit A-RAE (mg)	Vit A-IU (mg)	Vit B-12 (mg)	Vit C (mg)
mussels, raw	40 [b]	7.4 [b]	3.69	2.24	2.24	286	3.95	34	197	320	633 [b]	48	160	12	8
mussels, steamed	83 [b]	14.8 [b]	7.39	3.1	4.48	369	6.72	37	285	268	331.1 [b]	91	304	24	13.6
deer, raw	120	22.96	0	0	2.42	51	3.4	23	202	318	5	0	0	6.31	0
deer, cooked	158	30.21	0	0	3.19	54	4.47	24	226	335	7	0	0	0	0
jackrabbit, raw	114	21.79	0	0	2.32	50	3.2	29	226	378	12	0	0	0	0
jackrabbit, stewed	173	33.02	0	0	3.51	45	4.85	31	240	343	188	0	0	6.51	0
chinook salmon, raw	179	19.93	0	0	10.43	47	0.25	95	289	394	26	136	453	1.3	4
chinook salmon, smoked	117	18.28	0	0	4.32	672	0.85	5	164	175	11	26	87	3.26	0
steelhead trout, dried	382	77.27	0	0	8.06	2850	2.96	84	976	1720	0	0	0	22.4	0
cattail, root	25	1.18	5.14	4.5	0	109	0.91	63	45	309	54	1	11	0	0.7
wild rose hips	162	1.6	38.22	24.1	0.34	4	1.06	69	61	429	169	217	4345	0	426

[a] All nutritional values are from United States Department of Agriculture (2014) except where indicated; [b] Stevens (2000).

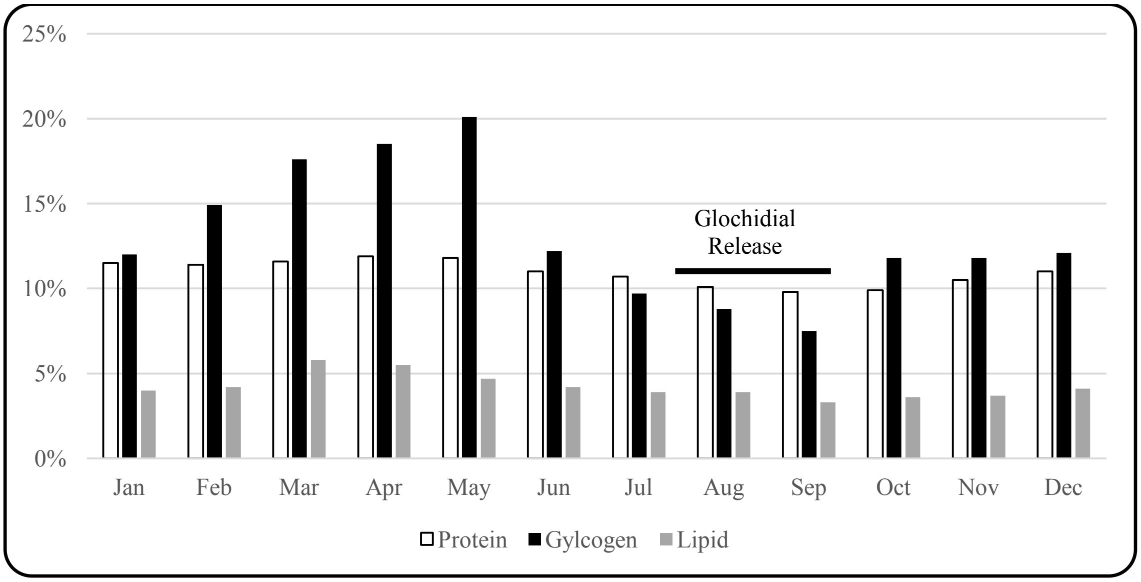

Fig. 1. Seasonal variation in whole-body contents of protein, lipids, and glycogen of the freshwater mussel, *Lamellidens corrianus*, relative to the release of its offspring (glochidia). All organic contents are expressed as percentages of wet tissue weight (Jadhav and Lomte 1982).

Reproductive strategies of freshwater mussels have been classified into two different categories of breeders—long and short-term breeders. Long-term breeders have fertilization during the late summer and fall, then brood their young over the winter and release them in the early spring. Short-term breeders, including *G. angulata* and *M. falcata*, begin reproduction and fertilization in the early spring and release their offspring, glochidia, during the late spring and summer (The Xerces Society for Invertebrate Conservation 2010a and 2010b; Haag 2012). For both *G. angulata* and *M. falcata* this period is correlated with water temperature. Few studies exist, but fully developed glochidia of *G. angulata* have been noted in June with average daily water temperatures between 51^{o} F and 59^{o} F (O'Brien 2013). *M. falcata* glochidia were noted in early May but only when the daily water temperature reached 54.5^{o} F (O'Brien 2013). Fig. 2 represents a theoretical model of seasonal variation in total wet tissue weight for *G. angulata* and *M. falcata* based on Fig. 1 and adjusted according to the presence of fully developed glochidia for each species.

Water temperature also plays a role in encounter rate. During winter when the water temperature is low, most species of freshwater mussels burrow into the sediments. *G. angulata* is one such species whereas *M. falcata*, due to its physiology, does not burrow during winter (Haag 2012). During the spring and summer, up to 80% of *G. angulata* communities are visible at the surface. During the fall and winter, up to 90% of the same communities are beneath the surface (Haag 2012). This seasonal behavior has the potential of increasing or decreasing encounter rates depending on the time of the year. During winter, mussel beds of *G. angulata* would burrow deep and could be better hidden under the sediment.

Host Fish and Mussels

Consideration of the host fish species for both *G. angulata* and *M. falcata* is also needed for a discussion of seasonal availability use. A number of fish species have been confirmed as hosts for *G. angulata*. These include the mottled sculpin, Paiute sculpin, shorthead sculpin, perch and Tule (The Xerces Society for Invertebrate Conservation 2010a; O’Brien 2013). Various salmonid species are believed to be the hosts for *M. falcata*, including Steelhead trout and Chinook salmon. River systems where these species of fish are located, either contemporarily or prehistorically, have implications for the location of mussel beds of *G. angulata* or *M. falcata* are to be found.

All sculpin species are bottom feeders and prefer cooler streams, particularly around cold springs or systems with strong currents. They do not conduct runs, being found in streams year round with spawning occurring in the spring (Meyer et al. 2013).

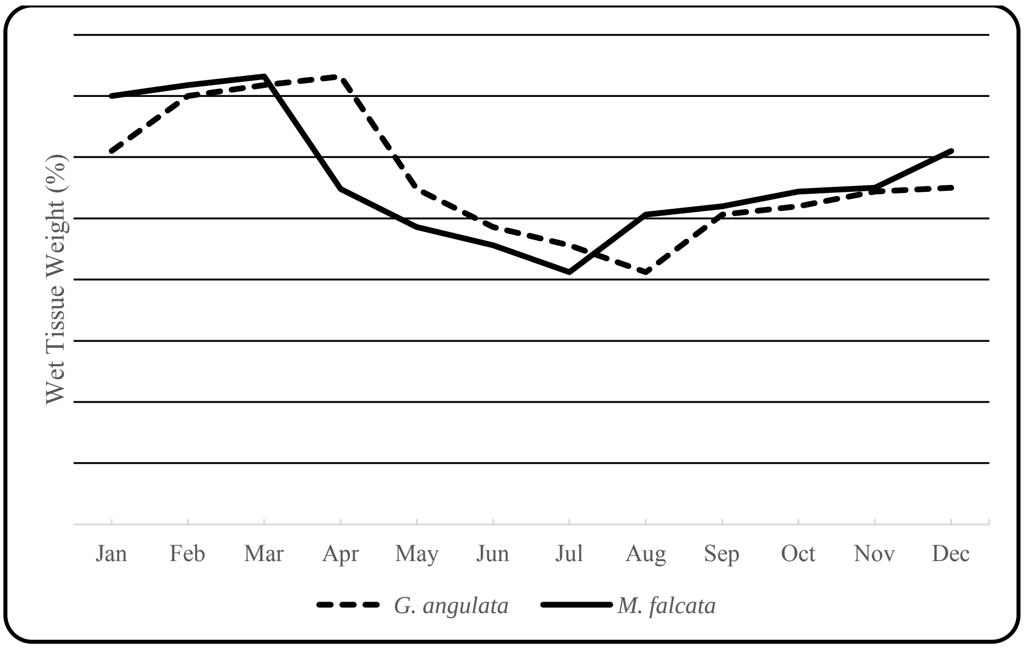

Fig. 2. Theoretical model of seasonal variation in wet tissue weight for *G. angulata* and *M. falcata* based on data from Fig. 1.

There are three runs of salmonids in the Western Snake River—early spring, early summer, and fall. The early spring run, during March and April, is comprised primarily of anadromous subspecies of *Oncorhynchus mykiss*; Steelhead trout (Steward 1970 [1938]). Chinook salmon (*Oncorhynchus tshawytscha*) make up the late spring into early summer salmonid run (Keefer, et al. 2008). This species makes its run from May to June (Plew 1983). The last run, during August and September, is also comprised of Chinook salmon (Fulton 1968). The two earlier runs are the most important of those runs for the *M. falcata* reproductive cycle.

The spring and summer salmonid runs align with the timing of the release of *M. falcata* glochidia, when these offspring need to find and attach to a host fish to survive. As noted above, *M. falcata* release their glochidia in May (O’Brien 2013) which could indicate that Chinook salmon is a primary host fish. It also means that before releasing their offspring, *M. falcata* would have experienced gametogenesis three to four months prior to May, from January to March. Between February and April, *G. angulata* would have been experiencing their peak levels for fat, sugar, and protein tissue increase prior to fertilization. One important note, however, is that both *M. falcata* and *G. angulata* have short spawning periods compared to those of other freshwater mussels; two weeks long and one month long, respectively.

Knowing the host fish for mussels is important in creating models of seasonal use of shellfish resources. For *M. falcata,* gametogenesis increases the amount of protein, fat, and sugar stores within each mussel during the spring run of salmonids: however, these stores are depleted during the fall run (Jadhav and Lomte 1982; McMahon 2001). During the spring these store contents provide more nutritional value than in the fall. By knowing the host fish for any species of mussel, a model similar to Fig. 2 could be developed for other regions. The model would provide a baseline for understanding freshwater mussel use in the region of research. Also, knowing when and where a host fish has historically been found within a region would have implications for where particular freshwater mussels would have been present.

Appetite Suppression and Potential Histamine Poisoning

All species of freshwater mussels have high concentrations of biogenic amines, also known as polyamines. The organic compounds within this group of amino acids include histamine, spermidine, spermine, putrescine, tyramine, and cadaverine—all of which are toxic in large doses (Cipolla et al. 2007; Rauscher-Gabernig et al. 2012; Cheves 2013). Putrescine and cadaverine are particularly foul smelling organic chemicals which can cause histamine poisoning when ingested (Atiya Ali et al. 2011; Haag 2012; National Center for Biotechnology Information 2014). This may occur when putrescine and cadaverine prevent the natural breakdown of histamine within the body. Histamine poisoning is not fatal in humans, but can effectively reduce an individual's appetite and mobility, although severe nausea and allergic reactions may occur with excessive consumption. In general, the benefits of polyamines in the diet have been neglected with the idea of polyamines as appetite suppressants based on polyamine influences on cell proliferation in cancer cells (Kalač and Krausová 2005; Atiya Ali et al. 2011; Lagishetty and Naik 2015). The anti-oxidant effect of polyamines is seen as important in the diet of the elderly as it relates to the loss of polyamines in aging organs (Lagishetty and Naik 2008; Atiya Ali et al. 2011), in treating wounds and promoting cellular regeneration (Kalač and Krausová 2005), and in reversing lipid peroxide formation for all types of inflammation (Lagishetty and Naik 2008).

When compared to other food resources mussels have approximately three to four times the concentration of polyamines than other game animals. Estimated values for daily polyamine intake range from 250 to 700 µmol/d (Kalač and Krausová 2005; Atiya Ali et al. 2011). Mediterranean Europeans and the Japanese tend to be at the higher end of the spectrum; both regions tend to exhibit diets higher in marine resources. Mussels exhibit a total of 459.3 µmol/g of putrescine, cadaverine, spermidine, and spermine within soft tissues (Cipolla et al. 2007). In contrast, salmon exhibit 150 µmol/g of polyamines while rabbit only exhibits 134.6 µmol/g (*ibid*.). The level of polyamines within mussels is also on the higher end when compared to those in fruits and vegetables, although some fruit can exhibit levels into the thousands of µmol/g. It is also important to note that biogenic amines do not break down from meat resources when cooked or frozen (Cheves 2013). Concentrations within mussels remain the same whether they are raw or cooked. Polyamines concentrations are leeched out of plant resources when cooked or over time when simply stored (Kalač and Krausová 2005).

There are a number of studies that have determined levels of tolerance for polyamines ingested by humans though further research will increase our knowledge of the effectiveness of putrescine, cadaverine, and other biogenic amines as an appetite suppressant. With that said, individuals that intensively utilized mussels as a food source could have been affected by polyamine toxins, which would have implications for mobility and subsistence behaviors. Yet, beyond the potential of mussel consumption suppressing diet, the general health benefits of polyamines need to be considered.

Conclusion

Overall, freshwater mussels exhibit only moderate levels of nutritional value when compared to other types of food resources. They are relatively low in calories and protein when compared to other prey. However, they do exhibit higher levels of carbohydrates, vitamins, and some minerals. When compared to plant resources, freshwater mussels have more protein, fat, and iron but fewer vitamins and minerals. As such, freshwater mussels could have been a valuable food resource for filling the nutritional gaps of other prey items and plants. Data also indicate that due to gametogenesis, edible tissue weights increase prior to the release of glochidia which may have increased the importance of mussels during the late winter and spring period. Ethnographically, this period coincides with times when many groups would be present at rivers and streams anticipating the spring and early summer anadromous fish runs. Perhaps more important is the winter increase in protein, sugar, and fat tissues as well as vitamin A—all important to winter health. In addition, with the presence of polyamines, mussel consumption could have served as an appetite suppressant—potentially important during a period of decreased food availability—though more research is required to determine the level of these toxins within mussels and the levels at which histamine poisoning might occur in humans. Additionally and as noted, the polyamines in mussels provide other health benefits relating to the dietary requirements of the elderly, treatment of wounds and inflammation. These characteristics were likely observed by indigenous peoples.

Mussels could have also been utilized in some instances to meet the short-term nutritional requirements of a small group as they traveled within the Western Snake River Plain. Mussel beds are predictable and stable and would have been a relatively consistent source of nutrition during any season. However, when the caloric value of mussel assemblages was calculated for twenty archaeological sites within the Western Snake River Plain, evidence suggests that freshwater mussels were not exploited at levels that would indicate their use as a primary resource—though its rank order may have been greater on an isolated basis with its preparation increasing its food value.

With these lines of evidence, mussels appear then to be an "in-between" food resource which would have been predictable as to location and capability of filling daily nutrient requirements in the absence of other resources. At the same time there may have been instances in which mussel exploitation represented a primary activity. The nutritional value of freshwater mussels may, however, have been more important due to increases in iron and other vitamins during the winter period—a period during which these items would be more difficult to acquire. In addition, freshwater mussels may have served as an appetite suppressant and provided other health benefits all important during periods of resource scarcity.

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SNOQUALMIE FALLS: THE FIRST TRADITIONAL CULTURAL PROPERTY IN WASHINGTON STATE LISTED IN THE NATIONAL REGISTER OF HISTORIC PLACES

Jay Miller with Kenneth Tollefson

ABSTRACT

Making good on their apologies to Northwest tribes for prior religious and colonialist abuses, the Washington Association of Churches, Church Council of Greater Seattle, lawyers, and justice advocates fought on behalf of the public and Snoqualmie Indian Tribe to list Snoqualmie Falls—sacred origin site whose rising mists carry prayers to Heaven—as the first documented traditional cultural property in Washington. These forces especially struggled against public utility Puget Sound Power's then arrogant control of water flow over the Falls. Building on this momentum, the Snoqualmie themselves also achieved restored federal recognition, benefiting from ready advice of lawyers, clergy, and Seattle Pacific University anthropologist Ken Tollefson.

What began as a careful process in the years just after National Park Service Bulletin 38 (1990) set federal guidelines, efforts to build consensus to list Snoqualmie Falls (Falls) in the National Register of Historic Places as Washington state's first Traditional Cultural Property (TCP) ended in active hostilities. Coordinated by public and tribal forces battling active corporate opposition, the scenic and strategic falls of the Snoqualmie River was, for many years, the only place in Washington formally determined to be eligible for listing as a TCP. The effort was much less friendly and cooperative than procedures for listing Mount St. Helens, the state's second TCP, listed nearly a quarter-century later (McClure and Reynolds 2015). By this time, many tribes preferred that the final P of TCP stand for "Place" instead of "Property," as a less capitalist and colonialist term.

The Falls registration form was prepared by Leonard Garfield (a staff member at what was then the state Office of Archaeology and Historic Preservation) from a 2 January 1992 "draft nomination by Dr. Kenneth Tollefson" (Garfield with Tollefson 1992). Snoqualmie Falls was determined eligible by National Park Service staff in 1994 under Criterion A, as a "Property associated with events that have made a significant contribution to the broad patterns of our history ~ Ethnic Heritage." It was not formally listed in the National Register, due to opposition from Puget Sound Power's successor, Puget Sound Energy, until 2 September 2009.

Background

Plummeting 268 feet, the Falls distinguished Upper from Lower Snoqualmie communities, while also marking the place of the creation, uniting them as a tribe (Fig. 1). Extensive prairies, and later huge hop farms, characterized upper communities closely tied with the Plateau, while river resources, especially salmon, were vital for those below, with much sharing, trading, and exchange between these ecozones.

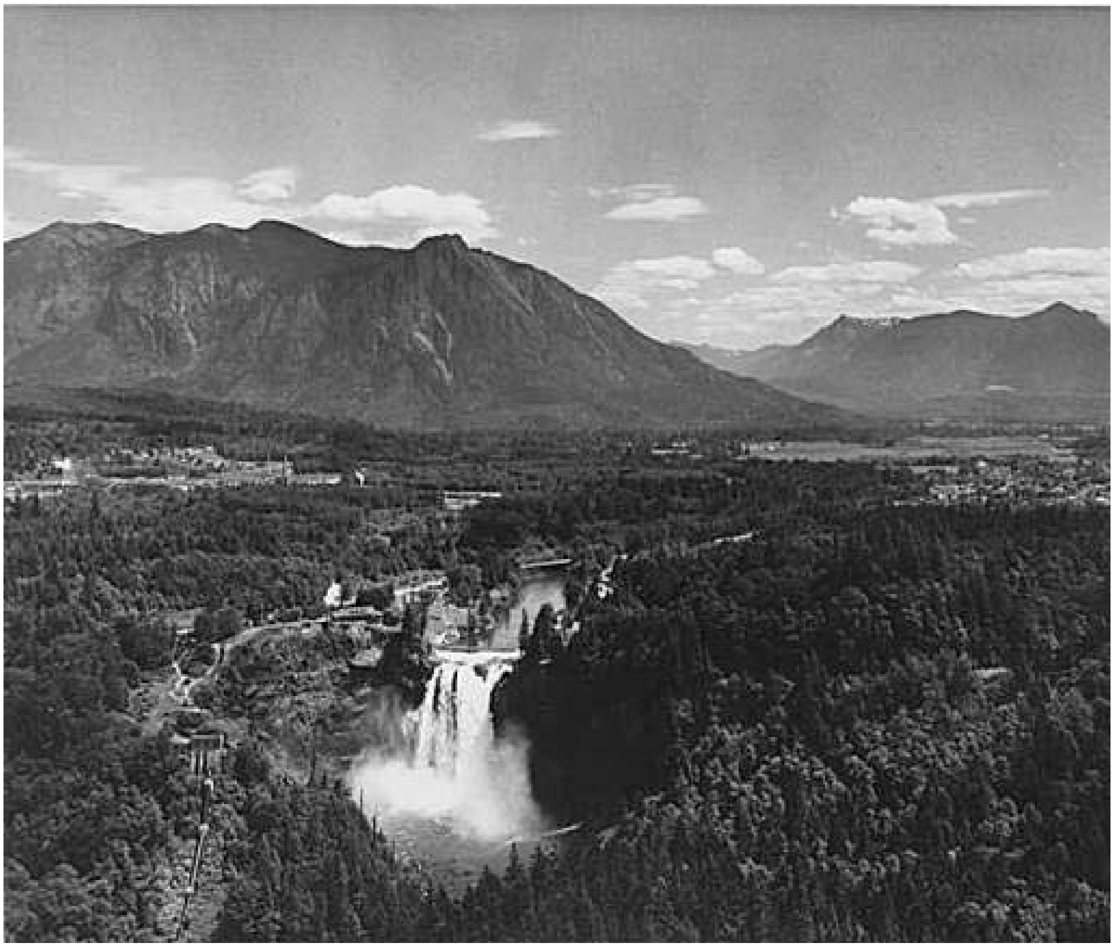

Fig. 1. Aerial photograph of Snoqualmie Falls from the south, ca. 1950. Courtesy of Museum of History & Industry, Seattle, Washington.

Moon, the Transformer ~ Changer (Ballard 1999) of this region, actively changed this landscape at the beginning of time as we know it. Often called Star Child ~ Star Husband, this epic also sets the origins of chiefly families throughout Puget Sound. It begins with two Snoqualmie sisters, from the ancient village of Tolt (now Carnation) of the lower Snoqualmie, camping in the upper Snoqualmie prairie to dig fern roots. Sleeping outside, looking up at the sky, each girl wishfully selected a star to be her husband. These Star beings accepted and took the girls up into the sky country, where each awoke lying beside a man, one very old and the other young. Resentful of her aged choice, the elder sister nonetheless became pregnant with the child who would become Moon. Secretly making a rope ladder, she escaped from the sky and gave birth on earth, only to have her baby stolen by Salmon women. Profoundly grieving, another son came to her, often from the wringing of a soiled diaper, but their lives were miserable. When both were fully grown, the twin brothers met, finished making the world, and went into the sky as Sun and Moon, rejoining their Star fathers. Along the way, Moon changed many species, one by one, into their present forms and purposes, and, most dramatically, changed a large, productive fish weir into the present Falls. In each river valley, he placed a married man and woman, giving every pair particular fish and wild game to feed their children forever. Some say the very first couple were placed at the Falls and continue to live in its mists.

At the Falls, however, there was no "forever" for natural conditions (Fig. 2). An electric generating station, the first built entirely underground, intruded: Plant 1, 1898 ~ expanded 1905, within a chamber below penstock intakes on the south bank; Plant 2, 1910 ~ expanded in 1957–8, on the north bank about one-quarter mile downstream of the Falls. There are also a concrete and wooden dam, four penstocks, a tailrace tunnel, a concrete-lined tunnel, an open forebay, a headgate house, generator leads, transformers, and transmission lines connecting both plants to a switching station.

The conflict between these religious interests and Puget Sound Power emerged because the federal guidelines require community consultations prior to relicensing the station. The Federal Energy Regulatory Commission (FERC), formerly Federal Power Commission, issued the initial license until 31 December 1993 for Snoqualmie Falls (Project # 2493) on 13 May 1975, retroactive to 1 March 1956.

For members of the Snoqualmie Tribe, the Falls remains the home of powerful spirits, where those of prairie and river meet, in addition to the one who lives in the deep plunge pool. Natives continue to pray, seek visions, and ask for help there. The water itself is holy, and used for cleansing, healing, and religious applications. Most especially, the bowl of the Falls—rim, cliffs, basin, pool—concentrates mists, which rise up into the sky, carrying prayers and hopes of Snoqualmie and others of the faithful.

