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Transitions in Tool Technology Relating to Social Changes Among Prehistoric Pacific Northwest Coastal Groups

by

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Thesis Abstract -- Idaho State University (2021)

Transition in stone tool morphology preceding and during the Marpole Phase (ca. 2500-1500 BP) along the central coast of the Pacific Northwest (PNW) correlated with cultural factors such as social inequality. Data was gathered via online databases, published articles, and a museum collection. Approximately 1,691 tools were analyzed. Lithic sources and quarry locations were mapped out using Google Earth to determine any patterns or similarities among the various sites. Results were ultimately limited due to gaps in data, as well as restrictions in accessing certain museum collections due in part to the COVID-19 pandemic. Substantial changes occurred preceding the Marpole phase as seen in tool types, materials, and size. There was no immediate and sudden replacement of chipped stone tools with ground stone or osseous tools. Factors behind this change include climate change and maintaining a broad-spectrum diet alongside a more specialized toolkit.

Keywords: Pacific Northwest; Marpole Phase; Olcott Phase; prehistoric Native Americans; Indigenous cultures; First Nations; Coast Salish; lithic technology; chiefdoms; Entanglement; Ian Hodder; climate change; bioarchaeology

Chapter 1: Introduction

Archaeological research in the Pacific Northwest Coast (PNC) has often focused on prehistoric subsistence strategies and sedentism patterns. This results from long-standing beliefs that these cultures were different from any other known culture because they were sedentary groups with large populations that did not rely on any form of agriculture. They were seen as anomalous from the much smaller, egalitarian, and mobile groups widely examined in other ethnographic studies (Sassaman 2004:228). Upon increased European contact in the Pacific Northwest, it was believed that it was the Euro-Americans bringing their new, sophisticated technology and ways of life that caused this increased social stratification and complexity among the indigenous peoples (Arnold 1996:87). However, over the past thirty years, anthropologists have pointed out that complex hunter-gatherer groups are found among the Jomon in Japan, the Natufian during the Levant Period, some groups in the Midwestern United States during the Archaic period, as well as prehistoric coastal Peruvian and coastal Thailand cultures (Arnold 1996:83). Also, the idea that hunter-gatherers were always simple groups, both politically and socially, acting as a building block towards more complex societies like modern civilization, has been discredited (Ames 1999:45).

Social groups in the Pacific Northwest (PNW) are commonly classified as ranked chiefdoms. These are societies where there are fewer positions of power than can be filled by individuals within a given group. Not everyone has the same access to positions of power, but everyone does have equal access to the same resources. Ruling chiefs do not have coercive power over their group but instead have social power (Ames 2007:490). Prehistoric Northwest groups have also been identified as complex hunter-gatherer societies, since they demonstrate

defining factors such as population density, storage practices, sedentism, and intensive subsistence strategies (Arnold 1996:88; Sassaman 2004:230).

Archaeologists have long associated the intensification of salmon fishing and processing as a primary driving force behind the rise of social complexity of prehistoric groups (e.g. chiefdoms, semi-sedentism, different tool technologies, and warfare). However, this prolonged interest in salmon has produced a fairly biased image of the PNW. Within the last few decades researchers have called this salmon-focused phenomenon a "salmonopea", where researchers focus only on salmon populations and essentially ignore the importance and relevance of other species of fish (Campbell & Butler 2010:15). This way of thinking oversimplifies and does not adequately describe the more complex systems – sociological and ecological – in place. Even the idea of intensification systems in harvesting salmon has been called into question. Thornton et al. have criticized the argument concerning subsistence patterns in the PNW and the belief that since the PNW is naturally abundant in resources, the people living there had little to no effect on their environment (2015:191). Previous researchers essentially dismissed the possibility that any cultivation practices were occurring.

In reality, the environment was not always as abundant as presumed and any environmental changes like droughts or earthquakes could have significant ramifications for human populations (Thornton et al. 2015:191). Some amount of ecological manipulation was occurring throughout the PNW. Grier argues that there needs to be a broader perspective when studying the interactions between ecological and social spheres, and doing so will generate a more informative, holistic view of the relationship between people and their surrounding environment (2014:240).