The Snoqualmie family leading this plea was the Sweets, some of whom were college-educated ministers of the Indian Shaker Church. Because their tribe was between sovereign federal status, they sought federal involvement by enlisting the help of local museum and cultural resources specialists to work with state historic preservation office on the first TCP in Washington. Ironically, after the federal tribal recognition was restored, and a brother served as chairman, the Sweets were briefly banished. Their concern with the sanctity of the falls remains undiminished and they lead an annual thanksgiving service to its rising mists. Tribal elders also had a special pole placed at the lip of the Falls as a further spiritual claim.

The Determination of Eligibility

State and federal officials found that the Falls meets National Register criteria for integrity and significance. Specifically, the Falls meets National Register Criterion A for its historical associations with the traditional customs and beliefs of Snoqualmie culture and for its associations with the legendary figure Moon. Documentation of the place's significance benefited from the personal dedication and experiences of Rev. Dr. Kenneth Tollefson (2015b), the advisor most involved in this entire listing process with the tribe.

Before Ken became involved, in November 1987, Christian bishops and other religious leaders across the Northwest asked forgiveness from Native peoples for what their churches, schools, and missionaries had done to them, in a published statement:

> This is a formal apology on behalf of our churches for their long-standing participation in the destruction of traditional Native American spiritual practices. We call upon our people for recognition of and respect for your traditional ways of life and for protection of your sacred places and ceremonial objects (Church Council of Greater Seattle 1987, 1997).

Fig. 2. Historic postcard of Washington's state flower and icon falls for Christmas greetings. Courtesy of Greg Watson.

In the apology's aftermath, Snoqualmies and others came forward to ask for help improving conditions at Snoqualmie Falls, according it status as a TCP, and listing it on the National Register of Historic Places. Soon enlisted in this cause was Tollefson, a professor at Seattle Pacific University, a Free Methodist campus, who was already working on the petitions for federal re-recognition of Snoqualmie and Duwamish tribes, both maliciously dropped by the Bureau of Indian Affairs (BIA) from their own federal listings in 1953. The Snoqualmie Tribe was reinstated in 1999, though problems remain with the membership of their constitutional government. The Duwamish received final federal denial in 2015 by the BIA process, though they briefly had status for three days between U.S. Presidents Clinton and Bush in 2001 and still have other avenues to pursue.

The Falls have long been a famous regional tourist attraction, with a gazebo above it much favored for outdoor weddings. Yet the tremendous spiritual significance for the Snoqualmie Tribe was ignored or, occasionally, actively maligned, especially by the power company. Made aware of this disrespect, taking up the words of their apology for "recognition, respect, and protection of your sacred places," the Church Council and Churches Association joined in the tribe's efforts (led by Chair Ron Lauzan, Vice-Chair Art Freese, and Elder Emma Sweet) to change how the Falls were managed. Tollefson, already involved, now added to his tasks, noting:

> Once the churches began to branch out into the community to mobilize support for defending the Falls, that's when I got involved. Church Council attorneys, especially Ann Cross Eschenbach, were already enthusiastically involved, and,

> gradually, it gained a life of its own. We began to meet not in the churches but in visibly public places, like outdoors at the Falls.
>
> One whole day, to win us over, Puget Power (now Puget Sound Energy ~ PSE) hosted us, fed us a big fancy lunch, had all the VPs, everybody of rank, talk all day long, all layers of their hierarchy, oblivious that they could not just do anything they wanted. They were completely insensitive to other ways of living and believing. At the end of the day, Lois Sweet Dorman (a Shaker) and other Natives got to talking among themselves. Finally, she got up and said, "This is my mother, these are my children, we are really real; we've listened and talked to you all day long, but, again, you haven't listened to a thing that we said." That was the end of the day: stunned silence, everybody walked out, no one said anything until we were outside in the parking lot, where people tried to calm down. (Tollefson 2015a)

Originally, the determination had been carefully vetted and negotiated among all the parties, guided by Mary Thompson, State Historic Preservation Officer, but in May 1992 Puget Sound Power announced it would instead oppose the listing, suspecting that it would be used to threaten their relicensing, historic buildings, and future plans for expansion. They were especially distrustful of the Snoqualmie's intentions to use listing "as a weapon" to remove Puget Sound Power entirely from the Falls, even though the tribe was then in an ambiguous limbo (1953–99) between federal recognitions (*P-I* 1992). Puget Sound Power went out of its way to avoid any mention of the Snoqualmie "tribe or nation," denying it any political status.

On a national level, however, support had built to protect "sacred places." The Center for American Places, founded in 1990, through Abrams and Liveoak Editions (Page 2001:82–87) produced a lush volume documenting 18 such places, including the Falls, while the battle still raged. Meanwhile, a plan was emerging for the Snoqualmies to manage or buy the environs as Puget Sound Power was considering a strategic shift from the generation to the distribution of energy. A letter from the Native American Taskforce of the Church Council of Greater Seattle highlighted the hypocrisy of the power company's proposal to allow full flow on "Native American Allocation Days (which in fact did not coincide with the Snoqualmies' ceremonial uses" (Page 2001:86). Supporters made much use of this book and its appealing photographs, insisting that any manipulation of the mists was an assault on "religious expression," to show that the Falls were part of a global effort.

Mobilized by the formal apology, the Native American Taskforce of the Church Council of Greater Seattle had formed. Their first request came from Lummi seeking protection for Madrona Point, a native cemetery on Orcas Island, eventually bought by private funds. A subgroup then formed the Snoqualmie Falls Preservation Project (*Snoqualmie Valley Reporter* 1993), with local clergy leading ceremonies at the Falls, such as "A Blessing of the Waters, A Ritual of Repentance, Cleansing, and Renewal" on 12 September 1992. Lutheran pastor Rev. John Magnuson also wrote articles for newspapers, quoting theological scholars such as Mircea Eliade and Joseph Campbell, on sacred places and universal beliefs so as to respect and honor indigenous faiths and places. Ron Adams next led the project. Natives from other tribes also conducted their own public and private ceremonies at the Falls, expanding intertribal support from the Northwest and Plains.

But not all tribes agreed, and some conflated protection of the Falls with the Snoqualmie Tribe's effort to regain federal recognition. Tulalips, in particular, opposed separate Snoqualmie restoration since some Snoqualmie treaty signers and leaders did move to Tulalip in accord with the 1855 Treaty of Point Elliott at Mukilteo, though there was never enough space for all of these tribes on the reservation. This was recognized by the Bureau of Indian Affairs in their Final Determination to Acknowledge the Snoqualmie Tribal Organization:

> The Snoqualmie Tribal Organization was given until September 9, 1995, to respond under section 83.10(k) to third party comments. The extended period was granted because of the voluminous nature of the comments submitted by the Tulalip Tribes and because of the extended period of time that third parties had to comment on the proposed finding…. Third party comments were received on September 27, 1994, in opposition to acknowledgment from the Tulalip Tribes, Inc., and from Les Wahl and Dorothy Cohn, members of a separate petitioner called the Snoqualmoo tribe. Comments were received from the Snoqualmie Tribal Organization on September 5, 1995. (Federal Register 1997)

Additionally, the Tulalip Tribe argued the Falls had lost its sacred status, and they should be paid for this damage:

> Although the Falls were historically important for cultural and religious uses, construction and tourism have interfered with such uses of the area, according to the Tulalip (Williams 1992 [un-referenced]). The Tulalip have noted that Indian cultural ceremonies require seclusion and an undisturbed site, with water flows minimally affected by human development. The Tulalip are seeking compensation for their loss of the Falls as a cultural site, following original Project construction in 1898. (CRMMP 1996:38)

The private property owner of the project area, Puget Sound Power, which became Puget Sound Energy [PSE] in 1997), opposed listing the Falls as a TCP in the National Register of Historic Places due to unfounded concerns that the Snoqualmie would use listing as a device to deny the relicensing effort (CRMMP 1996:40). However, the implementing regulations of the NHPA section 106, 36CFR800.4.c.2 states, "If the agency official determines any of the National Register criteria are met and the SHPO/THPO agrees, the property shall be considered eligible for the National Register for section 106 purposes," therefore, regardless of whether the Falls are listed or not listed, once they are determined eligible, FERC has to treat the Falls the same as if it is listed.

Public hearings on FERC relicensing held at Mount Si High School in Snoqualmie, WA, and eastside community colleges were well attended, with outspoken testimony from church and civic leaders, righteously bristling at Puget Sound Power's arrogance and ignorance. Ken Tollefson explained:

> What really upset people is that it seemed as though Puget Power was turning the water off at night, then on during the day, like it was their own private fountain. (They actually were diverting the full flow into the penstocks at night.) That did not sit well with the Indiens [sic], fisherman, or anybody else. It was arrogant and bigoted. Indiens believe that the flow and the mist carried prayers, so turning it off was like sacrilege and worse.
>
> Soon, efforts begin to pick up. We worked to overcome their attempts to impress and suppress us. During that full day, they also took us down and showed us the power plant operations inside the rock walls, in big tunnels, carved out cavities holding all these big dynamos. Enormous. They have to go in every year to clean

> them out, get out whole logs and other big things. They were that huge; a real interesting education to go down inside a long way under the rock, very impressive.
>
> More changes came as parks departments took on a bigger role, all kinds of parks got involved: county parks, national parks, city parks, different layers got involved because the National Park Service administers the National Register. King County Parks and City of Snoqualmie could have been made potential stewards of the Falls overlook, if PSE was willing to transfer ownership. Fishermen, different kinds of fishing groups, joined, leading to a big political rally.
>
> But we needed hard data. To keep up with things, I got together with a statistician who had done a lot of stuff on government in Portland, the sociologist Martin Abbott. We began study of the Falls, using questionnaires and interviews, and then crunching the numbers of the responses (Tollefson and Abbott 1993, 1998)
>
> When it got to be big and public, Tulalip came in and wanted to take it over. It's our Falls! because they [especially Lower Snoqualmie Chief Patkanem] signed the 1855 treaty of Point Elliott including that land. They hired Gail Thompson, an archaeologist, who also worked on the final Puget Power report. We got along well…At the time, I wasn't concerned with wide openness, I had trust in the system and most of the people.
>
> It came to be a real political football. But we kept up the outreach. We made presentations of those survey results to all the different groups, anyone interested or that we wanted to be interested. (Tollefson 2015a)

Working in tandem with these wider communities, steady pressure was applied by local museums, newspapers, and intertribal organizations. When Linda Dombrowski of Small Tribes of Western Washington (STOWW) first visited the Falls, she noted a prominent plaque recognizing the strong cultural ties of the Snoqualmies with the Falls, but on her next visit it was gone.

> One of the issues was the limited amount of water flowing in the winter causing a freezing and thawing cycling that was physically destroying their sacred site. This was very painful to them.
>
> When I first visited the falls with a tribal representative, as we walked up the steps to view the falls from above, on one of the walls was a metal installation linking the Snoqualmie Tribe to the falls. After the tribe started to voice their concerns, it was removed. All that remained were the holes. In July/August of 1989, during the time of the Good Will Games, the Snoqualmies went up to the falls on a Sunday afternoon to stage a demonstration. I told them I did not think they would get any media coverage because it was the weekend, too far from Seattle, and during the games. But it was important to them and a large group went in full regalia. Well a media team did go and they gave them at least 10 minutes on the late news on Sunday. I think it was King5. (Linda Dombrowski email to Jay Miller, Thursday, 30 April 2015, 03:26 PM).

In the midst of these struggles, Greg Watson (1996) asked, on behalf of the Snoqualmie Valley Historical Museum, for permission to gather up discarded historic artifacts and mementos.

He was allowed only a single day to do so, and, in the process of saving examples of early electrification, collected the discarded sign from the machine shop where it had been tossed aside.

Tollefson continued:

> Then we met in the county parks offices on the East Side. I had become the spokesperson for the tribe because I already worked for the tribe on federal restoration. Snoqualmie chair Andy de los Angeles asked for my help. I prepared the re-recognition petition, we got publications into peer-reviewed journals. Abbott and I took over the high moral ground, as Puget Power got more and more aggressive, and tried to take us down with all kinds of bad, insulting publicity. It became a real battle, but we had the survey data and persuaded the groups. I said, "Should I call in CNN?" They said, "Yes," so I called. CNN come out and set up in my Seattle Pacific University office, we laid out the problem for the news, then we went to the Falls. The tribe talked, both sides talked, they talked to Puget Power, whose spokeswoman said, "We'll give water to them. Any time they want more water, we'll give it to them, we won't turn it off at night, if they want to use it at night, we'll work with them on it." Again, their arrogance was assuming they wanted us "to be like them" to have control of turning the flow off and on, instead of maintaining a continuous flow for spiritual wellbeing via the rising mists to heaven.
>
> We worked our way through a series of focuses: from religion, to preservation, then cultural brought into the wider umbrella that in time became heritage preservation. Puget Power fought it, sometimes helped by Tulalip. They went out of their way to never refer to the Snoqualmie Tribe ~ Nation as such by name and title, always keeping any reference to them vague and apolitical.
>
> The last night before I was to present our case to the state Advisory Council on Historic Preservation in Tacoma, Leonard Garfield called with second thoughts, but I reminded him we were quoting data that was from a peer reviewed, academic, professional journal (*Ethnology*), so we went ahead.
>
> The next day, I took a carload of students down there, and the reporter and photographer for the school newspaper, the *Falcon*. I took the granddaughter of Mel Sheldon from Tulalip, who had the Tollefson Scholarship awarded by the department. I presented the whole deal, no problem in any way. The board withdrew, went into seclusion about 20 minutes, came out, and announced the unanimous decision of all nine.
>
> After that, everything I did, I headed for high moral ground, usually in a refereed academic publication (listed in Tollefson 2015b). By that time, I was well trained. A lot of my publications were just a way to protect the data and people. I did not know anything else to do, and it has worked out pretty good (Tollefson 2015a).

In 2008, FERC and the Washington Department of Archaeology and Historic Preservation (DAHP) forged a Memorandum of Agreement (MOA) confirming the Falls's 1992 eligibility with the Keeper of the National Register. Subsequently in 2009, FERC and DAHP entered into a Memorandum of Agreement (MOA) with PSE as a concurring party. Stipulation A-16 of that MOA required PSE to withdraw its objection to the Falls TCP being listed on the National Register (FERC 2008). PSE then sent a letter to the Keeper certifying that PSE no longer objected to the TCP nomination of Snoqualmie Falls, and on September 2, 2009, the Snoqualmie Falls TCP was officially entered into the National Register of Historic Places (FERC 2009; NRHP 2009). DAHP produced a vivid poster for Archaeology Month (October) of the natural Falls with all historic buildings and features removed.

Summary

The public and members of the Native American Taskforce of the Church Council of Greater Seattle continue their concern for the Falls, dismayed by construction of huge housing developments nearby and increased traffic congestion. But the momentum toward justice and fairness has been lost. The famous Salish Lodge located at the head of the Falls (Fig. 3) was purchased by the Muckleshoot Indian Tribe in 2007, adding to the conflicts and complexities of the area. Once Snoqualmie federal recognition was restored by the BIA, they quickly started a successful casino, which uncharacteristically includes huge windows open to Mount Si and other features of their stunning landscape. But it has led to both successes and difficulties, especially with regard to issues of tribal enrollment rules and investment strategies, usually fought out in courts.

Fig. 3. Photograph of Snoqualmie Falls and Salish Lodge in June 2015.

According to their own publicity, PSE is "Washington state's oldest local energy company … serving communities and … helping make them better places to live and work" but not, apparently, worship unless pressured to do so by churches, communities, and citizens lawyering up. Eventually, as noted by Raelene Gold, a vital member of the Taskforce, Puget Power became "very sensitive to their Public image and wanted to maintain a positive public image and this issue was giving them a black eye" (Raelene Gold email, 19 November 2015, 10:31AM).

Lastly, as several reviewers noted, these were brand new guidelines, and DAHP and the state Advisory Council on Historic Preservation did not want the state's first nomination to go down in flames, or else it would be a long, long time before there was a second TCP National Register nomination. Which was exactly what happened.

ACKNOWLEDGMENTS

Our thanks for reviewing painful memories and the joys of justice gained to James Knobbs, Lois Sweet Dorman, Marvin Kempf, Raelene Gold, Holly Taylor, Linda Dombrowski, Greg Watson, and Shelly Means. Anne Eschenbach never responded to repeated requests and a conversation with her family.

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ABOUT THE AUTHOR

Writing up a life's worth of fieldwork devoted to detailed, coherent, syntheses of major Americanist concerns among eight tribes across four directions, Miller is thinking very long term about providing data-rich reference works offering handy overviews for tribes and classes.

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THE ARCHAEOLOGY OF OBSIDIAN OCCURRENCE IN STONE TOOL MANUFACTURE AND USE ALONG TWO REACHES OF THE NORTHERN MID-COLUMBIA RIVER, WASHINGTON

Sonja C. Kassa and Patrick T. McCutcheon

ABSTRACT

To explain the occurrence of obsidian artifact variation in a sample from Northern Mid-Columbia River archaeological assemblages, we employed an evolutionary archaeology model to test our hypotheses. This model identified inter-variable relationships between stone tool cost and performance sub-variables to define classifications for the collection of artifact provenance, material, technological, and functional data. Data resampling and a stepwise statistical analysis were used to make arguments for why certain partitions of the data were representative and non-randomly associated across source, time, and space. Non-random associations of data frequencies across these variables revealed that natural selection was the primary causal mechanism structuring obsidian occurrence. Results demonstrated a preference for the manufacture of tools from local, low-quality sources; the use of local sources decreased through time, while source diversity generally increased following the expansion of trade systems, and obsidian occurrence across space differed likely due to environmental factors and proximity to trade hubs.

Introduction

As in other geographic regions where obsidian artifacts are a component of stone tool assemblages, the archaeological occurrence of obsidian is at the center of discussions regarding tool stone geography and social interaction spheres in the Pacific Northwest (e.g., Carlson 1994; Galm 1994; Minor 2013; Ozbun and Adams 2015). Here, evidence of obsidian in regional trade and exchange systems dates to approximately 9000 years before present (BP) (Carlson 1994; Minor 2013); however, only recently have archaeologists begun to characterize the intra-source variability and the archaeological distribution of Washington obsidian sources (Galm 1994; McClure 2015; Mierendorf and Baldwin 2015). In comparison to the 134 recorded obsidian sources in Oregon, there are only 12 documented sources in Washington (NROSL 2015) many of which are considered to be relatively small and/or low quality (Galm 1994). Consequently, the archaeological distribution of Washington sources and inclusion into exchange systems appears to have been limited (Galm 1994; McClure 2015; Mierendorf and Baldwin 2015) and many recovered obsidian artifacts are understood to have been procured through trade networks from sources in British Columbia, Oregon, Northern California, and Idaho (Carlson 1994; Galm 1994; Minor 2013).

In Washington, obsidian typically occurs in low frequencies (Galm 1994). However, stone tool assemblages from two reaches of the Northern Mid-Columbia River Valley contain hundreds of obsidian artifacts making this area distinctive in comparison to others in the region (Gunkel 1961; Schalk and Mierendorf 1983). In these assemblages, obsidian artifacts are manufactured from local, low-quality obsidian sources as well as nonlocal, high-quality sources. While it is known that past people living along the Northern Mid-Columbia River used obsidian sources for stone tools, the quantity and degree to which certain sources occur across stone tool manufacture and use has been minimally documented (Kassa 2014).

Obsidian provenance studies in the Pacific Northwest Region have identified variations in the archaeological occurrence of obsidian. In the Washington Cascade Mountains and adjacent regions, some studies (McClure 2015; Mierendorf and Baldwin 2015) observed that obsidian source frequencies decreased as the distance from source-to-site increased, demonstrating a pattern of monotonic decay (Renfrew 1977), while others found that source frequencies did not follow these patterns (Vaughn 2010; Parfitt 2013). In studies regarding obsidian source occurrence over time, source-to-site distances and source variability decreased and became localized (Mack et al. 2010; Cadena 2012) despite an increase in regional obsidian trade and exchange (Galm 1994). These discrepant results demonstrate that explaining obsidian occurrence is complex and requires identifying the selective conditions (e.g., tool stone raw material quality) under which the material was incorporated into lithic industries (stone tool manufacture and use). For example, variables such as material properties or quality would have likely influenced not just obsidian source occurrence, but also the physical forms of those sources found in the archaeological record (Andrefsky 1994).

In order to explain the occurrence of obsidian artifact variation present in a sample from Northern Mid-Columbia River archaeological assemblages, we employed an evolutionary archaeology model based on stone tool cost and performance variables. This model used a complex set of sub-variables of stone tool cost and performance, which included artifact provenance, material properties, technology, and function. We then identified inter-variable relationships so that classifications of these sub-variables could be constructed to collect obsidian artifact data. Once the data was gathered, a resampling technique and a stepwise statistical analysis were used to make arguments for why certain partitions of the data were representative and non-randomly associated across source, time, and space. The identification of non-random associations (i.e. inter-variable relationships) indicated a selective condition structuring obsidian occurrence in the Northern Mid-Columbia River Valley. This approach provides a specific model for investigating variation in stone tool manufacture and use that is broadly applicable throughout the Pacific Northwest.

A Model of Stone Tool Analysis

To test the null hypothesis that obsidian source occurrence was random across stone tool manufacture and use, we chose a model and technique guided by an evolutionary archaeology theoretical framework. This theory is helpful for framing stone tool manufacture and use studies (e.g., McCutcheon 1997; Wilhelmsen 2001; Shott 2008) as it provides a scientific way to explain structure and variation in artifact assemblages over time and space (Dunnell 1978a, 1978b). Under this theory, cultural transmission and natural selection are the two principal causal mechanisms that sort variation in populations such as lithic assemblages (Dunnell 1978a; Leonard and Jones 1987; Shott 2008). Once formation processes that affect the structure of the archaeological record are taken into account (Schiffer 1996; Waters 1997; O'Brien and Lyman 2000; Lipo and Eerkens 2008), differences in relative attribute frequencies of stone tool manufacture and use can be assessed.

Cultural transmission filters for selectively neutral or stylistic traits (e.g., lithic raw material color) that have little to do with the fitness of an artifact's physical interaction with the environment. Representations of cultural transmission are a product of replication of traits on the social scale and innovation on an individual scale (Eerkens and Lipo 2007). Under natural selection, certain traits within a population become increasingly abundant because they function efficaciously under a given set of environmental conditions (Dunnell 1978b, 1980; O'Brien and Lyman 2000). Accordingly, the physical environment or natural selection is the mechanism producing differential sorting. These causal selective mechanisms produce distinct patterns in the structure of lithic organization. The remains of this process, manufacture, use, maintenance, and discard, form the archaeological record (Eerkens and Lipo 2007) and are used to assess lithic raw material occurrence (McCutcheon 1997).

Guided by this theory, we outline a model of stone tool cost and performance to identify stone tool variables and how they inter-relate (McCutcheon 1997) (Fig. 1). While this model employs variables used in many stone tool studies (e.g., Andrefsky 1994; McCutcheon 1997; Kornbacher 2001; Pfeffer 2001; Wilhelmsen 2001; Eerkens et al. 2002; Pierce 2005; Eerkens et al. 2007), we focus on two points that distinguish our approach from that of others such as the organization of technology (Nelson 1991) or behavioral evolutionary ecology (Torrence 1989), which require assumptions about past decision making processes that cannot be seen in the archaeological record. First, our model was designed to identify what archaeologists investigating stone tool manufacture and use want to know about the archaeological record and is built on the assumption that past individuals made choices, which are in part represented in the archaeological record. Second, those decisions generated random variability while an independent mechanism, such as natural selection, sorted that variation into differential frequencies of artifact forms. Where non-random frequencies occur, a selective condition (e.g., environmental constraints like source proximity or obsidian quality) caused the non-random sorting. The value of our approach lies in its ability to measure stone tool variation and independently determine the mechanism sorting that variation.