This thesis examines a specific period called the Marpole Phase that occurred throughout much of the central NWC. The Marpole Phase (ca. 2500-1000 BP) was a time of significant cultural changes including: more prominent, emerging social stratifications; intense marine and riverine resource gathering; development from pit houses to large plank houses; different burial patterns; and widespread warfare (Prentiss and Kuijt 2012:73). The environment was also changing towards a warmer, drier period that in turn affected the floral and faunal resources, namely increased fish populations (Lepofsky et al. 2005:272). Furthermore, prior to the Marpole Phase lithic technology had primarily consisted of flaked or chipped stone tools, which are relatively easier and faster to make than ground stone tools. During the Marpole Phase, however, there was a significant transition in lithic technology where ground stone and bone tools significantly replaced the production of flaked stone tools (Ames and Maschner 1999:144).

One important feature about this transition is that ground stone tools are much more difficult to make than flaked ones, but they last longer, do not dull as quickly as flaked tools, and are easily curated or resharpened. This level of efficiency would have been crucial when mass-processing fish and other marine resources at the levels occurring throughout the Marpole Phase (Prentiss and Kuijt 2012:55). As for bone tools, very little research has been conducted on this tool type, but it stands to reason that there would have been plenty of bones available from the harvested mammal bones. Shaping animal bones into tools would have saved time and energy for these groups by not needing to travel to a quarry, as well as avoided any risk by leaving their settlement undefended for neighboring groups who could claim it for themselves.

My main research questions were: Why was there this shift in tool technology? How does this correlate with the social and ecological transitions occurring before and during the Marpole Phase? My research objectives are: determine any cultural transitions evident in the lithic

technology of the PNW; determine why there is a shift from flaked stone to bone and ground stone tools; and produce more data surrounding how and why these prehistoric hunter gatherers shifted from migratory egalitarians to more sedentary chiefdoms.

To achieve this, I looked at available archaeological and ethnographical data concerning Coast Salish groups. I looked at both stone and bone tools from time periods preceding, during, and following the Marpole Phase. This helped determine if certain morphological types become more or less common through time, as well as to see if certain tool types are more commonly made with stone or bone materials. I also compared the lithic data with bioarchaeological studies that have been conducted on burials in the PNW. This helped demonstrate whether there is a connection or not between cultural phenomena (e.g. burial practices, morphological features of the bones, evidence of social stratification) and the rise in certain tool types and materials. These prehistoric groups would have needed different tools for woodworking, canoe building, salmon processing, weapons construction, etc., all to better accommodate and sustain the cultural practices occurring during the Marpole Phase, and bioarchaeology offers a unique perspective on the life and culture of past groups.

As will be discussed in later chapters, various ecological and cultural factors played a significant role in lithic technologies, such as resource procurement to make tools, tool usage, and tool technology developments (e.g. shifting from stone to bone materials). Granted, there are a plethora of questions and potential answers regarding the interactions and correlations among these factors, and this thesis does not propose to fully answer all of them. However, it is important to establish some sort of foundation as to why there was a shift from mobile foraging groups to sedentism in semi-permanent villages that largely subsisted upon marine resources with a changing toolkit.

There is not one clear, explicit reason explaining how and/or why mobile foraging groups subsisting upon a broad, varied diet decided to become sedentary and establish chiefdoms. For the PNC during the Marpole Phase specifically, there was a "perfect storm" of events and factors that had to have occurred for this change to happen: climate change affected the flora and fauna of the region, thereby allowing more dense populations; toolkits developed to the point where they could still be used to hunt or fish on a broad spectrum yet specialized enough for the PNW environment; and more dense human populations allowed them to better cultivate their immediate ecological niches. People had the tools that could be further altered in order to take advantage of local food resources more efficiently. There was no longer a need for these groups to continue traveling long distances to hunt and gather less food in the long run. Instead, they could focus on resource procurement on a local level. This ultimately resulted in families claiming proprietorship over rivers, streams, stone quarries, etc., separating the once-egalitarian bands into different groups. Here, the head of family became the leader who organized how best to protect and utilize these resources.

As for the shifts from stone to bone tools, it would have been logical to utilize as much of an animal as possible – especially where mammals like deer, elk, seals, and even whales were abundant – as well as the idea that certain families controlled stone quarries. There may also be many other factors that contributed to the rise of chiefdoms and social stratification by the Marpole Phase, yet the confluence of cultural and ecological factors was likely the most significant and impactful.

I looked at four sites for my research: the Great Marpole Midden (DhRs-1), the Olcott site (4455N14), the Scowlitz site (DhRl-16), and the Pender Canal sites (DeRt-1 and DeRt-2). The Olcott site, dating to the Cascade Phase ca. 10,000- 4,000 BP, is a type site for lanceolate

projectile points and will act as a comparison for the changes and developments in stone tools that occurred in that region (Butler 1961:48; Noll 2019). The three Marpole Phase sites – the Marpole Midden, Pender Canal, and Scowlitz – investigated here are relatively close to each other and should exhibit enough variation in toolkit technologies.

In the course of researching and writing this thesis, the COVID-19 pandemic began, affecting a great many lives and businesses, including museums. I originally intended to gather data from museums in the greater Vancouver, British Columbia area concerning all three of the Marpole Phase sites. With limited access and travel restrictions, however, I was only able to obtain substantial data for the Marpole Midden, although some general information concerning the toolkits utilized at Scowlitz and Pender Canal is also examined here. The Olcott Site – located near Puget Sound, Washington – was included as part of this research not only because I had ready access to it via the Idaho Museum of Natural History, but it offers a unique perspective on the shift from mobile, egalitarian hunter-gatherers using chipped stone tool technology to the sedentary, ranked, groups with their ground stone and bone tools.

The Great Marpole Midden site, or *c̓əsnaʔəm,* should have had the strongest correlation between shifting tool technologies and increased stratification since coastal groups were more complex when compared to neighboring, in-land groups such as those living at the Scowlitz villages (Prentiss and Kuijt 2012:56). The Pender Canal site should also have had fairly similar traits as the Marpole Midden since it was used as a summer residence for the mainland Coast Salish, and bioarchaeological data shows that stratification was present on the island. The Scowlitz site – *Sq'éwlets* – should have shown the greatest variation and differences from the other two sites examined in this thesis because of its location further inland. There would have been different floral and faunal resources gathered there, as will be discussed later. Prentiss and

Kuijt say that the inland Salish were related and influenced by the Coast Salish but had slightly different cultural attributes (2012:71). This was a large and significant site during its time and should exhibit some correlation between any tools discovered there and the social complexity of the group.

With that said, I anticipated that there would be too much regional and cultural differences between the Marpole Midden and the Olcott Site due to the vast differences in age, climate, culture, etc. to demonstrate a clear and succinct correlation between the rise of chiefdoms and the shift in tool technologies. There should also be differences between the three Marpole Phase sites, despite being relatively similar in age and culture. Clark (2010) argues that there were too many differences between the central PNC Indigenous groups that the term "Marpole Phase" should not be used to describe the cultural phenomena occurring around the Salish Sea, or even throughout the PNW . Each culture, while closely related linguistically and archaeologically, had too many differences that emerged at differing points in time to fit in with the model 20th Century researchers created to describe the plethora of cultural changes occurring from 3000 BP-1000 BP (2010:3). While there may be some correlations between increased sedentism, intensified fishing practices, changing toolkits, and ranked individuals at the Pender Canal, Marpole Midden, and Scowlitz sites, they may not have been significant enough to clearly establish a connection linking lithic technology and chiefdoms. Through my research here, I aimed to help disambiguate these minor details surrounding this transitory phase by utilizing as holistic an approach as possible.

The three Marpole Phase sites are part of the Stó-lō/Central Coast Salish cultures. These sites have several different radiocarbon dates surrounding the Marpole Phase, as well as significant archaeological and lithic data. They are all relatively within close proximity to each

other, spanning across roughly 110 km, and are located in the southern British Columbia (B.C.) coastal region. The Pender Canal site is located on Pender Island in the Gulf of Georgia, B.C., with archaeological dates ranging from as early as 4500 BP to ca. 340 BP (Carlson and Hobler 1993:45). The Marpole Midden, only fifty kilometers from Pender Island, is a National Historic Site in the greater Vancouver area near the coast. This is one of the largest prehistoric middens in the region and dates from ca. 4000 BP to 200 BP. The Scowlitz site is the most inland of the three sites, located approx. 88 kilometers from the Marpole Midden and over 100 km from Pender Canal. The remains of a permanent village, a cemetery, and various short-term occupational sites make up the Scowlitz site, next to the Harrison River, where occupation began ca. 3000 BP until the 20th Century (Lepofsky et al. 2000:391).