This model directed the techniques used to collect empirical data by measuring dimensions of rock physical properties, technology, and function (Table 1). To ensure comparability across all assemblages in our sample we defined dimensions within each classification that were composed of mutually exclusive, equivalent modes or attributes (Dunnell 1971) providing the means to record the complex elements of stone tool industries. When coupled with spatial, temporal, and provenance data via non-destructive X-ray fluorescence spectrometry (XRF), these paradigmatic classifications provide a valuable tool for assessing the selective conditions of obsidian occurrence. The utility of these classifications has been demonstrated in the Pacific Northwest Region over the past 40 years (e.g., Dancey 1973; Dunnell and Lewarch 1974; Campbell 1981; Dampf 2002; Vaughn 2010; Parfitt 2013).

Once documented, filled classification dimension frequencies were used to assess the representativeness of a sample. Resampling, following Lipo (2000) and McCutcheon (1997), employed bootstrapping (i.e., random sampling with replacement) to assess the representativeness of each filled artifact dimension. The technique of resampling was used to identify and remove unrepresentative data so that conclusions drawn from statistical testing could be considered reliable.

Using only the representative artifact dimensions, a step-wise statistical strategy was next applied to systematically identify the non-random associations, assess the strength of those associations, and identify which modal intersections of the dimensions (e.g., biface, presence of use-wear, etc.) significantly contributed to the non-random association. Our analysis sought to test the null hypothesis (H_0): *Obsidian source occurrence is random across stone tool manufacture and use.*

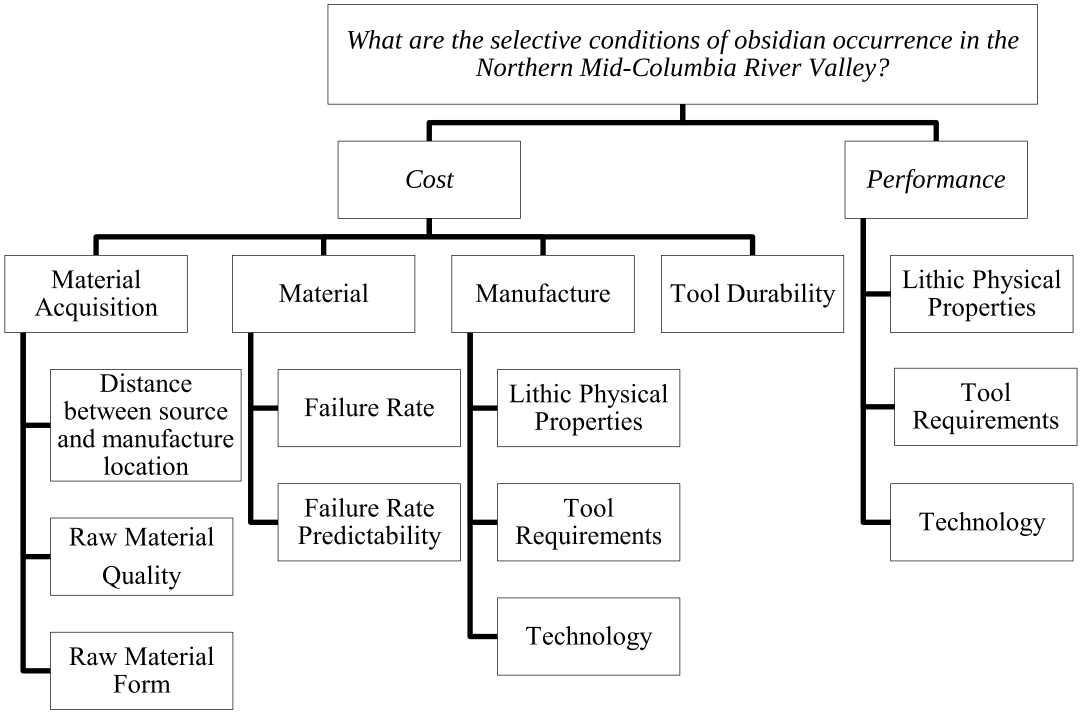

Fig. 1. Cost and performance model adapted from McCutcheon (1997:Fig. 60).

TABLE 1. PARADIGMATIC CLASSIFICATIONS, DIMENSIONS, AND MODES

Paradigmatic Classifications	Dimensions	Modes
Rock Physical Properties	Groundmass –Solid Inclusions	Present, Absent, Cortex Present
	Groundmass – Void Inclusions	Present, Absent, Cortex Present
	Groundmass –Distribution of Solid Inclusions	Random, Uniform, Structured, None, Cortex Present
	Groundmass – Distribution of Void Inclusions	Random, Uniform, Structured, None, Cortex Present
Technology	Object Type	Biface, Large Flake/Flake Fragment, Small Flake/Flake Fragment*, Chunk, Cobble, Core
	Amount of Cortex	Primary, Secondary, Tertiary, None
	Other Modification	None, Flaking, Grinding, Pecking, Incising, Other
	Platform Type	Cortex, Simple, Faceted, Bifacial unfinished, Bifacial, unfinished, wear present, Bifacial, finished, Bifacial finished wear present, Potlids, Fragmentary, Not Applicable, Pressure Flakes, Technologically Absent
	Completeness**	Whole, Broken, Flake Fragment, Debris, Other
	Reduction Class (Only Whole and Broken Flakes)	Initial Reduction, Intermediate Reduction, Terminal Reduction, Bifacial Reduction/Thinning, Bifacial Resharpening, Not applicable
Function	Presence of Wear	Present, Absent

* This designation for small (<10 mm) and large flakes (>10 mm) follows Eerkens et al. (2007).
**This designation follows (Sullivan and Rozen 1985).

Associations between dimensions were calculated using a chi-square test (χ^2) or, if the calculated expected values or observed sample sizes were too small, Fisher's exact test was used as an alternative (Fisher 1970; Tamhane and Dunlop 2000). An alpha level of .05 was used for all statistical tests when determining the critical value for rejecting or not rejecting the null hypothesis.

If H_0 was rejected because obsidian did not occur randomly, then observed data were used to evaluate the alternative hypothesis (H_a): *Obsidian source occurrence is non-random across stone tool manufacture and use.* In this case, the strength of the identified non-random association was measured using Cramer's V (Cramér 1946; Privitera 2012); however, this test was only appropriate to use for chi-square analyses. Non-random associations were further explored through an analysis of adjusted residuals, to identify which intersecting modes of the dimensions significantly contributed to the rejection of H_0 (VanPool and Leonard 2011). If observed, non-random associations between cost and performance variables allowed us to ascertain the causal mechanism (e.g., natural selection or cultural transmission) structuring obsidian stone tool manufacture and use, and to construct explanations of occurrence across source, time, and space.

Study Area: Northern Mid-Columbia River Valley

Local and nonlocal obsidian artifact occurrence in sites along the Northern Mid-Columbia River has been of interest to archaeologists since the early 1960s (Gunkel 1961; Grabert 1968; Schalk and Mierendorf 1983; Galm and Masten 1985; Galm 1994). Currently there has been no comprehensive analysis of obsidian artifacts in this area (Kassa 2014). Initial interests stemmed from the occurrence of artifacts made from an obsidian or vitrophyre described as a highly distinctive greenish/blue-gray material exhibiting abundant phenocrysts in a glassy groundmass (Skinner and Thatcher 2010) of a local, but unknown provenance (Gunkel 1961; Grabert 1968; Galm 1994). This source, referred to as Chelan Butte Obsidian, has only been recovered from sites along two reaches of the Northern Mid-Columbia River between Entiat and Bridgeport, Washington (Gunkel 1961; Grabert 1968; Schalk and Mierendorf 1983; Chatters 1986). In comparison, obsidian artifacts made from high-quality sources, most notably from Oregon or British Columbia, have been repeatedly identified as components of regional trade and exchange networks (Carlson 1994; Quinn 2006; Minor 2013). Based on their research, some archaeologists suggested that certain localized low-quality obsidian was presumably not valuable in regional trade and exchange and the source distribution may instead align with the traditional territory of local tribes or bands (e.g., McClure 2015).

In an effort to understand how past people were selecting for and using Chelan Butte and other obsidian sources, local literature was reviewed to determine the documented distribution of the Chelan Butte source and identify other obsidian artifacts from sites along the Northern Mid-Columbia River. Literature review (Daugherty 1956; Gunkel 1961; Grabert 1968; Schalk and Mierendorf 1983; Galm and Masten 1985; Chatters 1986; Galm 1994) and support from Jacqueline Cook (Repatriation Specialist/Collection Manager), identified 656 curated obsidian artifacts from 18 archaeological sites ranging in age from approximately 8000 years BP to the historic period (Fig. 2; Table 2). These artifacts served as our study sample and represent the known distribution of Chelan Butte Obsidian. The artifacts were derived from previous controlled excavations and salvage collections between the late 1950s and the 1980s at sites along the Northern Mid-Columbia River.

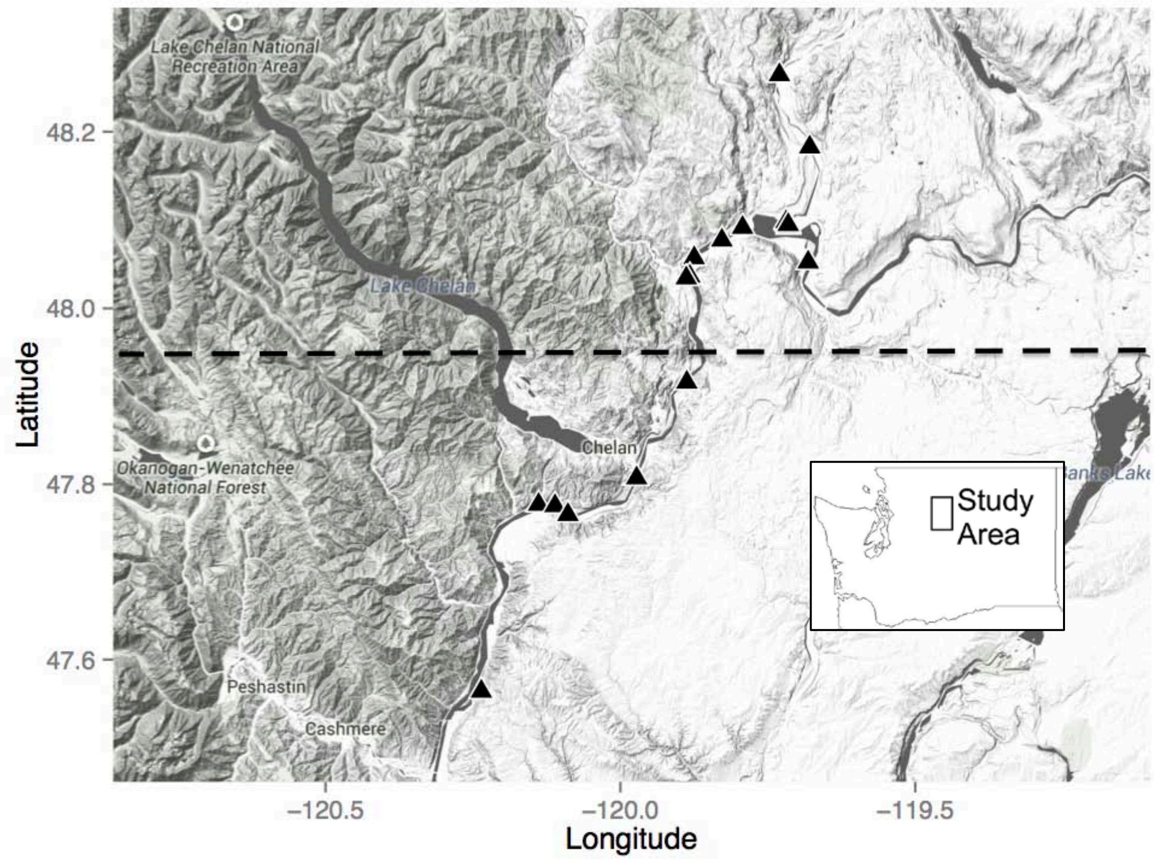

Fig. 2. Location of archaeological sites (base map provided by Google Maps 2014). Due to site proximity and map scale site locations may overlap. The dashed line represents the boundary between the northern and southern reaches of the study area.

For the purposes of this research, the Northern Mid-Columbia River Valley was defined as the land adjacent to the banks of the Columbia River from the town of Entiat north to Bridgeport, Washington. The northern and southern reaches of the study area vary in topography and resource availability, which in turn affected human utilization of the landscape. The northern reach is generally steep, with the exception of low-lying river terraces and floodplains mainly where the Methow and Okanogan rivers flow into the Columbia River. This reach has a diverse environment with accessible resources and was favorable for human habitation (Chatters 1986). The southern reach is characterized as a steep-sided river valley interspersed by few low relief terraces and channel bars (Mierendorf 1983); here, the deeply incised Chelan River connects Lake Chelan and the Columbia River. The steep relief of this reach likely restricted human habitation and availability of resources, and constrained the movement of peoples throughout this area (Schalk and Mierendorf 1983). As such, site types identified within this reach demonstrate an orientation towards procurement and processing activities with few manifestations of prolonged settlement unlike the more diverse set of land use patterns observed at sites upstream and downstream of this reach.

TABLE 2. ARCHAEOLOGICAL SITE AND ARTIFACT COUNT ORGANIZED BY NORTHERN AND SOUTHERN REACHES OF THE NORTHERN MID-COLUMBIA RIVER

Reach	Archaeological Site	Artifact Count	Reach	Archaeological Site	Artifact Count
Northern	45DO372	1	Southern	45CH57	12
	45DO387	38		45CH58	29
	45OK69	6		45CH61	284
	45OK92	1		45DO59	7
	45OK94	1		45DO409	43
	45OK113	1		45DO417	5
	45OK382	7			
	45OK383	20			
	45OK419	9			
	45OK422	143			
	45OK424	47			
	45OK426	2			

Hypotheses for Obsidian Occurrence in the Northern Mid-Columbia River Valley

Our objective for hypothesis testing was to determine if empirical evidence existed in our sample for statistically significant non-random sorting across source, time, and space. If evidence of non-random, inter-variable relationships were present, then we could identify the characteristics of obsidian that were chosen and place our results into a historical context to explain obsidian artifact occurrence. Our model assumed that natural selection was sorting obsidian occurrence along the Northern Mid-Columbia River Valley and would be patterned as follows:

1. Raw Material Quality: Raw material quality, in terms of predictability of fracture, was an essential variable for structuring stone tool assemblages (Andrefsky 1994; McCutcheon 1997; Eerkens et al. 2007; McClure 2015; Mierendorf and Baldwin 2015). Based on this premise (cf. Eren et al. 2014), we predicted that local obsidian would disproportionately exhibit inclusions, which would in turn be randomly distributed in the rock body. This assumption is supported as sources in Washington State are generally recorded as low quality with minimal archaeological dispersion from the source (McClure 2015; Mierendorf and Baldwin 2015).

2. Object Type: It was expected that local material, generally held to be low quality (Galm 1994), would be used across all object types (cores, small flakes, large flakes and bifaces) as it was readily available, while nonlocal material would be higher quality and occur as small flakes and bifaces (Andrefsky 1994; Eerkens et al. 2007). Considering the inter-variable relationships of stone tool cost and performance, we predicted that we would observe patterns in distance decay where nonlocal sources would have lower representation and local sources would have higher representation (Renfrew 1977). It was expected that at sites in our study area flakes produced from nonlocal sources would be present as late reduction classes indicating that initial reduction likely took place at quarry locations thereby lowering the cost of transport (Beck 2008). In turn, flakes from sources closer to our study area would be represented in earlier reduction classes that would be larger in size and exhibit cortical material (Teltser 1992; Beck et al. 2002).

3. <u>Time</u>: We anticipated that obsidian procurement did not become localized over time as seen elsewhere (Mack et al. 2010; Cadena 2012) due to increased trade and exchange (e.g., Chatters 1986). In later time phases, amplified trade may have helped offset procurement costs associated with nonlocal sources. We expected that local sources would be used throughout time due to their availability.

4. <u>Space</u>: The occurrence of obsidian would differ between the northern and southern reaches due to the variations in landscape suitability and resource availability, which affected human settlement patterns and trade hub locations. Based on archaeological evidence, the landscape of the southern reach appeared to have been less desirable for human occupation resulting in the high number of procurement and processing sites (Schalk and Mierendorf 1983). The northern reach was more suitable for habitation with numerous winter village site types located at the confluences of Methow and Okanogan Rivers with the Columbia River (Chatters 1986). Historically, the confluence of the Okanogan and Columbia rivers was also the location of the Fort Okanogan trade hub and was en route to the Okanogan Falls tertiary trade hub to the north (Swagerty 1988).

Geochemical Results

Of the total 656 artifacts, 612 artifacts were visually analogous to the description of the Chelan Butte source and 44 artifacts exhibited different visual profiles. A sample of 97 artifacts comprised of 53 of the 612 artifacts exhibiting the range of documented Chelan Butte variation (Fig. 3) across all object types in addition to the remaining 44 artifacts were selected for XRF analysis. XRF analysis by Northwest Research Obsidian Studies Laboratory (NROSL 2014) and the Archaeometry Laboratory at the University of Missouri Research Reactor (Ferguson 2014) assigned 95 of the 97 artifacts to ten sources in Washington, Oregon, and Idaho (Fig. 4). The two unassigned artifacts, due to size or irregular surfaces, were excluded from source analysis. All 53 of the sourced artifacts that were macroscopically identified as Chelan Butte were identified to the Chelan Butte/Unknown Vitrophyre 1 (CB/UV1) source. Similar to other local low-quality sources (McClure 2015; Mierendorf and Baldwin 2015), this source has a highly localized archaeological distribution (Gunkel 1961; Grabert 1968; Mierendorf and Bobalik 1983; Galm and Masten 1985; Chatters 1986) and is macroscopically distinctive. An analytical decision was made to visually characterize the remaining artifacts (all waste flakes) in this sample as CB/UV1 (Craig Skinner personal communication 3 February 2014). While the selection of artifacts for XRF sourcing sought to maximize the analysis of local source variability, the use of macroscopic sourcing may minimally affect the accuracy of the local source sample due to the potential, but unlikely, inclusion of outliers from other local sources.

Study Results

Our resampling results indicated that the dimensions platform type and amount of cortex were unrepresentative. Consequently, these were not included in our investigations of obsidian occurrence. For the dimension object type, only CB/UV1 was identified as chunks and cobbles in low counts in our sample. While these object types could represent a raw material acquisition stage, they were not included in analysis as they contain little technological or functional data.

To test the hypothesis that obsidian raw material quality played an important role in source occurrence, tool form, and use in Northern Mid-Columbia stone tool industries, we analyzed the material, technological, and functional class frequencies recorded for local (within the Northern Mid-Columbia region) and nonlocal (outside of the Northern Mid-Columbia region) obsidian sources. In eight comparisons H_0 was rejected, demonstrating significant non-random associations across local and nonlocal sources (Table 3).

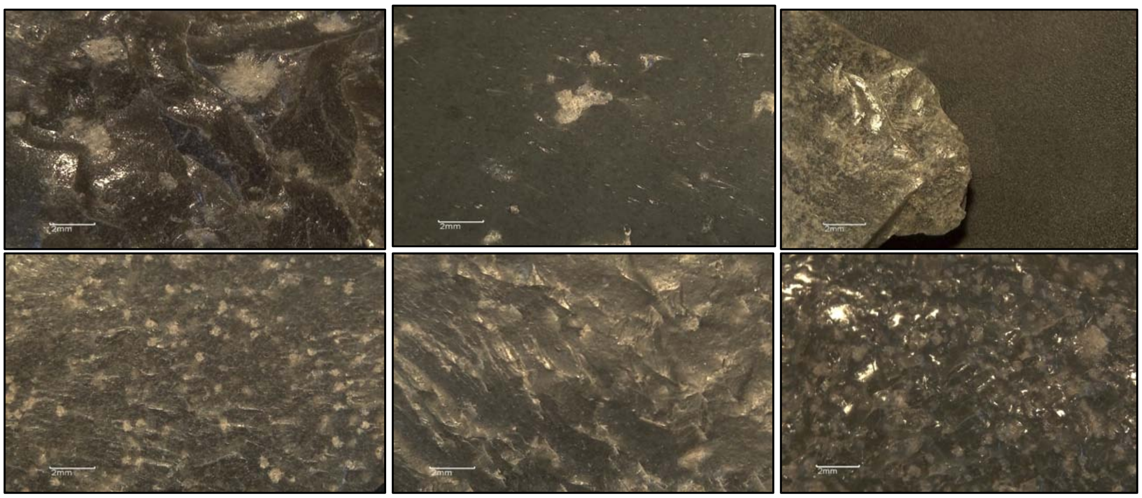

Fig. 3. Microscopic (10X) groundmass variation of the Chelan Butte/Unknown Vitrophyre 1 Source(s). A 2-millimeter scale bar is located in the bottom left hand corner of each photograph.

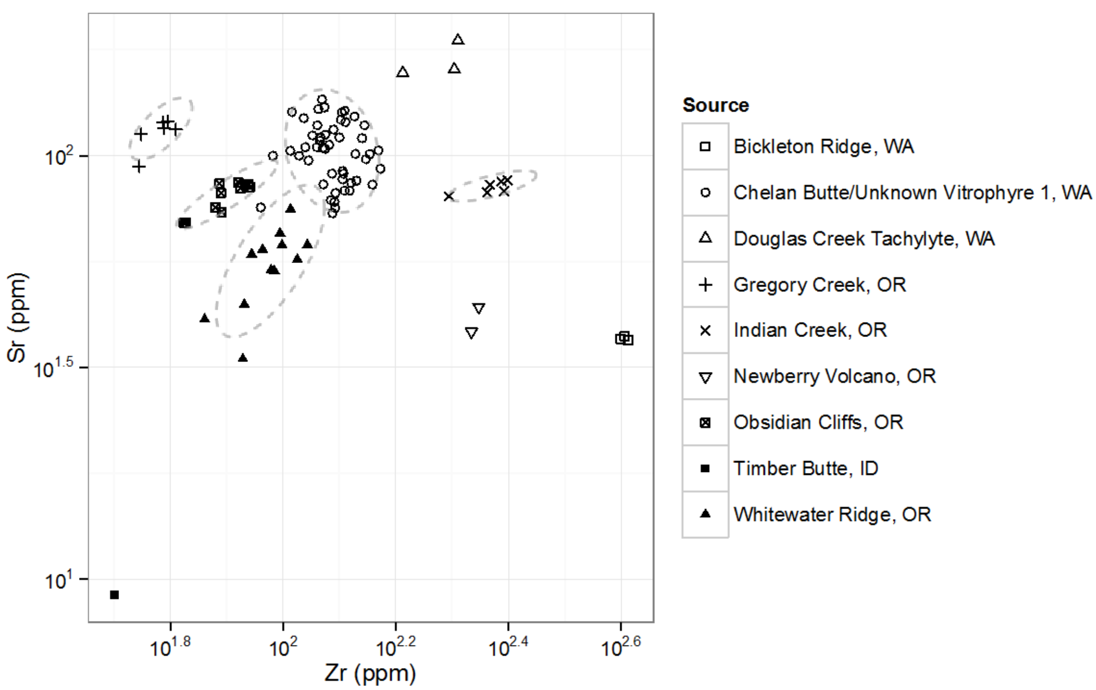

Fig. 4. XRF source data adapted from Ferguson (2014). Ellipses represent 90% confidence intervals assuming a t-distribution. Scales are log transformed.

TABLE 3. COUNTS OF STATISTICALLY SIGNIFICANT CROSS TABULATIONS OF DIMENSIONS AND MODES ACROSS OBSIDIAN SOURCE

Statistically Significant Dimensions and Modes	Obsidian Source Statistics				Obsidian Source Count	
	p	Test	*df*	*V*	Local	Nonlocal
Solid Inclusions	< .001	two-tailed Fisher's exact	-	-		
Present					605	8
Absent					6	33
Dist. of Solid Inclusions	< .001	two-tailed Fisher's exact	-	-		
Random					480	2
Uniform					125	6
Void Inclusions	< .001	$\chi^2 = 177.29$	1	.52		
Present					538	3
Absent					73	38
Object Type	.003	two-tailed Fisher's exact	-	-		
Biface					5	1
Core					37	0
Lg. Flake					529	32
Sm. Flake					34	8
Flake Completeness	.001	two-tailed Fisher's exact	-	-		
Whole					43	10
Broken					242	10
Flake Fragment					278	20
Flake Reduction Class	.001	two-tailed Fisher's exact	-	-		
Initial					71	3
Intermediate					175	6
Terminal					24	6
Bifacial					15	5
Other Modification	.002	$\chi^2 = 9.60$	1	.12		
Present					116	16
Absent					496	25
Presence of Wear	.001	two-tailed Fisher's exact	-	-		
Present					58	15
Absent					554	26

Note: For chi-square tests, only the statistically significant counts based on the analysis of adjusted residuals are reported. All non-significant cells from the adjusted residuals for chi-square analyses are denoted by hyphens. All Fisher's exact test counts are reported.

Results based on stone tool material properties demonstrated that local, low-quality obsidian sources were selected for over nonlocal, high-quality sources. Solid inclusions have variable effects on crack propagation depending on their distribution (McCutcheon and Dunnell 1998). Uniformly distributed inclusions increase the predictability of crack propagation by providing a consistent matrix for fracture while, randomly distributed inclusions decrease predictability. Void inclusions typically cause inhomogeneity in the rock body, making crack propagation inconsistent or decreasing predictability. The absence of solid inclusions, absence of void inclusions, and uniformly distributed solid inclusions (80, 93, and 75 percent, respectively) were the significant modal intersections and occurred overwhelmingly in nonlocal, high-quality sources of obsidian. CB/UV1 exhibited abundant (99 percent) solid inclusions that were primarily randomly distributed (79 percent) in addition to the presence of void inclusions (88 percent). Due to the high frequency of random and void inclusions, CB/UV1 likely did not perform equally to nonlocal obsidian sources as these attributes increased wastage during stone tool manufacture; however, these costs may have been reduced due to raw material availability and abundance.

The selective conditions structuring the manufacture and use of local and nonlocal sources were identified through the dimensions object type, flake completeness, flake reduction class, other modification, and use-wear. Non-random sorting of source was biased towards local sources, from which all cores and the majority of the bifaces were manufactured. Source diversity across object type consisted of large flakes (8 sources), small flakes (6 sources), bifaces (3 sources), and cores (1 source). Unsurprisingly, flakes occurred most frequently with the majority of both large flakes (94 percent) and small flakes (81 percent) produced from local sources. Likely due to the documented differences in material quality, local sources had approximately five times more broken flakes than whole flakes while nonlocal sources had equal frequencies of whole and broken flakes.

From the whole and broken flakes, reduction class was determined. Local and nonlocal sources occurred across all flake reduction classes, but their distributions within these classes varied. Local sources contributed to the majority of obsidian artifacts in initial (96 percent), intermediate (97 percent), terminal (80 percent), and bifacial (75 percent) reduction classes. In contrast, nonlocal obsidian flakes were only prominent in terminal and bifacial reduction classes.

Results demonstrated selection against the presence of other modification in the form of edge flaking (e.g., retouch) and use-wear. Nonlocal sources exhibited higher and near equal percentages of edge flaking (39 percent) and use-wear (37 percent). Local sources appeared to have minimal edge flaking (19 percent) and use-wear (9 percent). It should be noted that presence of modification on the edges of lithic tools could provide a more robust and durable edge that can endure the accumulation of use-wear (Terry et al. 2009). However, obsidian remains on average less durable than other lithic materials (Cheshier and Kelly 2006).

Spearman's rho tests were calculated to analyze if a correlation existed between un-aggregated obsidian source distances and artifact count and weight (Beck et al. 2002), based on the assumption that increased transport costs are incurred as the distance from source to a site increases (Renfrew 1977) (Table 4). These tests established that both count ($\rho = -.54$) and weight ($\rho = -.50$) demonstrated a moderate, negative correlation with regard to obsidian source-to-site distances corresponding to a fluctuating trend rather than a monotonically decreasing trend at a regional scale.

TABLE 4. RANK ORDER OF OBSIDIAN SOURCE ORGANIZED BY DISTANCE FROM STUDY AREA: COUNT AND AGGREGATED WEIGHT

Rank	Local/Nonlocal Source	Obsidian Source	Count	Aggregated Weight (g)
1	Local	CB/UV1	606	586.58
2		Douglas Creek	6	10.52
3	Nonlocal	Bickleton Ridge	3	1.09
4		Indian Creek	6	0.42
5		Whitewater Ridge	12	2.18
6		Obsidian Cliffs	11	1.76
7		Newberry Volcano	2	0.07
8		Gregory Creek	6	3.00
9		Timber Butte	1	0.45

Analysis of obsidian occurrence over time was achieved by assigning artifacts to four sub-regional cultural phases defined for the Okanogan Highlands (Grabert 1968; Chatters 1986). Only artifacts from proveniences securely assigned to these age ranges were used. The cross tabulation of five dimensions rejected H_0 (Table 5). Based on these non-random associations, selection over time can be summarized as follows: the occurrence of obsidian decreased; source diversity increased with CB/UV1 occurring less frequently and nonlocal sources occurring more frequently; the spatial distribution of obsidian occurrence fluctuated; the presence of other modification and use-wear increased; and object type became more evenly distributed.

Patterns in source occurrence over time were variable. Source diversity was lowest during the early Holocene in the Okanogan Phase (3 sources), with only 3 nonlocal artifacts (1 percent) present. During the Okanogan Phase, nearly seven times more obsidian artifacts were present in the northern reach than the southern reach. During the Indian Dan Phase, source diversity increased (8 sources) and over half of the artifacts were from nonlocal sources. Six sources were present during both the Chiliwist and Cassimer Bar Phases. However, results demonstrated that during the Chiliwist Phase, there were approximately twice as many artifacts in the southern reach as there were in the northern reach. CB/UV1 and Obsidian Cliffs were present in all four periods and had uneven representation over time. Local sources comprised the majority of the obsidian present, with the exception of the Indian Dan Phase. Gregory Creek, Indian Creek, and Whitewater Ridge were present during the Indian Dan Phase into the Cassimer Bar Phase; however, the frequency of occurrence decreased over time. Douglas Creek was also present, but remained constant through time. Bickleton Ridge, Newberry Volcano, and Timber Butte were only present during a single time period.

Non-random associations across object type, other modification, and presence of wear identified additional selection of stone tool manufacture and use over time. The frequencies of object type became more evenly distributed over time. In all phases, object type frequencies increased in the following order: bifaces, cores, small flakes, and large flakes. In this sample, the presence and absence of edge flaking and use-wear were statistically significant during the Okanogan, Indian Dan, and Cassimer Bar Phases. Edge flaking became more evenly distributed over time and use-wear increased over time from 14 percent in the Okanogan Phase to 50 percent present in the Cassimer Bar Phase. These changes were likely due to the increased occurrence of nonlocal sources over time, which exhibited more retouch and wear than local sources.

Recorded dimensions were next statistically analyzed to determine if landscape suitability and resource availability influenced obsidian occurrence (Schalk and Mierendorf 1983; Chatters 1986). The cross tabulation of four dimensions rejected H_0 (Table 6). The non-random occurrences across the northern and southern reaches of the study area appeared largely driven by differences between source diversity in the two reaches, which in turn structured the distributions of object type, flake reduction class, and use-wear.

The northern reach exhibited higher source diversity; however, the majority of the obsidian present was still local material (88 percent). The dimensional modes intermediate, terminal, and bifacial reduction classes were the significant intersections across space. While the northern and southern reaches had almost equal proportions of flakes (41 percent and 49 percent respectively). The northern reach had 37 percent of the intermediate flakes, 76 percent of the terminal, and 80 percent of the bifacial flakes, indicating a bias towards the end of the reduction trajectory. Source diversity was higher for terminal and bifacial flakes (4 sources) than intermediate flakes (3 sources) with only CB/UV1 and Whitewater Ridge occurring across all three statistically significant reduction classes, a finding consistent with Eerkens et al. (2007). Large flakes and small flakes occurred across all reduction classes. Use-wear occurred on 20 percent of the artifacts from six sources, and was primarily observed on CB/UV1.

TABLE 5. COUNTS OF STATISTICALLY SIGNIFICANT CROSS TABULATIONS OF DIMENSIONS AND MODES ACROSS TIME

Statistically Significant Dimensions and Modes	Statistics Across Time				Count Across Time (Phase)			
	p	Test	*df*	*V*	Okanogan (ca. 8000-6000 BP)	Indian Dan (4400-3500 BP)	Chiliwist (3300-2200 BP)	Cassimer Bar (1000 BP-historic)
Obsidian Source	< .001	two-tailed Fisher's exact	-	-				
Local					259	22	54	16
Nonlocal					3	30	16	7
Object Type	.005	two-tailed Fisher's exact	-	-				
Biface					1	2	4	2
Core					23	5	3	3
Lg. Flake					211	38	55	13
Sm. Flake					28	8	7	6
Other Modification	< .001	$\chi^2 = 27.09$	3	.26				
Absent					213	29	-	11
Present					50	24	-	13
Use-Wear	< .001	$\chi^2 = 38.98$	3	.31				
Absent					227	29	-	12
Present					36	24	-	12
Space	< .001	$\chi^2 = 105.76$	3	.51				
Northern					229	-	21	-
Southern					34	-	50	-

Note: For chi-square tests, only the statistically significant counts based on the analysis of adjusted residuals are reported. All non-significant cells from the adjusted residuals for chi-square analyses are denoted by hyphens. All Fisher's exact test counts are reported.

In the southern reach, selection differed from that observed in the northern reach. Source diversity was lower (CB/UV1, Douglas Creek, Obsidian Cliffs, and Gregory Creek) with an emphasis on local source exploitation (98 percent). Object type distribution was similar to the northern reach, as discussed above. Artifacts from nonlocal sources occurred as a single broken biface and five large flakes. CB/UV1 was present across intermediate, terminal, and bifacial reduction flakes; Douglas Creek occurred as a single bifacial flake; and Obsidian Cliffs occurred as a single terminal flake. Source diversity was higher for terminal and bifacial flakes (3 sources) than for intermediate flakes (1 source). Unlike the northern reach, large flakes and small flakes were classified as intermediate flakes and only large flakes were identified as terminal and bifacial flakes, which included nonlocal sources. Similar to the northern reach, CB/UV1 primarily exhibited use-wear; however, it was only minimally represented (5 percent), as the majority of artifacts present were unutilized flakes from local sources.

In order to better understand site, artifact count, and source diversity frequency between the two reaches, the spatial densities were mapped using kernel density estimations (Fig. 5). Site frequency was twice as high in the northern reach (n = 12) than in the southern reach, centering around the confluences of the Methow and Okanogan Rivers with the Columbia River (Fig. 5a), artifact frequency was almost evenly distributed between the northern and southern reaches (Fig. 5b), and source diversity frequency was twice as high in the northern reach (n = 8) than in the southern reach, also centering on the confluences of the Methow and Okanogan Rivers with the Columbia River (Fig. 5c). Of the nine unique obsidian sources in the study area, only three were represented in both reaches: CB/UV1, Gregory Creek, and Obsidian Cliffs. Source frequency by site varied with no more than four sources observed per site, and many sites had only a single source represented. A very weak correlation was observed between source diversity and archaeological site sample size (Spearman's Rho $\rho = .14$) demonstrating that selective conditions like landscape suitability and/or resource availability were likely driving the non-random distribution of source diversity and that differences in the observed frequencies between these reaches may also be tied to source use over time.

TABLE 6. COUNTS OF STATISTICALLY SIGNIFICANT CROSS TABULATIONS OF DIMENSIONS AND MODES ACROSS SPACE.

Statistically Significant Dimensions and Modes	Statistics Across Space				Count Across Space	
	p	Test	*df*	*V*	Northern	Southern
Obsidian Source	< .001	$\chi^2 = 34.12$	1	.23		
Local					238	374
Nonlocal					35	6
Object Type	.003	two-tailed Fisher's exact	-	-		
Biface					3	4
Core					20	17
Lg. Flake					223	338
Sm. Flake					29	15
Flake Reduction Class	< .001	$\chi^2 = 27.34$	4	.30		
Intermediate					67	116
Terminal					23	7
Bifacial					16	4
Presence of Wear	< .001	$\chi^2 = 32.68$	1	.22		
Present					54	20
Absent					222	360

Note: For chi-square tests, only the statistically significant counts based on the analysis of adjusted residuals are reported. All non-significant cells from the adjusted residuals for chi-square analyses are denoted by hyphens. All Fisher's exact test counts are reported.

Discussion and Conclusions

We used an evolutionary archaeology model to identify the selective conditions under which past people incorporated obsidian into stone tool manufacture and use in the Northern Mid-Columbia region. The results of our research established that obsidian occurrence appeared largely influenced by natural selection where stone tool attributes demonstrated a balance of cost and performance as established in our method. Drawn from local and regional obsidian research, we outlined a set of expectations based on natural selection as a causal mechanism for the non-random occurrence in our sample.

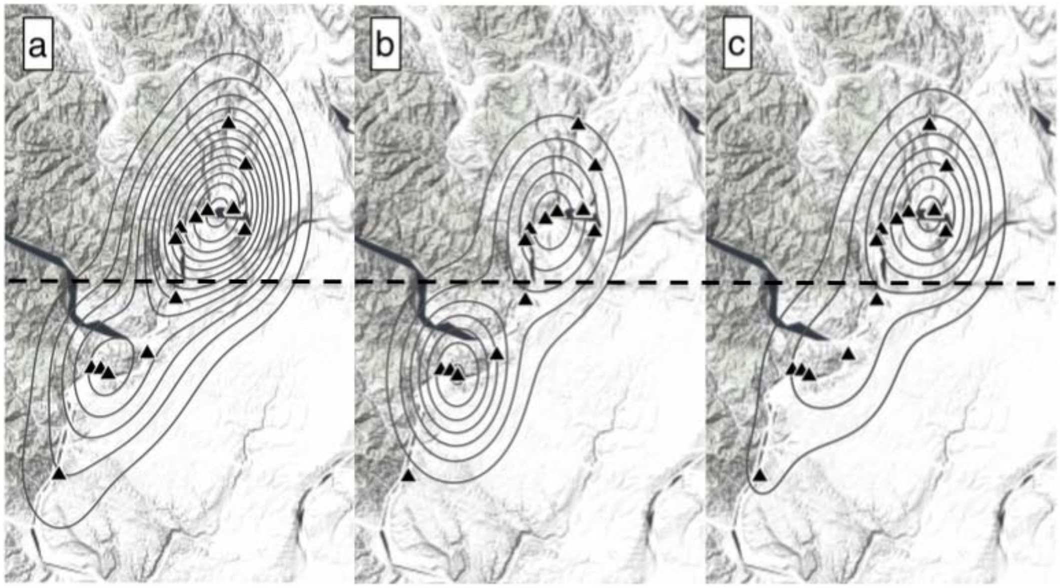

Fig. 5. Spatial frequency distribution or density represented by two-dimensional kernel density estimations of a) site frequency, b) artifact frequency at a site, c) source diversity frequency at a site (base map provided by Google Earth 2014). The black triangles represent the location of archaeological sites and the dashed line represents the distinction between the northern and southern reaches. Due to site proximity and map scale site locations may overlap.

We expected that raw material quality was an essential variable in structuring obsidian source occurrence. Based on related research (Andrefsky 1994; Eerkens et al. 2007; Vaughn 2010; McClure 2015; Mierendorf and Baldwin 2015), we projected that local material properties would exhibit higher frequencies of inclusions. The dominant local source, CB/UV1, did in fact exhibit a statistically significant presence of random, solid inclusions and void inclusions. The presence and distribution of such inclusions decreased the predictability of reduction and performance thereby increasing the costs associated with the use of this raw material (i.e., increased wastage) (McCutcheon 1997; McCutcheon and Dunnell 1998) and resulted in the plethora of unmodified, unused waste flakes. Despite this, local obsidian was predominant, indicating that the material's abundance/availability likely aided in reducing the costs associated with the difficulty of tool manufacture. Nonlocal sources exhibited little to no inclusions and could therefore be reduced in an easier and more predictable manner than local, low-quality sources. Accordingly, nonlocal materials were likely valuable in long distance procurement and exchange.

We also anticipated that local, low-quality obsidian would be readily available and would be used across all object types (e.g., small and large flakes, cores, and bifaces) (Andrefsky 1994; Eerkens et al. 2007), while nonlocal, high-quality material would occur mainly as small flakes and bifaces. Our data demonstrated that local, low-quality sources were present across all object types, not just low energy and expedient tools (Andrefsky 1994). As expected, all cores were crafted from local sources. However contrary to expectations, five of the six bifaces were manufactured from local sources. Nonlocal sources occurred primarily as large flakes followed by small flakes.

As observed by other local researchers (McClure 2015; Mierendorf and Baldwin 2015), we anticipated a pattern of monotonic decay as source-to-site distances increased (Renfrew 1977). Unlike results documented by Vaughn (2010) and Parfitt (2013), a moderately strong, yet variable, negative correlation was observed between distance from source to study area, and count and aggregated weight of obsidian source. Clearly, the selective conditions related to transport cost were not exclusively based on distance and other mechanisms (e.g., cultural transmission) might account for why certain nonlocal sources occur in fluctuating counts and weights (Quinn 2006; Minor 2013). Observations across flake reduction class did demonstrate a pattern of distance decay where high-quality, nonlocal sources occurred in later reduction trajectories. Alternatively, low-quality, local sources comprised the majority of all reduction classes and almost the entirety of the early reduction classes. These results were consistent with observed patterns regarding reduction strategies and source-to-site distances (Teltser 1992; Beck et al. 2002; Beck 2008).

We reasoned that source occurrence did not become localized over time as observed by others (Mack et al. 2010; Cadena 2012). We observed that source diversity generally increased over time, with CB/UV1 occurring less frequently and nonlocal sources occurring more frequently. Similar to Schalk and Mierendorf (1983), we observed high proportions of CB/UV1 in early phases with high frequencies during these phases in the northern reach sample. The Indian Dan Phase exhibited a disproportionate percentage of nonlocal sources compared to other phases and had the highest source diversity, which was likely linked to the influx of trade and exchange during this phase as observed by Chatters (1986). It is likely that the increase of exchange systems and mobility over time helped to offset the cost of procurement through a form of secondary procurement as opposed to direct procurement.

Galm (1994) discussed exchange systems conveying obsidian into the Columbia Plateau region. The Great Basin network was the most prominent, transporting obsidian from central and southern Oregon north through trade centers on the Columbia River. The southern Idaho exchange network also facilitated obsidian trade into areas of eastern Washington after 6500–6000 years BP. Our study area is located between two protohistoric tertiary-trade centers described as "trade fairs or subsistence sites" (Swagerty 1988:Fig. 1): the Kittitas Fair in the Kittitas Valley southwest of our study area and Okanogan Falls on the Okanogan River to the north of our study area. Within the northern reach, the historic Fort Okanogan was located at the confluences of the Columbia and Okanogan rivers. The proximity of our study area to these trade centers may also be a factor that contributed in the increased occurrence of nonlocal sources. It is important to note that while information regarding protohistoric era trade is available (Swagerty 1988), the ethnographic literature is largely silent regarding the specifics of obsidian trade networks (Minor 2013). The value of the archaeological record for understanding these networks is clear from our study and those of others (e.g., Carlson 1994; Galm 1994; Quinn 2006; Mack et al. 2010; Minor 2013).

Differences in the spatial distribution of obsidian between the northern and southern reaches of the Northern Mid-Columbia River Valley met our expectations. We hypothesized that variation in landscape suitability and resource availability were significant conditions that affected settlement patterns and consequently, the location of obsidian trade and exchange areas. We infer that these environmental constraints led people to utilize the northern and southern reaches differently, leaving behind observable differences in the material record and consequently in obsidian occurrence (Schalk and Mierendorf 1983:362; Chatters 1986). The northern reach exhibited higher source diversity and an emphasis on later reduction classes, which had higher source diversity than intermediate reduction classes. This reach also had more small flakes and artifacts exhibiting use-wear. These patterns align with expectations based on the northern reach's proximity to the trade centers and Chatters' (1986) conclusion that over time technology shifted from expedient manufacture to curated tool kits with an emphasis on "preparation over procurement" (Chatters 1986:207). The southern reach exhibited patterns of low source diversity, an emphasis on intermediate reduction, higher frequencies of large flakes (mainly from local sources), and minimal use-wear. While obsidian lithic assemblages in this area exhibited an overall orientation towards mid- to late-reduction trajectories, previous researchers noted that four of the six sites we studied were oriented toward initial stages of lithic processing (Schalk and Mierendorf 1983).

Our study was successful in identifying the selective conditions structuring obsidian occurrence in our sample. Based on our research efforts, we recommend four areas to increase the resolution of our study in the Northern Mid-Columbia Region. First, the understanding of obsidian occurrence could be bolstered by the inclusion of additional obsidian assemblages from sites in this area (45OK74, 45CH216, 45CH782, 45DO68, 45CH62, 45CH254, and 45CH409) that were unavailable at the time of analysis. Second, a systematic study of central Washington obsidian raw material source provenance and geochemical signatures could help elucidate source inclusion and distribution in the archaeological record. Third, our research focused on the selective conditions structuring obsidian occurrence in stone tool industries. It would be valuable to likewise demonstrate the selective conditions structuring the occurrence of other stone tool raw materials present and compare those patterns to obsidian occurrence in the Northern Mid-Columbia River Valley. Fourth, an analysis of traditional territories, trade and exchange systems, and obsidian occurrence would help produce a broader picture of precontact and ethnohistoric systems of obsidian distribution.

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THE RIGHT TOOL FOR THE JOB: SCREEN SIZE AND SAMPLE SIZE IN SITE DETECTION

Bradley Bowden

ABSTRACT

Many archaeologists in the Pacific Northwest employ 1/8 in. screen as a standard method for artifact recovery. Some archaeologists favor use of 1/8 in. screen for all screening applications, while others employ it as a sampling strategy to test for smaller items. While finer mesh screen is more reliable at detecting the range of archaeological materials that may be present, it is more time-consuming, and its use on site identification surveys will result in a smaller sample of any given landform or project area in any given time frame. This paper examines the relative pros and cons of 1/4 in. vs. 1/8 in. screen for identification survey and concludes that 1/8 in. screened shovel probes should be more effective at identifying sites or portions of sites dominated by small flaking debris when densities are relatively low but evenly dispersed. This means that 1/8 in. screen should be more effective at identifying site boundaries and portions of sites containing very small, dispersed items, but identifying the variety of archaeological materials that may be present in any given location will always be improved by increasing opportunities to detect them. In the case of buried archaeological materials where mechanical means of detection are not preferred, increasing the number of shovel probes excavated will most consistently increase opportunity, and this is most easily accomplished by using coarser mesh screen. The use of 1/4 in. screen as a standard technique, supplemented with samples of 1/8 in. screen, is recommended, particularly when 1/4 in. screen has not been effective.

Introduction

A debate has been brewing over the past several years in the Pacific Northwest regarding the appropriateness of 1/4 in. vs. 1/8 in. screen for various archaeological applications. While 1/4 in. screen, often supplemented by sampling with finer mesh sizes, has been a standard size throughout the United States for several decades, 1/8 in. screen has also been broadly employed in parts of the Pacific Northwest for many years. In the recent past, some public agencies have begun to promote, or even require, the use of 1/8 in. mesh as the standard screen size for all projects subject to review under Section 106 of the National Historic Preservation Act. The following article seeks to address the question of whether 1/8 in. is always a more effective screening method than 1/4 in. for identifying buried archaeological sites, and if not, under what conditions might 1/4 in. screen be more appropriate. The ultimate goal of this exercise is to suggest the most appropriate screening methods to use under a variety of field circumstances.

Ozbun's (2011:239) article *The Inadequacy of 1/4-in. Mesh Screen in Archaeology* provided the most definitive argument for use of 1/8 in. or finer mesh screen in "most or all screening applications." Ozbun's rejection of 1/4 in. screen was supported by three lines of evidence: 1) the geometry of flakes and the mechanics of screening, 2) a case study in which 1/4 in. and 1/8 in. mesh were used in the same area on two different surveys with highly varied results, and 3) the results of flint knapping experiments that have shown that few flakes produced from the manufacture of arrow points are large enough to be captured in 1/4 in. screen. Before making his case, Ozbun (2011:235) commented that some archaeologists have favored coarser mesh screen for identification survey and boundary delineation. He acknowledged that screening with finer mesh takes more time, and that some archaeologists consider this to be too expensive from a cost/benefit perspective. Ozbun (2011:235) stated that such archaeologists typically justify their use of coarse mesh screen because they believe that larger artifacts typically accompany smaller artifacts, and the recovery of such smaller artifacts is not necessary for the purposes of identification and boundary delineation. Ozbun's (2011:236) article proceeded to debunk the assumption that larger artifacts always accompany small ones explaining that the two smallest dimensions of flakes, typically their thickness and width, are the most significant factors in determining whether a flake will pass through the two-dimensional hardwire screen. He further argued that the vibration created by use of a shaker screen allows for flakes to intersect with the screen at various angles so that there is a greater likelihood that the smaller dimensions will find their way through the screen. Through several illustrations, Ozbun (2011:236) showed that a flake that is less than 0.9 mm in width and thickness can pass through 1/4 in. mesh. The experiments conducted by John Fagan showed that most flakes from the manufacture of an arrow point were smaller than this. During an experiment in which all of the flakes produced from the manufacture of various arrow points were captured on a tarp and passed through nested screens, a total of 6 of 316 flakes were captured in 1/4 in. mesh. In six individual experiments, three of them captured two flakes each, and three of them captured no flakes in the 1/4 in. mesh (Ozbun 2011:239).

Ozbun's examination of why archaeologists might favor coarser mesh and find 1/8 in. mesh too expensive was cursory, but to his credit, few archaeologists have examined this question closely. Schalk et al. (2000) were some of the first to address this question directly in the Pacific Northwest. In their examination of 1/4 in. vs. 1/8 in. artifact recovery from a series of sites in the Chief Joseph Reservoir, Schalk et al. (2000:153) showed that more lithics and fauna were captured in 1/8 in. screen, but that more tools and identifiable fauna were found in 1/4 in. screen than exclusively in 1/8 in. screen, meaning that the materials captured by 1/8 in. screen that were not captured by 1/4 in. screen were typically too small to represent tools and identifiable species. They also reported that the average time of recovery of 1/8 in. materials was about four to five times that of 1/4 in. recovered materials through all phases of investigation. Schalk (et al. 2000:155) ultimately concluded that finer mesh screen captures more artifacts, but less valuable archaeological data, and that the time needed to capture these additional artifacts was at the expense of quality data that could be used to better interpret a site. They made a case for sampling with finer mesh in limited quantities to test for the presence of materials that might be missed with the coarser mesh. If important information was captured in the finer mesh samples, the researcher could always increase the sample size.

Both perspectives have compelling aspects. It is hard to argue with the concept that finer mesh will produce more artifacts, and likely, more artifact diversity. The counter to this argument is equally compelling: because finer mesh takes more time, smaller, and therefore less representative, samples of any given site or landform are likely to be collected. This could produce non-representative samples. Though Ozbun's thesis runs directly counter to that of Schalk's, Ozbun (2011) was largely focused on the discovery of archaeological materials; whereas, Schalk et al. (2000) were discussing the excavation and interpretation of known sites. Regional archaeological literature has few, if any, examples of the application of appropriate screen sizes to archaeological survey and site identification, and generally, there are few articles that approach this question specifically from the screen size perspective. In focusing on survey, this article assumes that the goal of investigation is to find archaeological materials regardless of their size and character. As such, it specifically avoids the question of whether all archaeologists feel that there is valuable data contained in small artifacts and how that might influence their choice of screen size. Rather, this article attempts to answer the question of whether smaller screen sizes always produce better detection results, and/or, under what circumstances that this might be true or false. Detection here is defined as the identification of the first archaeological object or what Krakker et al. (1983) called *intersection*.

A variety of factors must be considered to explore the potential effects of screen size on detection. Some of these are static and have to do with the actual character of any given assemblage—the density of artifacts within any given area, the size of those artifacts, and the ratio of smaller to larger artifacts. Other factors are more dynamic and relate to the replicability of any given survey. These include the level of effort expended on finding sites in any given area—the number of probes excavated, the amount of time devoted to screening them, local field conditions (soils, weather, etc.), the attention span and thoroughness of any given archaeologist at any given time, and the perception that archaeological resources should be present in any given area, or, what some scientists call "confirmation bias." The following discussion will proceed from the more concrete or static factors to the more dynamic ones.

Artifact Density

In the early- to mid-1980s when academic archaeologists first began to dabble in what was then called "contract archaeology," a series of articles appeared in various national journals regarding the efficacy of various identification techniques (e.g. Schiffer et al. 1978; Krakker et al. 1983; Wobst 1983; McManamon 1984; Lightfoot 1986; Nance and Ball 1986). One of the more productive discussions of the factors influencing detection was that of Nance and Ball (1986:460), who noted that two independent probabilities informed detection. One was the intersection probability, or the likelihood that shovel probing will interact with a site of any given dimension, and the other was the productivity probability, which was the likelihood that a shovel probe within a site boundary will actually contain items. Schiffer et al. (1978:3) more broadly referred to this as the discovery probability: the probability that archaeological materials will be discovered with any given technique; though these researchers were more focused on the issue of how intra-site artifact density affects the presence of artifacts in an given shovel probe, not whether small flakes will be missed by using coarse screen. Few archaeologists screened shovel probes at this time.

Nance and Ball (1986:462–463) attempted to identify what they called a *reliability coefficient*, which they defined as the "proportion of variance in observations that is due to true differences among the observation units themselves" (Nance and Ball 1986:483), and ultimately argued that the best way to do this was to test multiple sites using the same interval and compare the frequency of positive shovel probes. They did this with 18 sites using 25X25 cm shovel probes placed at 5 m intervals, which were excavated to 10 cm below the surface and screened through 1/4 in. screen. The determination that a probe was within a site boundary was apparently made based on surface observations. They noted that only about 60 percent of the shovel probes within known site boundaries produced artifacts, though this varied widely by site from 7 percent to 100 percent. They noted a comparable survey on Cape Cod by McManamon (1982) had a range of 58–88 percent reliability among 10 sites. Nance and Ball deduced that 97 percent of variability of results was due to intra-site spatial clustering, and found that when the number of probes attempting to intersect a site decreases, the reliability of identifying a resource decreases proportionately (Nance and Ball 1986:470). They ultimately concluded that increasing the number of probes would help to mitigate for the variability of detection.

Probability equations have also been employed to examine appropriate shovel probe intervals. One of the more interesting applications of probability was Krakker et al.'s use of the Poisson distribution to estimate the probability of finding at least one item in a test unit of a specific size given an assumed average debris density (Krakker et al. 1983:476). Poisson distributions are generally used to expresses the probability of an event occurring in a fixed amount of time or space if these events occur independently and at a known average rate. They posited that frequency distributions should follow a Poisson distribution when mean occurrences per observation unit are low; theoretically, this does not work in denser portions of a site when occurrences are seemingly more dependent. The Poisson distribution is expressed as:

$$p = 1 – e\text{-}ad$$

> where p = detection probability, e = the base of natural logarithms (2.711828), a = the area of the sampling unit (.07 m^2 for a round 30-cm-diameter shovel probe), and d = the average density of artifacts per unit.

The use of this formula requires that you have an idea of the average density of artifacts per unit, but this number can be adjusted for perceived density. So for example, if the density of artifacts in any given location is assumed to be 10 items per m^2, the probability of encountering that density in a 30-cm-round shovel probe is 0.5, or 50 percent. A density of 5 items per m^2 returns a probability of 0.29, and a density of 30 items per m^2 returns a probability of 0.88. Keep in mind that this formula is not being used to calculate the probability of identifying a single item or even a specific number of items in the probe; rather, it is being used to calculate the probability of detecting that density of items per m^2. For this example, it is not necessary to worry about the volume of the shovel probe even though shovel probes occupy three dimensions; the surface area of the probe is being compared to a larger surface area. We could also use shovel probe volume and cubic meters, but it is not necessary for this illustration. It might help to imagine a buried surface that you are trying to detect with the area densities discussed here.

An evenly distributed density of 10 items per m^2 will be about 0.7 items in a shovel probe that measures 0.07 m^2. Thus, when looking at the probability of detecting densities hovering around 10 items per m^2, this is very close to examining the probability of detecting a single item. Accordingly, when low densities are considered, and the probability of detecting items is low, it is a strong indication that a single item will not be detected. Conversely, when density increases to 30 items per m^2 with a probability of 0.88 of detecting that density, there is a strong possibility that one or more items will be detected.

We can also use this probability equation to look at the point at which detection is likely regardless of screen size. Fagan's experiments for arrow points suggest that the ratio of flakes detected in 1/8 in. screen vs. 1/4 in. screen could be about 50-to-1. Schalk et al. (2000) concluded that the ratio at Chief Joseph was about 4-to-1. Some archaeologists have commented that laboratory experiments appear to inflate the ratio of smaller items to larger ones in comparison to field data, most likely due to the displacement of small items in field settings (see Vernhagen et al. 2012:246). For the sake of this demonstration, we will use a 10-to-1 ratio of small items to large items because it may be somewhere between real-world data and laboratory data, and because it happens to make this demonstration relatively easy to understand. At this ratio, when density is 100 items per m^2 or higher, shovel probes utilizing 1/4 in. screen should detect a single artifact half the time. When densities approach 300 items per m^2, shovel probes utilizing 1/4 in. screen should have a very high probability of success of a single item. Thus, when densities are between 10 and 100 artifacts per m^2 at this ratio, 1/8 in. screen should consistently yield better results provided the same number of shovel probes are excavated. Densities below and above this number should not consistently favor 1/8 in. screen. If the ratio of small to larger artifacts is less, 5-to-1 for example, then the range of density that likely favors 1/8 in. screen would be between 10 and 50 items per m^2.

Vernhagen et al. (2012) recently used Poisson distribution to examine the most effective methods in identifying Paleolithic and Mesolithic sites in Europe with core sampling. They further used binomial distribution to examine the probability of multiple cores being positive and the cumulative probability of at least one of up to five cores being positive (Vernhagen et al. 2012:Table 2). Binomial distribution is the discrete probability distribution of the number of successes within an experiment with a given probability. For instance, when a coin is flipped multiple times with a .5 probability of each outcome, it can be used to determine the probability that multiple flips will be heads, or the cumulative probability that one flip out of several will be heads. Vernhagen et al. (2012) used these formulas to conduct a series of simulations based on 11 sites with previously reported artifact densities. They demonstrated that the effect of artifact clustering diminishes the probability of success; however, they only found this to be significant when densities are high but testing is less intensive. They furthermore argue that smaller mesh size should be effective in detecting sites with relatively low artifact density; in their simulations using data from 11 previously excavated sites, this was less than 80 items per m^2 (Vernhagen et al. 2012:245–47).

Borrowing from Vernhagen et al.'s (2012) use of binomial distribution, we can look at the effect on artifact detection that adding additional probes will have based on the various detection probabilities by examining the cumulative binomial probability that at least one probe will be positive (Fig. 1). This is important information because use of 1/8 in. screen has been demonstrated to be more labor intensive; thus, more holes can be excavated and screened with a coarser mesh in the same amount of time. In a recent experiment near The Dalles, Oregon, Gleason (2012) found that twice as many shovel probes and up to one 1X1 meter unit could be excavated in a 1-acre parcel in the same amount of time as a series of shovel probes using 1/8 in. screen. In their discussions, Schalk et al. (2000) suggested that 1/8 in. screen was four to five times slower than 1/4 in. screen. Figure 1 shows that when detection probability is at .5 (the detection probability of a 30-cm-round probe excavated into an area that has a density of 10 items per m^2), two probes have a .75 probability of success, 5 probes have .97, and 10 or more probes should always result in a positive test. This chart also shows that the likelihood of detection will increase dramatically as additional probes are applied to areas with very low probability. Thus, when detection probability is similar over an area larger than a standard testing interval, adding probes between intervals should significantly improve success.

Average Artifact Size

The second variable to consider is the probability that all, or even most, of the artifacts from any given site are small items that would pass through 1/4 in. screen, and that artifact density is low enough that larger items will not be identified during shovel probing at a given interval. Fagan's experiment showed that few, and sometimes no, flakes were captured in 1/4 in. screen when manufacturing arrow points. But what about other tool types: dart points, spear points, scrapers, drills, abraders, choppers, fire-cracked rock, etc.?

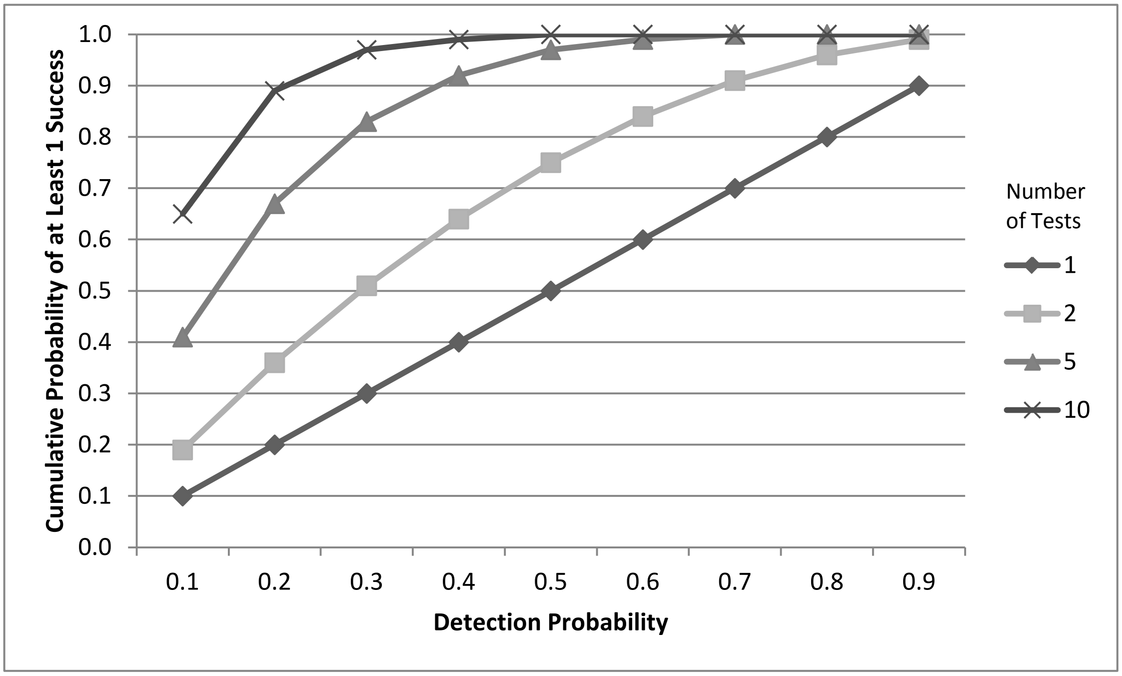

Fig. 1. The cumulative binomial probability of at least one positive shovel probe based on 1, 2, 5, and 10 probes at various detection probabilities.

Other researchers have conducted similar experiments with both faunal and lithic assemblages. In a similar experiment to Fagan's, Gunn et al. (1976) found that about 20 percent of flakes containing platforms from the manufacture of bifaces were captured in 1/4 in. screen and about 60 percent were captured in 1/8 in. screen. The biface that he illustrated appears to be about 100 mm in length, significantly bigger than the arrow points Fagan manufactured, and they did not discuss the material from which they were made. Gunn et al. (1976) also eliminated flake fragments and shatter from the equation, many of which could have been quite small.

Patterson (1990) produced dart points from Texas flint, and found that there was a consistent negative exponential curve to the distribution of flakes produced from bifacial reduction; that is, a very large percentage were quite small, and the percentage curved toward flat as flake size grew. He did not find this pattern with the production of large flakes from platform cores, however. With this kind of production, he found an irregularly shaped curve where the percentage of total flakes peaked (at 30+ percent) at about the middle of flake size (i.e. 45 mm). He also discussed how different stages of biface manufacture should produce different flake sizes and sought to determine whether stage could be elucidated from examining average flake size in an assemblage. Patterson's (1990:556) experiments indicated that variation in the form and the initial size of the flake blank had the greatest influence on average flake size, while other factors such as variation in the skill of the knapper and the specific stage of reduction influenced flake size as well.

As previously mentioned, Vernhagen (et al. 2012:246) commented that laboratory experiments appear to inflate the ratio of smaller items to larger ones in comparison to field data, and suggested that this may be because smaller items are more susceptible to erosion and do not preserve in place. One study that supports this assumption is Nicholson's (1983) survey of a landscape in Manitoba, where he used four different techniques throughout the study area: 1) excavation of 1X1 meter units with 1/4 in. screen, 2) excavation of 50-cm-diameter shovel probes using no screen, 3) excavation of 20-cm-diameter holes with a clamdigger using 1/4 in. screen supplemented with a 1 liter sample from screened materials that were subsequently water screened through finer mesh, and 4) use of a hand auger in which all sediments were collected and water screened through 2 mm, 1 mm and 0.5 mm mesh. He found that macro- and microdebitage results were poorly correlated, and that microdebitage presence was disproportionately high in aeolian deposits. He concluded that microdebitage may be more subject to transport through natural processes and may not represent the location of actual activity areas. A similar experiment in Alaska did not find a strong correlation between artifact transport and artifact size; however, microdebitage was not used in this experiment (Bowers et al. 1983).

Other factors likely to influence average artifact size include the quality of lithic raw material, primary site function, and distance to lithic source material. The distribution of raw material throughout the Pacific Northwest, if not the world, is quite variable. In some Pacific Northwest locations, lithic debitage assemblages are dominated by basalt, which typically produces larger flakes than CCS or obsidian. In places where the CCS is of poor quality and heat treatment is common, knapping this material produces a higher number of larger flakes and shatter in comparison to knapping finer grained materials. Many assemblages in coastal environments, even those associated with late prehistory when arrows were commonly used, are dominated by bone and shell tools; lithics, when present, are often choppers and scrapers with few associated flakes. Additionally, the last several decades of Cultural Resource Management (CRM) archaeology in the region, which have identified and recorded a much larger number of tertiary site types than academic archaeology, in concert with ethnographic information, tell us that there are several site types that are not dominated by flakes associated with bifacial reduction sequences. For example, many lithic assemblages at sites in the interior western valleys of Oregon and Washington are dominated by fire-cracked rock from earth ovens used for roasting camas, or by cobble choppers used for the processing of wood and other floral materials.

Thus, the average size of artifacts in any given portion of a site will be determined by the nature of activities undertaken and the tools being created, used, maintained, discarded, and repurposed. One portion of a site might be dominated by fire-cracked rock from an oven or hearth with few associated lithic debitage. Another portion of that same site might contain nothing but small flakes from the final stages of tool manufacture, and yet another portion of the site may only contain discarded broken tools.

The Opportunity Principle

Many researchers have acknowledged a variety of factors that affect the success of any given survey; Schiffer et al. (1978) provide one of the most comprehensive lists of these variables, and they discuss in detail how surveys must be built around them. I believe that all of these variables can be distilled into a single concept. What I am calling the Opportunity Principle is the simple concept that the more opportunities one has to identify archaeological materials, the more likely the chance that one will find archaeological materials. Thus, as opportunity increases, the variables affecting detection—overall site size, intra-site artifact density, artifact size, depth below surface, etc. will be diminished. This concept has also been recognized in the past on a variety of experiments involving surface survey in terms of the effects of vegetation, transect interval, and surveyor interest (e.g. see Wandsnider and Camilli 1992, for a summary).

As applied to screening specifically, the more challenging the screening conditions, the longer it takes to screen. The longer it takes to screen, the more opportunities the archaeologist has to examine the soils as they attempt to pass them through the screen. The more opportunities that the archaeologist has, the more likely they are to see small artifacts before they pass through the screen. Certain conditions could both increase and decrease opportunity depending on their specific nature. For example, clay content in the soil can initially increase opportunity by taking longer to screen. But if clay content is too high, it binds soils making them nearly impossible to break apart. Under saturated conditions, too much clay can make soils stick like glue to the screen making it very difficult to examine all components of the soil, including artifacts. Very small flakes might also be crushed with the force needed to pass saturated clay soils through a screen. In such cases opportunity may actually be decreased because examination is hampered, and the archaeologists may ultimately give up and dig fewer probes in any given area and/or not pass all of the soils through the screen. Likewise the work ethic, attitude, and mental state of the archaeologists could produce highly variable results; day to day or even hour to hour (see O'Brien et al. 1982). But assuming these variables combine to actually increase opportunity, detection becomes more likely.

The Opportunity Principle challenges Ozbun's (2011) assertion that artifact size primarily affects detection. This principle assumes that archaeologists do not screen with their eyes closed, nor do they ram soil through the screen without watching closely as they do it. While flake size may be a significant factor when screening pure sand with no organic materials present, such conditions are rarely present. Rather, the presence of silt and clay particles and organic materials create impediments to rapidly screening soil, and, therefore, archaeologists have more opportunity to examine the soils as they attempt to pass them through the screen. The longer and more diligently they work at it, and the more shovel probes they dig, the more opportunity they have, and the greater the likelihood they have of identifying artifacts, should they be present. It could be further inferred that the greater the number of archaeologists working together in the field, the greater the opportunity for detection, because the effects of variable interest and attention span of any given archaeologist become diminished. Thus, virtually every field experience has variable opportunity for detection independent of the local artifact density and average artifact size of any given site.

The Discovery Principle

The *Discovery Principle* is the idea that the initial identification of archaeological resources, regardless of the method of detection, leads to the discovery of additional archaeological materials. Here detection and discovery are almost synonymous, but discovery could more broadly be defined as the process by which archaeologists go about finding archaeological resources. It not only includes successful detection, but also the research conducted ahead of fieldwork, the assessment of local conditions that might affect detection, and the specific methods employed to successfully detect artifacts. Expressed as a probability concept, the

Discovery Principle assumes that when the first artifact or artifacts is/are found, the probability that more will be found increases substantially, perhaps exponentially. The *Discovery Principle* acknowledges that when archaeologists become aware that artifacts are present, they tend to focus their attention more diligently and/or modify their field methods in an attempt to find more artifacts. This might occur because research prior to fieldwork indicated a nearby resource, because once artifacts are identified on the surface they lead archaeologists to focus more attention immediately surrounding the initial find, because one archaeologist informs their co-workers of a find in their shovel probe screen and the co-workers look more closely in their own screens, and/or because the Field Director may choose to place additional shovel probes in proximity to an initial find.

Ultimately, initial detection leads to increased opportunity, which enhances discovery. There are variables related to discovery that could affect the creation of additional opportunity, however. A single flake identified in the very first probe excavated will likely create more opportunity than a single flake found in the 100th shovel probe excavated, for example. In the latter case, the archaeologists might convince themselves that they have thoroughly investigated the area, and the flake is an anomaly. In the former case, they might be motivated to dig well more than 100 probes, ultimately increasing opportunity and likely resulting in additional discoveries. Pavel (2011) has discussed these kinds of variables as forms of confirmation bias in archaeology.

The test case that Ozbun (2011) uses in his attempt to prove that 1/4 in. screen are not effective is actually a good example of this principle. Ozbun (2011:237–239) asserts that extensive shovel probing of 45-LK-521 at a close interval using 1/4 in. screen when the site was initially recorded (see Hannum and Wilson 2002) failed to identify artifacts in the same area where shovel probes by Baker and Smits (2006) using 1/8 in. screen, excavated opportunistically using a less rigid grid—and even fewer probes per acre—contained numerous artifacts. The shovel probes screened with 1/8 in. mesh resulted in increasing the site size significantly, and subsequent data recovery excavations resulted in the collection of over 25,000 artifacts in an area previously thought to be outside the site boundary (Ozbun 2011:238–239).

These statements are accurate, but Ozbun does not acknowledge important details that likely affected the results. First, the survey conducted for the second project (Baker and Smits 2006) took place after the initial survey, so that those researchers had knowledge that a site was present in the area. The archaeologists conducting the second survey used a 5 m interval pedestrian survey grid to examine the ground surface closely in this area, presumably because of the perceived probability of encountering artifacts, but also because they were working in a narrow survey corridor (an 85 ft. corridor along an existing gravel road, as opposed to a 200 ft. corridor through agricultural fields in the Hannum and Wilson [2002] case). They noted disturbances to Site 45-LE-521 east of their corridor associated with a wetland mitigation area, which was concerning to them. Through careful examination of the ground surface, immediately west of this disturbance, the archaeologists identified 2 CCS bifaces, 3 pieces of fire-cracked rock, and 17 flakes strewn over a roughly 50 m area (Baker and Smits 2006:8). Two additional surveys also were completed in the immediate vicinity related to the same project (Baker et al. 2006; Sharma and Ozbun 2006). One of these surveys resulted in the identification of artifacts within a cut bank of a drainage ditch. Positive and negative probes were excavated in proximity to the artifacts within this ditch (Sharma and Ozbun 2006:4).

When archaeologists returned to conduct test excavations within the newly expanded boundary of Site 45-LE-521, they did so with the benefit of knowledge of the results of the last three surveys, and placed shovel probes in proximity to the 22 surface items identified west of the disturbed portion of the site (Baker et al. 2006:23–24). One of the tests adjacent to surface items contained nearly 300 items. A single 1X1 meter test unit was placed in this area and produced 1468 artifacts. When archaeologists returned to this site for data recovery, they excavated 16 contiguous test units adjacent to the previous prolific probe and test unit and recovered nearly all of the 25,000 artifacts mentioned in Ozbun's (2011) article immediately adjacent to the artifacts found on the surface, the 300 artifact shovel probe, and the 1468 artifact test unit (Ozbun et al. 2008).

In his summary of the Site 45-LE-521 test case, Ozbun (2011:239) poses the question, "Why did the coarse-mesh-screen shovel probes fail to identify a highly significant archaeological deposit where fine-mesh-screened shovel probes succeeded?" But the finer mesh did not actually identify the portion of the site that turned out to have the highly significant deposit; the close-interval pedestrian survey did that. Additionally, the knowledge that a resource was already present in the area, the visual confirmation of disturbances within the known site, and relatively narrow project area being investigated all contributed to the identification of artifacts on the surface where they had not previously been identified. Repeated subsurface testing of this area led to the discovery of the highly significant deposit.

To actually address the efficacy of 1/4 in. versus 1/8 in. screen from this test case, one would need to excavate shovel probes and test units with 1/4 in. screen in the same locations as those where 1/8 in. screen was employed. We can actually approximate the answer as to whether the 1/4 in. screen would have missed this deposit by reviewing the Phase II and Phase III data for the second project. Of the 1702 items recovered from the Phase II shovel probes and test unit, 1182 (69%) were in the 1/4 in. and 1/2 in. size class and 255 (15%) were larger (Baker et al. 2006:33). To be fair, the 1/4 in. to 1/2 in. size class is 6.4 to 12.7 mm, which as Ozbun (2011) shows, would contain some artifacts that could pass through 1/4 in. mesh. However, considering that at least 15 percent of the artifacts recovered were large enough to be captured in 1/4 in. screen, a shovel probe using 1/4 in. screen in this area should have resulted in the identification of artifacts.

There are two lessons to be gleaned from this example. One is certainly that finer-mesh screen can yield better results in situations where smaller artifacts are present. This is particularly true of the boundary determination that took place during several subsequent investigations of Site 45-LE-521 where boundaries were expanded significantly beyond those recorded initially by Hannum and Wilson (2002). The other lesson is that the knowledge of the presence of artifacts leads to increased discovery efforts, which sometimes leads to the identification of important archaeological information that could have been missed given the small sample sizes represented by most survey investigations, including those used during the survey that first identified Site 45-LE-521.

Discussion

Many factors affecting the detection of archaeological materials using shovel probing, as well as the relationship between these factors, artifact size, and screen size, have been discussed above. All of these factors indicate that increasing opportunity will increase the chances of detecting artifacts when they are present. There are numerous ways to increase the opportunities to detect artifacts. One of them is to attempt to remove vegetation obscuring the visibility of artifacts. After all, shovel probing on a grid represents a sample of well under one percent of the subsurface universe. For example, a 30-cm-round shovel probe dug every 20 m on a grid represents a 0.0175 percent sample of the area being investigated. When the surface is exposed the sample increases significantly, even when relatively wide transects are being walked, because the investigator can examine such a large area. Small artifacts may be harder to detect from five to six feet away, but the sample is so much larger than that of a shovel probe survey, that the chances of detecting a single artifact large enough to see makes surface examination an infinitely superior method to shovel probing.

When artifacts are buried, and/or when it is not practical to remove vegetation, shovel probing is a reasonable method of detection, but the very small sample that shovel probes represent means that only relatively densely distributed portions of sites are likely to be identified. As discussed above, if large portions of a site have densities less than 10 items per m^2, a 30-cm-round probe is not likely to be effective regardless of the screen size used. But when the number of probes is increased, the cumulative probability increases. Doubling the number of probes turns a 0.5 probability area into a 0.75 probability area, for example (see Fig. 1). Thus, increasing the number of probes should be the most effective means of identifying sites with low to moderate but variable densities because of the additional opportunity this method creates. The ratio of small to large artifacts will affect results, but only when it is relatively extreme so that overall site density is not actually low, only the density of artifacts easily detectable in 1/4 in. screen. Indeed, if artifact size ratios are perceived to always be so extreme that 1/8 in. screen must be used, then one must simultaneously argue that pedestrian survey is a complete waste of time; if the small flakes cannot be detected in a relatively coarse screen from two to three feet away, how are they to be detected from five to six feet away? A series of other variables will also affect detection including soil conditions, weather conditions, and field crew composition.

Krakker et al. (1983) remind us that the goal of shovel probing as an identification survey method is not actually the discovery of a certain number of artifacts representing a certain site or local density; rather, the goal of shovel probing is intersection with the site (a.k.a. detection). Once a single item is identified, then the test is successful. Once this happens, the researcher can choose to alter their objective to one of understanding the character of the resource, and their methods can change accordingly. When artifacts are buried and mechanical means are not preferred, increasing the opportunity for detection can most easily be accomplished by increasing the total number of shovel probes excavated. Gleason (2012) found that 1/8 in. screened probes took more than twice as much time as 1/4 in. screened probes in the same acre of land. As previously mentioned, Schalk et al. (2000) found screening times to be four to five times higher on sites containing abundant faunal materials.

When one considers the relatively small sample size of any given shovel probe along with the effect of cumulative probability and the other benefits of increasing opportunity, there are relatively few situations in which 1/8 in. screened shovel probes are likely to be the most effective way to identify the range of buried archaeological sites that could exist in any given area. Resources must be dominated by very small artifacts that contain very few larger artifacts and also evenly distributed this way. With few exceptions, this would seem to include late stage tool finishing sites, resharpening stations, or the margins of more diverse sites where very small items have been transported farther from the remnant activity area than larger ones (see Nicholson 1983). Sites exclusively containing the remains of bird or fish bone without associated artifacts used to process them might also be better identified this way. Such sites would have to be relatively dispersed so that densities are so low that individual items are not detected in the screen before the soils that contain them pass through the coarser mesh. Extremely sandy soils would further challenge detection as they would pass through screens relatively quickly.

Conversely, sites associated with short-term or limited seasonal activities containing very discrete activity areas and very limited associated tool finishing or resharpening activities could easily be missed by not digging enough shovel probes to intersect them. Increasing the number of probes not only increases the cumulative probability of intersection within low to moderate probability areas, it creates additional opportunity to identify denser portions of sites and to see smaller artifacts in the soil prior to their passing through the screen.

Conclusion

For years archaeologists have attempted to quantify the probability of encountering archaeological resources on any given landform. Predictive models can be effective at a coarse level for planning purposes, but at the local level, most project areas and landforms contain a vast amount of what one might be forced to call moderate probability areas, that is, locations where no site has been identified, but where local conditions indicate that archaeological sites might be present. Depending on past land use history, such areas could contain a wide variety of artifacts with highly variable intra-site densities.

We can assume that the initial identification of villages, seasonal camps, and most historic sites should not be dramatically affected by the mesh size used because artifacts of variables sizes should be present and readily identifiable. But seasonal procurement and other briefly occupied sites with relatively light densities and discrete profiles are more challenging to identify. Finer mesh screen should be effective at detecting normally distributed low-density lithic scatters dominated by small flaking debris, and at identifying site boundaries where such debris might be more prevalent. But the time investment needed to employ 1/8 in. screen ubiquitously could also lead to undersampling, discouraging the identification of sites comprised of discrete activity areas that have not been significantly dispersed. The ubiquitous use of any given screen size or interval might facilitate the identification of certain sites, but discourage the identification of others. In fact, the universal application of any given survey strategy will inevitably normalize results toward sites that are best detected with those methods.

Ultimately, however, the creation of as much opportunity as possible should have the greatest positive effect on detection. Thus, when boundaries, densities, and size ratios are unknown, which is the case in virtually every shovel probe survey, and when conditions and circumstances require that shovel probing be used at the primary detection method, the coarser 1/4 in. screen should be used in order to maximize the number of probes excavated, and it should be supplemented with 1/8 in. screen when the coarser mesh has not been effective so as to test for the presence of smaller artifacts that may not be co-located with larger ones. This could be done by infusing transects with a sample of 1/8 in. screened probes. A twenty-five percent sample of finer mesh screened probes, for example, placed judiciously so as to minimize the distance between them, could serve to test for the presence of relatively isolated small artifacts when no larger artifacts have been identified. Additionally, shovel probe surveys should employ samples of closer interval probes (10 m if 20 m is the standard interval) to test for very discrete sites when the larger interval has not been effective. These methods should be considered whenever a relatively large area should be shovel probed so as to allow for the identification of a broad range of resources in a reasonable time frame. Alternatively, when project areas are very small (less than 2 acres, for example), it may be just as effective to solely employ 1/8 in. screen because the amount of time saved with 1/4 in. screen can only be applied to a small number of additional probes. Finally, because the margins of sites are likely to contain light scatters of the smallest materials present, 1/8 in. screen should be used to identify or confirm site boundaries. Importantly, screen size can be changed immediately upon finding a single artifact in the coarser mesh or on the surface, but in most cases the finer mesh is only warranted as a sample until the first item is found. While it may be cumbersome to consider employing multiple screen sizes and intervals on any given survey, the use of varied methods should facilitate the identification of a broader range of resources.

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ALPHONSE LOUIS PINART AMONG THE NATIVES OF ALASKA

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ABSTRACT

In the late 1800s, European society developed a desire to document the native cultures that were rapidly disappearing. Alphonse Louis Pinart was France's representative in this rescue effort. He hastily collected materials and published his results in brief articles. Three of his twelve articles on Alaska are translated and reproduced here. In these three articles, Pinart describes some of the customs of Alutiiq and Tlingit peoples, as well as Aleut masks and other artifacts he found in a burial cave on Unga Island in the Shumagin Islands.

Introduction

Alphonse Louis Pinart was a French explorer and ethnographer who represented France in the late nineteenth-century European efforts to document disappearing native cultures. Following an overview of early European history of Alaska, the life of Pinart, and the contributions of Pinart, translations of the following three articles by Pinart are presented:

- *Eskimos and Koloches: Religious Ideas and Traditions of the Koniag* relates to material Pinart collected during a six-month stay on Kodiak Island in 1871 and a brief visit to Sitka the following year; the information collected concerns the Alutiiq Eskimos of Kodiak Island and Tlingit Indians of the Northwest Coast.
- *Concerning a Rock-Shelter Burial of the Ancient Aleuts of Aknañh, Unga Island, Shumagin Archipelago (Alaska*) pertains to the discovery of cultural material in a cave on Unga Island, located west of Kodiak Island.
- *Aknañh Cave, Unga Island (Shumagin Islands, Alaska)* provides additional decscriptions of cultural material discovered in the Unga Island cave.

Historical Background

Mikhail Gvozdev reportedly landed on the shores of present-day Alaska in 1732 (Gvozdev 1990). However, it was not until Commander Vitus Bering's ill-fated voyage of 1741 brought back knowledge of the wealth of furs to the Siberian *promyshlenniki* (Steller 1988) that the "fur rush" to Alaska actually started (Solovjova and Vovnianko 2002). Following an abortive attempt in 1728 to determine whether the two continents of Asia and America were connected, Commander Vitus Bering was sent by Peter the Great a second time in 1741. This time, Commander Bering on the *St. Peter* and Captain Alexei Chirikov on the *St. Paul* sailed directly east, reaching land in southeast Alaska. The ships became separated and while Chirikov reached Kamchatka safely, the *St. Peter* wrecked on an island (later named Bering Island) among a small group of islands (later named the Commander Islands) between the Aleutian Islands and Kamchatka. Following Commander Bering's death on the island, the crew constructed a vessel from the remains of the *St. Peter* and returned to Kamchatka the following summer. Bering's crew brought to Kamchatka the substantial collection of fox furs they had acquired over the winter.

When Bering's crew appeared with the fox furs, a rush for furs started into the Aleutian Islands; fur hunting in Siberia, especially ermine, had essentially eliminated the fur hunting as a source of income. The Russians had little interest in the islands except to procure furs, particularly sea otter furs. The inhabitants of the Aleutian Islands, the Aleuts, were forced to give up their furs and compelled to hunt sea otters—the Russians did not have the skills required for sea otter hunting. Through time, the Russians moved eastward along the island chain, hunting out one island and moving on to the next, reaching Kodiak in 1763. Here the Koniag (Alutiiq people) were given much the same treatment as the Aleuts; that is, they were forced to hunt sea otters, though here they were sent in large flotillas of baidarkas (kayaks).

In 1784, Gregorii Shelikhov established the first permanent settlement on Kodiak Island and subsequently, through his manipulation, managed to monopolize the fur hunting and trading in the Aleutians and South and Southeast Alaska. This was done under the oversight of the newly formed Russian-American Company. Managed by Alexander Baranov, this company gradually moved southeast into the Alexander Archipelago, establishing its headquarters on Sitkha (now Baranof) Island at the location now known as Sitka. Here the Russians were unable to completely dominate the natives (Tlingit) and therefore had to bring with them "Aleuts" (the name given by the Russians to both the Aleuts and Koniag Eskimos) to hunt sea otters (see Grinëv 2005).

The exploration of Alaska proceeded somewhat slowly, except along the shores where fur-bearing animals might be found. A number of tentative trips up the Copper River between 1796 and 1848 produced relatively little information (Grinëv 1993; 1997). It would be one hundred years after Bering's voyage (i.e., early 1840s) before another Russian, Lavrentii Zagoskin (1967) would travel up the lower part of the Yukon River. In Western culture at this time, native cultures were regarded as little more than entertainment—such as at Carl Hagenbeck's human zoos, where visitors could come and pay to see natives in their "natural" habitat (Ames 2009).

With the exception of Ivan Veniaminov (St. Innocent), who arrived in Sitka in 1823, little effort had been made to preserve any of the native cultures in the regions of Russian occupation in the early 1800s (Veniaminov 1984). Veniaminov gathered information on the Aleuts and later the Tlingit. He created an alphabet for the Aleuts and taught them to read. This, of course, was to be able to instill in them the beliefs of the Russian Orthodox Church. Most other information on the natives of Alaska appeared in the form of notes, memoirs, and diaries by travelers, merchants, and sea captains, many of whom were employees of the Russian-American Company.

By the late 1800s, after the sale of Russian America to the United States, there was a growing awareness of the rapid disappearance of native cultures. Western institutions began sending out people in an almost frantic effort to collect both material and nonmaterial items of fading cultures in an attempt to salvage as much as possible before every trace had disappeared (Rohner 1966, 1969; Cole 1985, 1991). Following the sale of Alaska to the United States, Americans came to explore the land and collect native legends and material goods. The explorers included Frederick Schwatka (1983), who in 1883 crossed the Chilkoot Pass to the upper reaches of the Yukon River, which he then followed to its mouth. In 1885, Henry Allen (1985) went up the Copper River, crossed over to the Tanana River, and followed it down to the Yukon. Other explorers were more interested in the people, such as Edward W. Nelson (1983) and William H. Dall (1870). Stationed at St. Michael from 1877 to 1881, Nelson collected an enormous amount of material for the Smithsonian Institution, while Dall explored many parts of Alaska, collecting scientific information on both the people and the land. Collectors came from other nations as well, primarily Germany. Aurel Krause (1956) lived among the Tlingit Indians and produced one of the basic ethnographic works on the Tlingit. Another collector from Germany, Johan Adrian Jacobsen (1977), a Norwegian, was employed by the Berlin Museum of Ethnology to travel about Alaska and make ethnographic collections (Bland 2012). Franz Boas, who focused much of his research efforts in Canada, studied the Tlingit and Haida in Alaska (Boas 1894, Rohner 1969). Though collectors came largely from Germany and the United States, France had one representative—Alphonse Louis Pinart (Fig. 1).

Alphonse Louis Pinart

Alphonse Louis Pinart was born in Marquise, Pas-de-Calais, France in 1852, the son of a director of an ironworks. Pinart attended French schools in Lille and Paris. Having a penchant for languages, he studied Sanskrit and attended lectures on Chinese. In 1867, at age 15, he visited the Paris International Exposition, where he met the Abbé Brasseur de Bourbourg, a noted French writer, ethnographer, historian, archaeologist, and scholar of Mesoamerican studies. Pinart became captivated by the study of native cultures, particularly those of the Native Americans. In 1869, he was on his way to California (Wagner 1962, Parmenter 1966).

Fig. 1. Alphonse Louis Pinart (Courtesy of the Collection of the Museum of Boulogne sur Mer, France).

Pinart represented France in the international scramble to salvage the disappearing cultures of native peoples. On 27 April 1871, Pinart made his first trip to Alaska to spend a year in the Aleutian Islands and on Kodiak Island collecting material for his research. On 4 September 1871, Pinart engaged a small crew of Aleuts in the native village of Illiuliuk (now the community of Unalaska) and set out in a kayak to Kodiak Island. He arrived in St. Paul (now the city of Kodiak) on Kodiak Island on 10 November of the same year. Shortly thereafter he traveled from St. Paul to San Francisco, returning to Sitka, Alaska, the following year to carry out a second and final trip to Alaska. In late 1872 he returned to France, where he was given a hero's welcome and acclaim by the French Geographical Society. Following his sojourn in Alaska, Pinart turned his attention to collecting linguistic data on the natives of Central America (Parmenter 1966:7).

During his lifetime, Pinart became a collector of linguistic material and also amassed rare books and manuscripts; in 1874, for example, he purchased Abbé Brasseur's library after the Abbé's death. Pinart's research took him to Germany and Russia—an occurrence that attracted Hubert Howe Bancroft's attention. The latter contacted Pinart with a request for books and manuscripts (Bancroft 1890:621). Pinart granted Bancroft's request, and as a result much of Pinart's work is now housed in the Bancroft Library in Berkeley, California.

In 1880, Pinart married Zelia Nuttall (1857–1933), the daughter of a wealthy San Francisco doctor.[1] Their marriage turned out to be an unhappy one and in 1887 they were divorced. Parmenter (1966:1) states that though Pinart was "wealthy in his twenties, by 1883 he had run through all his inherited wealth as well as the money of Zelia Nuttall."

Pinart died in 1911 at the age of 59 in Passy, France. His death notice, published in the journal *Anthropologie* (Verneau 1910), identified fourteen journal articles by Pinart. Subsequent research, however, indicates he published and contributed much more than that.

Pinart's Body of Work

A prodigious collector and describer of cultural data, Pinart left behind sixty-five published works and hundreds of pages of unpublished materials. His unpublished materials remain in the form of handwritten notes in various languages—English, Russian, French, German, and Spanish. Twelve of his publications pertain to Alaska (these works are listed in the References Cited). Of these, one is a catalog for a display in the Paris Museum of Natural History of items collected in Alaska (Pinart 1872b). Another is his "Voyages à la côte Nord-Ouest de l'Amérique exécutés durant les années 1870–72 par Alph.-L. Pinart" (Pinart 1875d), which is a collection of articles published by others analyzing fossils, rocks, and other data collected by Pinart. Another work is listed in Wagner ("Ethnologie de la Côte Nord-Ouest Île Vancouver, Columbie Britannique et Sitka"), which, according to Ross Parmenter (1966:10), might not have been published.

Pinart did much in a short amount of time. Partially as a result of his haste, he never seemed to have enough time to familiarize himself with his subjects. Throughout his publications are sections where he appears to be confused. Most noticeable are geographical inconsistencies, particularly in the "Voyage along the Coast of Northwest America from Unalaska to Kodiak." In

[1] Alfred M. Tozzer (1933) identifies Ms. Nuttall as "Zelia Maria Magdalena Nuttall." However, Henry R. Wagner (1962:6) gives her name as "Zelia Parrot Nuttall," her middle name being that of her grandfather, John Parrot, consul in Mazatlán, Mexico. Zelia became an outstanding researcher in her own right, discovering during her research such unexpected treasures as a Mexican codex. In 1902 the Peabody Museum of American Archaeology and Ethnology published a facsimile of it in her name—the *Codex Nuttall* (see Wagner 1962:4).

Pinart's defense, he was trying to acquire as much information as possible. He may have felt pressured by the fact that he was the sole representative for France, while the Germans and Americans had many people in the field.

Unga Island

When Pinart arrived in Alaska (Dutch Harbor), he hired six Aleuts with three baidarkas (kayaks) to take him from Unalaska to Kodiak (Fig. 2). On the way to Kodiak, Pinart stopped at Unga Island in the Shumagin Island group. Here in Delaroff Harbor he was taken to a cave by a local resident, an old man by the name of Lazar (Black et al. 1999:115). Pinart reported his finds in "The Cavern of Aknañh, Unga Island." According to Parmenter (1966:13), "Undoubtedly the most important single Pinart discovery on his first trip to Alaska was a cave on the island of Unga."

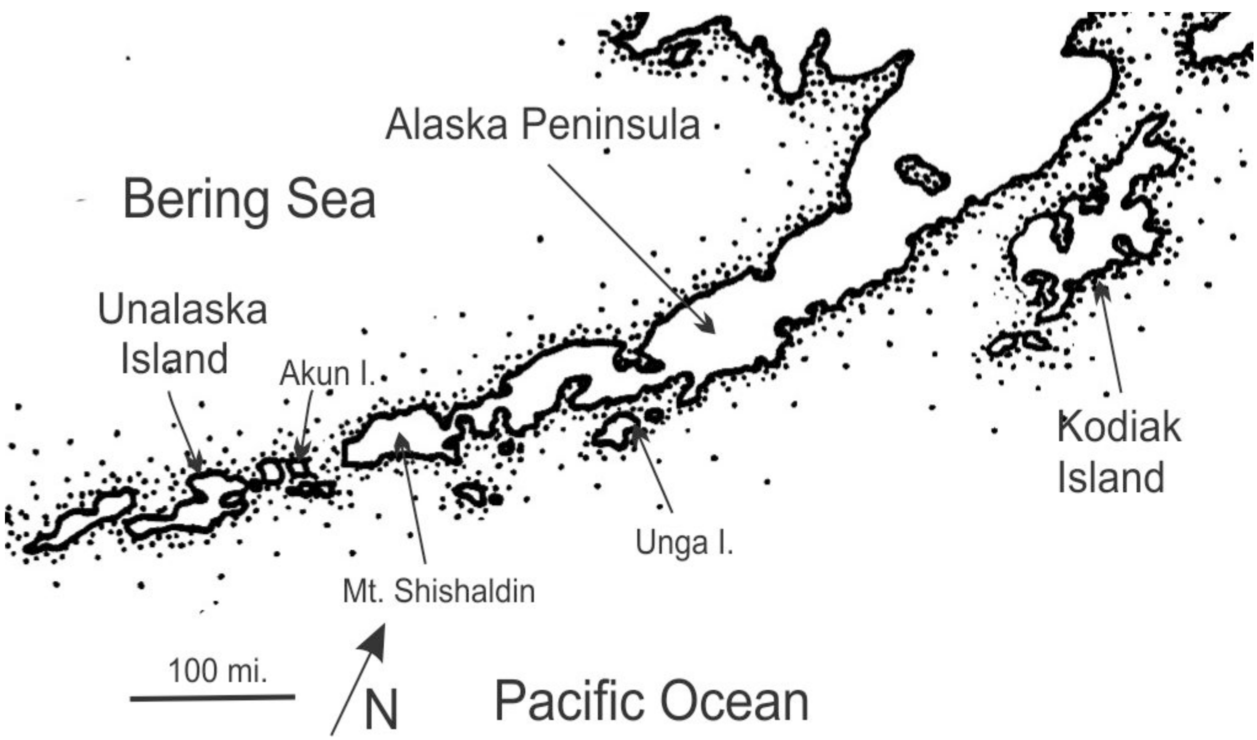

Fig. 2. Map showing Pinart's voyage from Unalaska to St. Paul, Kodiak Island.

While on Unga Island, Pinart visited a burial cave on 30 September 1871. Two years later in 1873, William H. Dall visited the cave and collected a number of items. Dall took issue with some of Pinart's conclusions regarding the burials.[2] The sense that Dall was going to scoop him made Pinart hasten to publish his work. Despite his hasty work, he must be given credit for

[2] For a comparison of Dall's 1873 finds with those of Pinart presented here, see Dall 1878:28–30: (*http://www.biodiversitylibrary.org/item/58733#page/7/mode/1up*) and Dall 1884:140: (*http://archive.org/details/onmaskslabretsce00dallrich*).

recording and publishing this information. Many burials were desecrated by others with no record of their existence. For example, Ivan Petroff was given a mummy as a present.[3] It is tempting to conclude that Europeans and Euroamericans systematically destroyed the burials of the natives. This is true only insofar as the former were motivated and equipped to go nearly everywhere for other purposes. The natives also destroyed one another's burials (Mackenzie 1931:268).

Pinart liked to present himself as a great explorer, which no doubt helped him raise funds for future travels. He dedicated himself to acquiring scientific data, albeit primarily in the form of word lists (Pinart 1875c), and frequently referenced himself as "a young traveler who, for the love of science, has, at his risk and peril, explored during nearly two years the rarely visited and almost unknown coasts of the northwestern region of North America" (Pinart 1872a:1). It is true that the coast of Alaska is perilous; however, one might take issue with his claim of "rarely visited and almost unknown coasts." The Russians had been in the region for over 100 years before Pinart arrived and were, in fact, in Shelikof Strait when John Meares "discovered" it for the English in 1786 (Meares 1967:x–xi). And this, of course, does not take into account the Aleut and Koniag peoples, who had lived on these coasts for 7,000 years or more.

Pinart was a man of his times who readily interchanged the words "savages" and "natives." I have not tried to soften any of his prose. Despite his sometimes inappropriate language, he was trying to save as much of the disappearing native heritage as he could.

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[3] Petroff says, "Mr. McIntyre showed me a mummy he had obtained from Nutchuk Island, where it had been kept in a cave on the side of a steep mountain. . . . Mr. M. made me a present of the relic" (in Hinckley and Hinckley 1966:48).

Eskimos and Koloches: Religious Ideas and Traditions of the Koniag[4, 5]

The Koniag, one of the southernmost tribes of the great family of western Eskimos, inhabit the islands of the Kodiak archipelago as well as the south coast of the Alaska Peninsula from Cape Douglas, at the entrance of Kenai Gulf (Cook's Inlet), to Kijoulik [Kujulik] Bay, where the village of Soutkhoum [Sutkum] is located. In the past they extended as far as Cape Koupreianoff [Kupreanof], at the 160th parallel from Greenwich, which formed their southern boundary with the Aleuts, whose first village was located a short distance from the other coast of that cape. The Koniag, along with the Aleuts, were the first to come into constant contact with the Russians, and for this reason they have actually arrived at a degree of semi-civilization that has permitted me to obtain from them a greater amount of information on their traditions and their ancient customs and religious ceremonies. It should be noted in passing that at present they are all members of the Russian Orthodox Church. The other tribes, who have only been nominally converted and who still retain their ancient religious practices, are very protective of their traditions. It has often been very difficult for me to obtain something definite from them, and I would say that the task would have been impossible if I had not had information from the Koniag to aid me.

The total number of Koniag might amount at the present time to about 1,500 (i.e., 1,000 on the islands of the Kodiak archipelago and 500 on the coast of the peninsula). Among these 1,500 are a number of creoles and métis, who actually form close to half the population. At the beginning of the century the population of the islands was greater and reached, according to different reports, about 8,000. Of that number, close to half were lost to the first epidemic of smallpox, then successively by other later epidemics until the population was reduced to the number we have today. At the time of the first epidemic there was no medicine on the islands; when the sick felt themselves taken by the malady they found nothing more urgent than going to bathe in the sea in order to extinguish the fire that devoured them. Of all those who did this very few survived.

Although the Koniag have the characteristic traits of the Eskimo family, they seem to have a mixture of foreign blood, and this is explained in the following way. When the Koniag came to be established on the archipelago, they first inhabited only the part of Kodiak Island situated on Shelikof Strait (a strait which, according to their traditions, was no larger than a large stream). They lived for a long time on that coast without suspecting that on the northern part of the island lived tribes of Koloches [Tlingit]. Little by little, having become more numerous and desiring to increase their knowledge of the coasts, they ultimately encountered the Koloches. Hence, wars followed. The Koniag were defeated, and the Koloches offered them peace on the condition that chiefs or tribunes of the villages would be chosen among them; this later formed a kind of hereditary nobility, the chief transmitting power to his son or to all the other members of his family. One would think that under these conditions the two races would mix. But Eskimo features seem to have had the most influence, since we see the features eventually increase beyond those of their ancient conquerors and end by driving the latter entirely from the archipelago. Although the Koniag chased out the Koloches, they nevertheless retained the system of hereditary chiefs established by the Koloches. It is through these families that I have been able to find the type that

[4]This text was originally published in 1873 as "Eskimaux et Koloches: Idées Religieuses et traditions des Kaniagmoiutes." *Revue d'Anthropologie*. Vol. 2:763–780. Paris.

[5] The following three articles have been translated by Richard Bland. Throughout the text Bland has used brackets [ ] to insert points of clarification. All other marks are Pinart's. All illustrations except the masks have been added by the translator.

is the most distant from the Eskimo, such as the only cases of artificially deformed heads to have come to my attention. Another influence that could also have contributed much to change the characteristics of inhabitants of Kodiak can be attributed to female hostages whom they took as prisoners of war or whom they obtained in exchange.

Their height is greater than in the average Eskimo family. The color of the skin changes, taking on that dark yellow and bronze tint, which I have previously indicated for the Koloches. The facial features are more regular: we rarely find among the Koniag the flattened nose with large and open nostrils. On the contrary, it is often fine and well made. The cheekbones, so prominent among the Eskimos in general, seem to be considerably softened. We no longer find among them, except in rare cases, the slanting eyes that are found among other tribes of the same group. We add to that the flattening of the skull that is practiced by strongly pressing the back of the head and causing the latter to be as wide as long. I pointed this out in a communication made to the Société d'anthropologie de Paris under the name of *Déformation en forme de pavé* (the effect of that deformation can be noted on one of the skulls of my collection, coming from Igak Bay [Kodiak Island], which is now located in the anthropology collection of the Muséum d'histoire naturelle de Paris). That custom of deforming the head, which I have not noted among any other tribe of Eskimos, is now entirely lost. The only cases I have observed were on old sexagenarians. Besides the different physical traits, which I have just indicated by showing the mixing that must have occurred among those two foreign tribes, it remains for us to point out the connections that exist in the traditions and religious ideas of the Koloches and Koniag. One very remarkable fact is that, in spite of all these vicissitudes, the Koniag language is preserved entirely pure from all foreign interference.

From the point of view of the religious and legendary, one of the most remarkable traditions introduced by the Koloches is that of Kanhlaχpak or the great crow (*kanhlak*, crow; *pak*, augmentative particle), to which the Koniag attribute all kinds of remarkable deeds. It is the Jelı' of the Koloches. They regard him as a divinity, a high spirit, although in addition they retained all their own classification, which, as we will soon see, is very characteristic and differs entirely from the various American [Indian] mythologies that are known to me. The Kanhlaχpak was supposed to live in the clouds. The storms were the effect of the beating of his wings, the flashes of lightning were the luminous rays that his eyes emitted in his anger, thunder was the noise produced by his immense wings as they beat against his body, and so on. If we compare this myth with similar myths that are found among the greatest number of American [Indian, that is, not Eskimo] tribes, the result will be the solid conviction that it is entirely American and completely foreign to the Eskimo family, the Koniag being the only tribe holding this belief. If a Koniag finds himself at sea in his frail kayak and a sudden storm comes up, he implores Kanhlaχpak to take him on his wings and put him down safe and sound on the shore. But he does not forget at the same time to invoke the *hlamchoua* (*hlam*, possessive of *hlak*, light, purity, universe; *choua*, plural and genitive of *chouk*, man), which in their own mythology are the most important personages and the most powerful. Along with that tradition, I will place the custom of using masks in the religious dances, a custom that seems to me to have been imported by the Koloches and to have been spread later from Kodiak onto the continent, where we find it again as far as the neighboring tribes of the *Kwichpak* or *Youkon* [Yukon]. It is easy to understand that the custom, once established among the inhabitants of Kodiak Island, would spread among the neighboring tribes if it is known that each year at the time of those ceremonies, from the end of November to the end of January, the different tribes—sometimes from great distances—usually invited and visited each other. It is easy to conclude that tribes located beyond the *Kwichpak*, belonging to groups speaking a dialect so different that they were understood only with difficulty, were not invited or were invited only rarely to those ceremonies, and that the custom of masks had not been introduced among them. We know also that the Aleuts employed masks in their religious ceremonies. The masks were also placed on the face of a dead person in order to prevent it from being able to see evil spirits during the peregrinations it was supposed to make after its death. It is also possible that the Aleuts adopted from the Koniag this custom of using masks in their dances. One tradition says that, at some unknown time, the Aleuts found themselves too numerous on their islands. Several families emigrated under the leadership of an old chief and came finally to establish themselves on Kodiak Island. In regard to this practice, we will have to examine the custom of placing a mask on the face of the dead later when we discuss the Aleuts in particular.

The religious and mythical songs of the Koniag quite often mention the name of the Koloches. I think they want to point out here and there that these songs were introduced among them by the Koloches.

The primitive cult of the Koniag and the western Eskimos in general appear to me to present a belief system quite superior to those of the Koloches or of the American tribes. It seems to resemble, on the contrary, certain quite Asiatic ideas. This cult, as far as I can guess, is the remains of a religious system lost today but indicating an order of ideas already elevated and leading one to suppose that the people who conceived it had arrived at a certain degree of civilization. I have taken substantial pains to interview many people and check their stories with those of others, and in the process to disregard those that were not corroborated and therefore not useful in giving me an exact understanding of their religion, which I now plan to discuss. It differs completely from what has generally been given on the subject by travelers or writers who have spoken of the Eskimos, and I hope that it will reveal a bit of the concealed history of those populations.

They divide the heavens into five regions superimposed one upon the other. They believe very pure beings, men of light (*hlam-choua*), exist in the fifth or highest. In the fourth heaven live beings less pure, but who nevertheless are able to purify themselves again and become *hlam-choua*. In the third heaven live the *kachaχpak*. (A *kachak* is identified as a man who is supposed to have relations with the *hlam-choua* and to know the future. He was the agent of both the traditions and the religious faith of those populations. They were very few in number, very revered, and placed well above the *kahlalik* or shaman). The word *kachaχpak* is derived from *kachak*, "educated man," "savant," "knowing the future," and of the augmentative *pak*. They speak generally of *kachaχpak* as a single being, but I think they want to indicate by this word a collection of beings who, according to their belief, maintain communications between the *kachat* (plural of *kackah*),[6] who are found on the earth, and the *hlamchoua*, in the fifth heaven. In the second heaven as in the first live beings less and less pure, and in the last live the *mittat* or star men. We find, therefore, in those different heavens, as we ascend, transformations, successive purifications. Anyone, whoever it may be, can, if he has lived in an honorable manner and conformed to their religious laws, becomes a *hlamchouk* through those different transformations.

Everyone, according to his beliefs, dies and is reborn to life five times, and it is only after having left life for the fifth time that he dies and leaves the earth forever in order to pass to another existence among the *mittat*—namely to the sun, the moon, the aurora borealis, and so on. On that subject I will cite here an anecdote that was told of a famous shaman, Aouachala (whose skull was sent to Saint Petersburg by the assistant Voznesensky). Feeling himself close to death, he gathered a large crowd around him and predicted that he would leave them in the night and that he would return in the aurora borealis, warning them at the same time to stay up all night, and that as soon as he died an aurora would appear, and that in the midst of that aurora they would see him. Coincidentally, the shaman died and the aurora appeared, an occurrence through which, up to the

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[6] It appears the h and k may have been reversed here.

present, the name Aouachala is preserved with veneration among the Koniag. If during his first four lives a man has been bad, he becomes an evil spirit, an Igak, instead of transforming into a planet. His head is elongated disproportionately and becomes pointed, his eyes appear on the back of his head, and he goes off to the west (*hlanik*). He returns from there occasionally to torment his fellow man. Those different successive deaths and births bear the following names: *tougannitouk* ("it is not death"), apply to the first three; *achouiχtouk* ("he becomes more evil") (from *achitouk*, bad), to the fourth; and *toukououk* ("he is completely dead") to the fifth.

The idea that the spirits of men who have been bad during their lives go off toward the west is linked to a very important tradition among those peoples. It is in the west, in effect, that they are said to originate, and that for a very long time their ancestors lived in the west, but that having become so nasty and bad, they were all exterminated—with the exception of a *kachak* and a *kahlalik*—and that all passed into the aurora borealis.

They say that below the earth there are five distinct regions. But who lives there? I have not been able to learn. The number five is a number that we encounter at every turn in their traditions, and it seems to play an important role.

They maintain a cult dedicated to the sun and to the moon, which, according to them, were once a man and a woman. The moon is the symbol of the masculine and the sun the symbol of the feminine and fertility. The tradition is the following: a man had a very pretty sister whom he loved madly and who shared his love in secret. One evening, having had intimate relations, the young woman disappeared. The brother hurried after her, and for a long time they ran through the sky without being able to meet. Every morning, before sunrise, these people usually return to the most elevated place near their village, or climb onto the roofs of their houses and stay squatting, their eyes fixed toward the east, until the rising sun comes once more to warm their numb limbs. A very mythical cult was also maintained for the moon at the time when it periodically disappears. They did not stop the singing of particular songs and lamenting during the time when it remained hidden. At that time the Aleuts held dances in which the women were nude and masked. No man could witness it under penalty of death. I cannot ensure that the same ceremony took place among the Koniag, but I have grounds for thinking it did.

Finally, I will give some details here on the customs and manners of the whalers, who were regarded as having communication with evil spirits and who are looked upon only with extreme fear. It seems that the whale was regarded among those populations as an animal whose death should be expiated by ceremonies similar to those that we find among the Ainu, the Gilyaks, and others, in expiation of the death of bears.

It was not possible for just anyone who desired it to become a whaler. The candidate had to pass through a number of initiation ceremonies. Whalers lived in special villages situated in inaccessible places, either on a high cliff or in the middle of a forest along the coast (forests abound on the northeast and the north of Kodiak Island, as well as on Afognak Island). Located in the middle of forests or in places that could not be polluted by the glance of an ordinary person, they had caves where they kept their mummies (*inχout*, dialect of the north; *aχat*, dialect of the south), which they viewed as guardian divinities. One of these caverns on Kodiak Island is divided on the inside into several compartments. At the entrance, and hidden behind a skin of *lavtak* (skin of sea lion dried and prepared) are two old men with white beards, seated, in the manner of Eskimos, on their heels and in the act of sharpening lance points of slate used in hunting. Another curtain of *lavtak* separates them from the interior. The grotto is almost circular. In the middle is a miniature lake on which a whale and a kayak float. In the kayak, a man is throwing a dart into the whale. On each side are a number of niches formed by skins of *lavtak*; in each niche is one of the mummies in the act of making one of the objects needed for hunting whales. On the right is a man preparing the wood of a dart. Opposite him, on the left, is a woman making thread of whale sinew that will serve to sew the *kamleika* (an impermeable garment made of the intestines of marine animals). Here is another one, with an infant at the breast, sewing the *kamleika*, and so on. The whalers bring offerings to these mummies consisting of the flesh of seals and other marine animals. They say that in return, when they have need of slate lance points, they only have to place the unworked slate at the entrance of the cavern, and on returning after several days they find their lances ready to use. The mummies about which I speak are treated in the following manner: as soon as the whalers learn that a person belonging to the aristocracy has died in a village, they go there, take the body to a certain stream reserved for that purpose, and place it in the water, where it is left to soak for about two weeks. They withdraw it then, remove the inner parts and, after cleaning it, dry it first in the smoke of a fire, then in the sun. When they have prepared it like this, they fill the interior with moss and certain herbs or preservative materials which I do not know, dress it in the richest garments, and carry it into the cavern. They boil other cadavers in order to obtain the grease which they rub on their lance points. This grease serves them in many other ceremonies that would be too long for me to describe today in the short space I have.

Concerning a Rock-Shelter Burial of the Ancient Aleuts of Aknañh, Unga Island, Shumagin Archipelago (Alaska)[7]

On the 30th of September 1871 I was at Port Delareff [Delarof], where I continued my investigations among the Aleuts who inhabit the southernmost part of Unga—the largest and most important island in the Shumagin Archipelago. An old man named Lazare, who had been pointed out to me as one of the natives most capable of furnishing me ethnographic, linguistic, and other information—which I was primarily collecting—let me know that he knew of a shelter burial of the ancient Aleuts located a short distance from the abandoned village of Aknañh. Despite the fanaticism of the first Russian missionaries, they had not found the burial near Port Delareff. We went to Aknañh and, directing ourselves toward the north-northeast, going for about 1 km near the crest of the cliff, we arrived at a point where a considerable pile of boulders had made a broad gap. We descended with infinite precautions and, arriving at about 50 m above the level of the sea, found ourselves in the presence of two enormous detached rocks in a part of the cliff that leaned against one another. It is in the shelter formed by these two rocks that the ancient Aleuts had situated the grave, which I had the honor of speaking about to the Academy. This shelter measured 4.70 m long. It was 2.50 m high at the entrance and its ceiling descended to 1 m toward the back, where a broad crack allowed water to ooze inside in rather large quantity. The floor was covered with more or less voluminous fragments of rock detached from the vault. On carefully cleaning it, we soon uncovered the remains of four individuals. Each body had been placed on a still quite recognizable bed of moss; their average length was 1.60 to 1.65 m, and each was separated from the neighboring grave by a wooden frame. Two figures occupied the back of the shelter. They were lying down, one beside the other. A third was at their feet. The fourth remained only as shapeless fragments. All that had been exposed in this grave had suffered greatly. The majority of the objects set down beside the deceased were deeply altered and impossible to preserve. I was able, however, to collect a certain number of interesting pieces. Thrown here and there in the different parts of the shelter lay fragments of large sculpted and painted wooden masks, the best of which had been reproduced on the planks which I place before the Academy. These masks, which served in the funeral dances, were broken after the ceremony for which they were made and

[7] This article was originally published as *Sur un abri-sépulture des anciens Aléoutes d'Aknañh, île d'Ounga, archipel Shumagin (Alaska)*. Gauthier-Villars, Paris, 1875a.

thrown into the grave. Along with the masks destined for the actors of the funeral ceremony were others that must have served another use. It was a rite among the ancient Aleuts to place a mask representing a human or animal figure on the face of the deceased (one of the masks from Aknañh represents a sea lion head). The reason for this is so the deceased would not be frightened or diverted from their course by evil spirits they encountered along the route that the soul of the deceased was supposed to take in order to reach the west, where the resting place of the souls is located. The bed of moss contained a considerable number of copies of painted wood of all the manufactured gear of the Aleuts before Russian occupation: harpoons, arrows, knives, and scrapers, among others. One will note that in this arsenal, which contains only imitations of tools and instruments, the graves exhibit almost exclusively instruments for fishing. Everything leads to the belief, indeed, that the grave at Aknañh is one of those specially consecrated graves of the whaling class. Fishing, or rather the hunting of those cetaceans, was, before the arrival of the Russians, the property of certain privileged and feared men. One could enter into the guild only after a whole series of initiation tests, whose details I will not go into here. The whaler was buried separately, far from the villages, in crevices of the rocks or in grottos of the cliffs, while the Aleuts who were not part of this kind of aristocracy of courage and of power were buried, bound in their skin clothes, either in the hut that they had occupied and that was then destroyed, or in one of the compartments (*jupan*) of their residence, which was walled in so that the rest of it could continue to be occupied.

The bodies in the shelter at Aknañh were extended, unlike those of simple Aleuts that are ordinarily buried in a flexed position, the head on the knees, which are brought back under the chest and the arms fixed around the legs. I did not find at Aknañh any vestige that recalled the wrappers of seal or sea lion (*lavtak*) skin that were in use among the ordinary Aleuts.

The two skulls I have placed in the galleries of the Museum of Natural History are the most characteristic: the height of the two subjects to which they belonged reached 1.60 m.
19 April 1875.

Aknañh Cave, Unga Island (Shumagin Islands, Alaska)[8]

This little piece which I offer the reader was only supposed to be published in the second volume of my *Voyages à la côte nord-ouest de l'Amérique* [Pinart 1873c], whose publication began some time ago. I have taken this ethnographic fragment from the collection in order to publish it immediately because I have heard that an American traveler,[9] abusing the confidence that I had in his scientific integrity, has recently portrayed himself before a group of scholars in a large town in the west as the author of the excavations that I was going to make known, without making it understood that he had only the ordinary title of collaborator.

The finds made at Aknañh are some of the most interesting results of my voyage in Alaska, and it can be easily understood that I am ensured, by the anticipated publication of a chapter of my voyage, the priority of a discovery that the members of the American academy, to which I have made reference, have well wanted to consider as being of certain importance, however insufficient the account made to them has been.

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[8] This text was originally published as *La Caverne d'Aknañh Ile d'Ounga (Archipel Shumagin, Alaska)* by Ernest Leroux, Paris, 1875b.

[9] He is apparently referring to William Healy Dall. For a different point of view regarding this burial cave: see Dall (1878).

Part I.

Aknañh, where the burial cave is situated and a description of which follows, is an old abandoned village on the south coast of Port Delarov [Unga Village], Unga Island. It is known that that island is the most important in the Shumagin archipelago, which extends along the Alaska Peninsula between 159° 30' and 161° 35' west lat. from Paris.[10]

Unga is also one of the rare islands of the archipelago that has retained its inhabitants, and I returned there in September 1871 to continue my investigations. An old man named Lazare, who had been pointed out as one of the natives best able to furnish me with the ethnographic, linguistic, and other information that I principally collected, made known to me that he knew of a cave burial of the ancient Aleuts on the other shore of the port, which the fanaticism of the first Russian missionaries had not been able to discover despite its proximity.

We returned to Aknañh on the 30th of September 1871; directing ourselves north-northeast, following near the crest of the cliff for a kilometer, we arrived at a point where there was a large breach in a huge pile of rocks. We descended with great caution and, having arrived at 50 meters or so above the level of the sea, we found ourselves in the presence of two enormous, partly detached rocks of the cliff, arch-buttressed against each other.

It is in a shelter formed by two rocks that the ancient Aleuts had created their sepulcher. The shelter measures 4.70 meter long, is 2.50 meter at the entrance, and its ceiling drops to 1 meter at the bottom, where a large crack is seen oozing water in rather great quantity. The floor was covered with large and small rocks, detached from the vault. On clearing it with care, we soon brought to light the remains of four individuals. Each body, which had been placed on a bed of moss, was still quite recognizable, of an average length of 1.60 to 1.65 meters, and separated from that of the neighboring burial by a wooden frame. Two subjects occupied the bottom of the shelter. They were laid one beside the other. A third was at their feet. The fourth remained only as shapeless debris. Everything that had been exposed to the air in the sepulcher had suffered greatly. Most of the objects deposited at the sides of the dead were profoundly altered and impossible to preserve. I was nevertheless able to collect there a number of interesting pieces. Thrown here and there in different parts of the shelter were fragments of large sculpted and painted wooden masks, most of which have been reproduced in the plates appended to the present work. Those masks, which served in the funeral dances, were broken after the ceremony for which they were made then thrown into the sepulcher. Along with the masks meant for the actors in the funeral ceremony, others were to serve another purpose. A rite of the ancient Aleuts consisted of placing a mask representing a figure of a human or an animal on the face of the dead. In the journey that the soul of the deceased was supposed to make in returning to the west, where the home of the souls is located, the mask is supposed to prevent it from being frightened or diverted from its route by the evil spirits it will encounter on the way.

The bed of moss contained a considerable number of copies in wood portraying the working gear of the Aleuts before Russian occupation (Pl. V and VII). It should be noted that in the stockpile, which consisted of other sculptures along with the reproductions of tools and implements, almost everything indicated a fishing industry. One of the masks represents the head of a sea lion. The other animals represented are the otter and the cormorant (Pl. IV, Fig. 1 and 2). Several tools are reproductions of instruments for fishing still employed today. The whole village has believed that the sepulcher of Aknañh is one of those especially consecrated burials of the class of whale hunters. Before the arrival of the Russians fishing, or rather the hunting of whales, was the distinctive feature of certain privileged and feared men. One could enter into the

[10] From here Pinart repeats much of the previous article. Since it is clearer and more inclusive it has been left in.

organization only after a whole series of trials by initiation, whose details I do not mention here. The whalers were buried apart, far from the villages, in the crevices of rocks or in the grottos of cliffs, while the Aleuts who made up no part of that kind of aristocracy of courage and power were buried tied up in their skin clothing, either in the hut which they occupied and which was then destroyed or in the compartments (*jupan*) of their residence, which was walled up so it could continue to be occupied by those who remained.[11]

The bodies from Aknañh Cave had been placed on a bed of moss, while the simple Aleuts are ordinarily interred in the flexed position, the head on the knees pulled up to the chest and the arms fastened around the legs. At Aknañh I have not found any vestige resembling the wrappers of skins of seals or sea lions (*lavtak*) that were used among the ancient Aleuts.

Part II.

Of all the objects discovered in Aknañh Cave, perhaps the most important in some regards are the arms and legs of a human represented in Plate IV (3, 3a, 4, and 4a). One part of the torso measuring 38 cm in height by 16.5 cm wide accompanied its members, but it was so severely decomposed that I judged it absolutely useless to reveal its design. However incomplete the remains were, they attest to the existence in one sepulcher of the ancient Aleuts of a statuette representing a man. But the first Russian travelers, and especially their missionaries, have claimed that the Aleuts did not have idols and did not possess any representation of the human form to which they rendered homage. Some words of the wise Metropolitan of Moscow, Innocent, formerly Ivan Veniaminov, however, make one think that certain islands of the Aleutian chain were an exception to the rule, since there existed in a certain cave large mannequins (*bolvan*) to which homage was probably rendered. Can our observations not be compared to those of the mummy caves of the whalers of Kodiak and the Aleutian Islands? Or was the human figure of which I just spoke meant to represent the deceased, and at the moment of the funeral dances was it not placed in the center of the circle of dancers? According to this hypothesis the dance ended at the time the masks were broken and thrown into the sepulcher. The effigy of the deceased would itself have been broken and the symbolic breaking would have indicated removing the deceased from his old companions, whose spirits, without that operation, would perhaps have sometimes come to visit and torment. This is not the place to discuss this question, which would go beyond the limits I have imposed on myself.

The arms of the statue of Aknañh, the figures in Plate IV, are 19 cm long—the longest leg attaining 44 cm, the other measuring 39 cm.

I have had four of the best preserved masks of Aknañh represented in Plates I, II, and III. All four are crudely carved. A brief description here: The mask in Plate I, which is supposed to have been placed on the face of the deceased, is 30 cm high. It is an entirely complete mask. On the nose a very curious spiral tattoo can be seen, which is not without analogy to those of some populations of the South Seas. The tricolor tattoo, which leaves the mouth to end in the middle of the cheek, is also very unusual. The wood with which this mask and the following one were made is driftwood, which might have been of cedar or fir thrown onto the coast by the currents.

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[11] Still another mode of burial was in use on the parts of the isles where wood is less rare. A kind of coffin was made in which the deceased was enclosed. The coffin was carried to an elevated place and erected there on four stakes driven into the soil to a low height above the ground. This custom is still in use among the Eskimos of northern Alaska. I will not deal with other modes of interment employed by the rich and distinguished men in certain circumstances.—*ALP*.

Plate I.

The two masks in Plate II were used in funeral dances, as confirmed by the orifices of the nose, which served as the eye holes for the dancer, and the open mouth, which permitted him to breathe freely. They had been broken and thrown into the sepulcher, as I have already said. The one that bears the number 1 is 26 cm high by 2 cm [?] wide. Figure 2 attains 41 cm in height and 21 cm in width. The first repeats on the nose the spiral and on the cheek the tricolor tattoo of the mask of the preceding plate, but it introduces us to another tattoo in the form of an engraved square on the brow between the two eyebrows. Figure 2 bears two double lines which part from the lower lip and rejoin abruptly under the cheek. Moreover, the last was decorated by a pair of moustaches and a goatee, traces of which can still be seen. The beard was made of small tufts of hair, inserted in holes arranged in a horizontal line on the upper lip and spread from the right and the left on the chin. This curious mask shows in its open mouth two rows of conical teeth; four teeth are still complete.

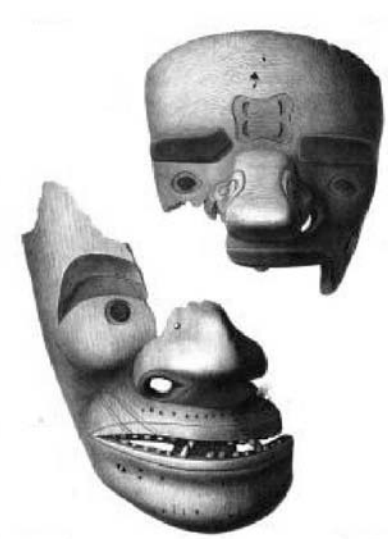

Plate II.

The fourth mask (Pl. III), 36 cm high and 26 cm wide, is also a dance mask that is rather wide open at the nostrils and mouth. A kind of flower with three red petals is engraved on its brow between the eyebrows, and a lightly engraved irregular double stroke covers its cheek from the corners of the mouth to the exterior extremity of the eyebrows. Three small lines accompany the exterior stroke to its origin. All the masks have the nostrils colored green; the last alone has the lips painted red. The eyebrows, tinted black, effect diverse forms. The eye is now a simple hole tinted black, now a scooped out round or oval from which a black circle stands out in relief.

Plate III.

My collection from Aknañh comprises the remains of other human masks that differ a little from those just described. I have also found in the cave a mask that represents a sea lion. The other animal figures are the otter (Figure 1 in Plate IV) and a bird which appears to be a cormorant (Figure 2). The otter is 33 cm, the cormorant 26 cm.[12]

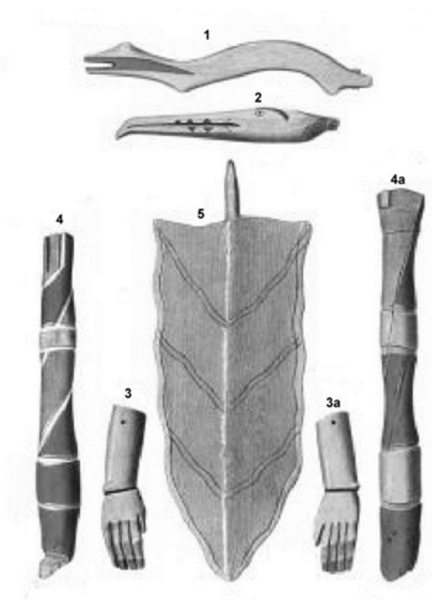

Plate IV.

[12] For a discussion of masks collected by Pinart, see Lot-Falck (1957) and Haakenson and Stefian (2009).

I have nothing to say about other sculptures of Aknañh. The foliate instrument shown in Figure 5 of Plate IV, and most of the objects of Plates V and VI, are indistinguishable. I recognize there only the point of a javelin, Figure 3 of Plate VII, which is quite reminiscent of the instrument similarly used yet today, a lance, Figure 2 of the same plate, and a scraper or aloudak used to cut meat, of which Figure 4 in Plate VII gives a good representation.

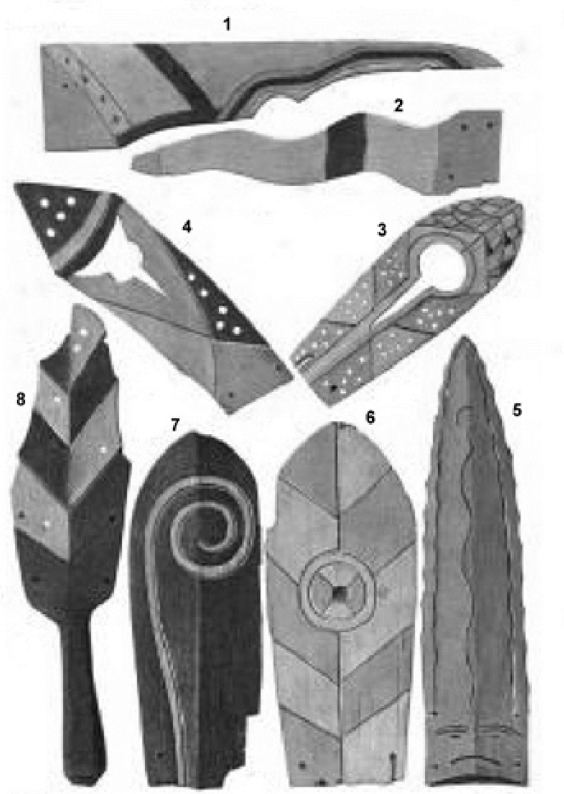

Plate V.

The dimensions of those different objects are the following: Figure 1 of Plate V is 39 cm; Figure 2 is 31 cm; Nos. 3 and 4 are 24 cm and 30 cm, respectively; Figure 5 is 38 cm; Nos. 6 and 7 are 30 cm each; and Figure 8 is 40 cm. Figure 1 of Plate VII is 30 cm; Figure 2 is 103 cm; Figure 3 is 20 cm; Figure 4 is 29 cm; Nos. 5, 6, and 7 are 20 cm, 17 cm, and 15 cm, respectively; and Figure 8 is 28 cm.

Most of these objects probably have a symbolic significance. This supposition is supported by their colors and the notations that have been added there.

It remains for me to say a few words about the objects represented on Plate VI of this paper and their study, which is particularly interesting. Figure 3 is a small board 31 cm long and 26 cm wide. It has a large number of small holes pierced on its two sides in an irregular manner, and into which strands of grass seem to have been inserted. It appears that it was supposed to represent grass-covered ground. Four small sticks, planted regularly and forming together a more or less regular quadrilateral, of which one is missing (its place still perfectly visible), rise on one of the sides of the board. Two of the sticks are broken; the one that is intact reaches 21 cm above the platform. Each of those small sticks has on its internal part two incised indentations at the same height. I believe that this device could have represented in miniature the funeral disposition peculiar to a certain class of the population, which I have spoken about above.[13] The small board filled with tufts of grass represents the ground; the four small sticks are the four small stakes on which the coffin rested, and the indentations of the sticks correspond to the points where the coffin was secured to the stakes.

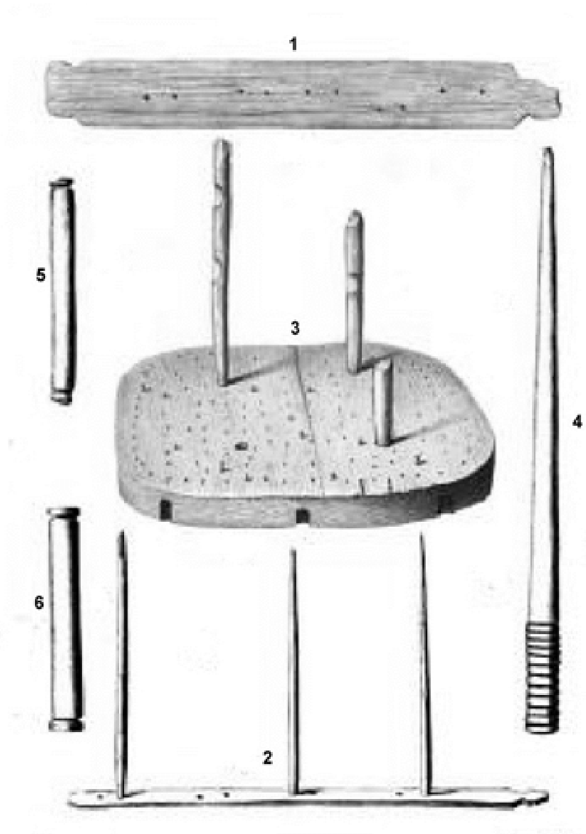

Plate VI.

Nos. 1 and 2 of the same small board must have served as marks—a calendar or hunting marks. One is 37 cm, the other 34 cm. I believe that the object represented in Figure 4, which is 39 cm long, is a short rod for making fire. Nos. 5 and 6 are reels to wind up thread—one measuring 14 cm, the other 16 cm. All the objects seem to have been covered in a blue ashen color.

Part III.

I collected at Aknañh two rather well-preserved skulls that I brought to the Museum of Natural History in Paris. Mr. Hamy, who has studied them very completely, considers them to be from the pure Aleut race. They are quite reminiscent, one of them especially, of the skulls of Aleuts from Unalaska described by Mr. von Baër in the Memoirs of the Academy of Science of Petersburg for 1859.[14] They have all the same cranial curves, all the facial forms.

[13] See the Note 4 (above).—*ALP*.

[14] C. E. von Baër, *Crania selecta et Thesauris anthropologicis Academiia Sanct Petropolitania*, Petropoli, 1859 in no. 6, esp. v, p. 23–27 and Pl. XIV–XVI.—*ALP*.

But one of the skulls is much more developed than the other in the transverse sense, while being exactly like it in its anterior-posterior and vertical dimensions. It is that amplitude of transverse diameters of the vault, which is due on the one hand to the augmentation of the mean cranial capacity and on the other to the elevation of some indices. Mr. Hamy has drawn up a complete table of cranial and facial measurements of the two Aleuts from Aknañh and compared them to those of the five Aleuts from Unalaska in the Museum of the Academy of Sciences in Petersburg, of which I had casts procured for him. The study of that table will permit the assessment of the numerous analogies and few differences those two series present.

A detailed description of those Aleut skulls, drawn up by Mr. Hamy, appears in one of the volumes of my *Voyages*. I direct readers there who want to know in detail the anatomical characters peculiar to that curious race.[15]

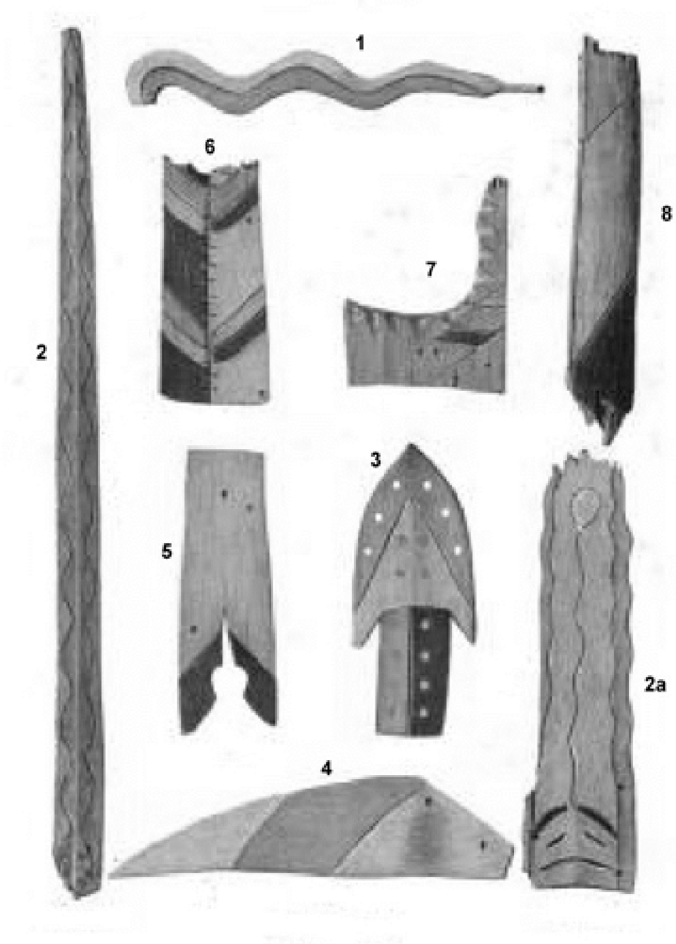

Plate VII.

[15] The *Voyages* to which Pinart refers is *Voyages à la côte Nord-Ouest de l'Amérique exécutés durant les années 1870–72 par Alph.-L. Pinart* (co-published by Ernest Leroux, Paris, and A. L. Bancroft & Co., San Francisco. 1875d). Dr. Hamy's analysis is absent from this work. In its introduction Pinart implies that Dr. Hamy will create a monograph from his studies. Pinart's (1875d) *Voyages* deals primarily with natural history, geology, and paleontology described by other scholars, with a very short section by Pinart analyzing Koniag stone tools that he himself collected on his Alaskan trips.

Cranial Measurements	Aknañh Aleuts	Unalaska Aleuts
approximate cranial capacity	1475 cc	1385 cc
anterior projection: total	101	402
facial	31	26
posterior projection	100	96
diameters: antero-posterior, maximum	175	176
antero-posterior, iniac	170	171
transverse maximum	150	145
transverse bitemporal	143	136
transverse biauricular	133	130
transverse bimastoid	105	105
transverse frontal maximum	118	111
transverse frontal minimum	91	91
transverse occipital maximum	113	115
vertical basil-bregmatic	125	122
curves: horizontal: total	520	514
pre-auricular	240	231
post-auricular	280	283
transverse: total	456	431
super-auricular	306	289
anterior posterior: frontal: cerebral	100	98
Total	424	421
parietal	112	111
occipital: cerebral	70	69
cerebellar	53	53
length of occipital gap	37	35
width of occipital gap	31.5	30
naso-basilar line	95	98
circumference median total	492	487
angles: auricular: frontal: super-cerebral	12	12
cerebral	51	50
parietal	55	57
occipital: cerebral	34	38
cerebellar	27	27
coronal	54	53

Cranial Measurements (cont.)	Aknañh Aleuts	Unalaska Aleuts
index#. [?]: length—100: width	35.69	31.64
height	71.70	69.15
width—100: height	83.73	84.64
frontal-parietal	60.73	65.53

Facial Measurements	Aknañh Aleuts	Unalaska Aleuts
width of the face: external biorbital	105	106
internal biorbital	96	98
inter-orbital	23	22
super-orbital gap	53	51
the two cheekbones	115	116
inferior bimalar	98	97.5
bizygomatic maxima	142	136
bimaxalary minimum	63	65
orbits: width	39	41
height	36	37
nasal region: width of nasal bone: superior	10	11.5
minima	9	9
inferior	14	17
maximum width of opening	24	25.5
length of nasal bone: median	—	26.5
lateral	27	27
height of face: total of the nose	54	53.5
super-cerebral of brow	24	23
inter-maxillary	20	20
total of face	97	95
cheeks	26	23
orbit-alveolar	47	43
auricular region: length of mastoid process	34	31
auricular-jugular distance	76	73
auricular-orbital distance	74	72
palatine region: length: total	56	56.5
maxillary	38	42
width: posterior	40	41
to 1st molars	39	36

Facial Measurements (cont.)	Aknañh Aleuts	Unalaska Aleuts
to canines	26	25
depth	11	14
distance to occipital gap	41	44
angles: facial: of Camper*	71	74
alveolar	60	65
dental	—	—
auricular of the face	41	41
facial indices: fronto-orbital	86.90	88.74
fronto-jugular	64.08	69.24
orbital	92.51	89.96
nasal	45.01	47.30
facial	68.30	69.62

* Possibly from Petrus Camper (1722–1789), Dutch anatomist, who tried to determine the degree of intelligence by facial angle.

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