I originally selected these three sites because of the abundant archaeological data gathered, the extensive research conducted, as well as their close yet varied proximity to each other. While there are certainly similarities in the tool technologies and bioarchaeological materials present at these sites, the differences present due to ecological or even temporal factors had an effect on the results of my research.

Chapters 2-4 provide contextual information surrounding the Coast Salish culture (Chapter 2), the environment (Chapter 3), and a broad overview of the various tool technologies (Chapter 4). Chapter 5 covers additional context and theoretical information that do not fit in with the themes of the preceding chapters yet are pertinent to this thesis, namely a discussion on Hodder's theory of "Entanglement", background information on the Olcott site, and bioarchaeological information regarding cultural changes in the PNW. Chapter 6 explains my methods of data collection and the results of my analyses. In Chapter 7, I discuss the results of

this research, and I conclude with a discussion of the significance of my findings and areas for future research.

Figure 1. Map of Research Area

Chapter 2: Culture

1. Social Theories on Complex Hunter-Gatherers

It will be pertinent to briefly define egalitarianism, rank and stratified societies, and then move on to describe complex hunter-gatherers. Egalitarian systems are where no one person holds more power or maintains permanent authority over those within a given group. Other aspects such as relatively small populations, nomadism, availability of resources, and band or tribe membership based upon kinship, are typical of egalitarian groups (Ames 2007:490). When Archaic groups first moved into the Pacific Northwest region no later than ca. 12,500 BP, they would have been these roaming, egalitarian groups, relying on various resources throughout the area.

Rank and stratified social systems are commonly applied in describing Northwest Coastal groups. Rank societies are where these are fewer positions of power than can be filled by the individuals within the group. In other words, not everyone has the same access to positions of prestige, but everyone has equal access to the same resources. Chiefdoms are where ranked societies begin to appear. It is important to note that a chief does not have coercive power over the group but does have some amount of social power (Ames 2007:490). An individual can attain these levels of social prestige by controlling certain resources and then redistributing them to the rest of the group. This prestige is typically ascribed, or passed down from generation to generation, allowing certain kin groups to rise in status above others. Stratified systems are similar to ranked ones in that there is limited access to positions of power and these positions are

ascribed, but not everyone has equal access to basic resources. The leaders do hold coercive power over the group, unlike the ranked chiefs (Ames 2007:490).

As for complex hunter-gatherers (CHG), Arnold gives a fairly succinct definition: "Complex… distinguishes societies possessing *social and labor relationships in which leaders have sustained or on-demand control over non-kin labor and social differentiation is hereditary*" (1996:78; italics in the original text). Individuals or kin groups within a given CHG will hold more power and authority over others in the group and over resources. Sassaman adds to this, explaining that complexity is relative and not necessarily a judgement statement (2004:231). The more parts within a society and the interrelationships existing between those parts, a more complex a society is. Hierarchies are present in CHGs, but as Ames puts it, "The adaptive usefulness of a hierarchy does not willy nilly bring that hierarchy into being" (1981:800). Some pre-existing conditions have to be present to call for the need of a chiefdom or hierarchy. Also, the social identity of hunter-gatherers is quite often conflated with the idea that they are egalitarian or are incapable of becoming as complex as agricultural groups. However, this can lead to confusion and misunderstanding not only among academics, but between researchers and the groups they are attempting to better understand. Hunting and gathering is a mode of subsistence that is not inherently linked to any given form of social organization (Arnold 1996: 79; Sassaman 2004: 230).

Complex hunter-gatherer societies can be identified through various criteria. Sassaman (2004:233) and Arnold (1996:79) give a sort of check-list to determine whether a group is complex or not. These factors include: population density; storage; sedentism; elaborate art and technology; long-distance trade; and intensive subsistence practices. While these are certainly present in CHGs worldwide and throughout the Northwest Coast, Sassaman cautions against

relying too much on ethnographic writings when studying CHGs (2004:233). Categorical thinking can limit interpretations for any CHG and overlooks any uniqueness or variability among and between groups. Different methods or concepts are often used to define a CHG beyond the *rank* and *stratified* terms. Frangipane proposes the terms 'horizontal' or 'vertical egalitarian systems' should be employed, instead of labeling any hunter-gatherer group automatically as 'ranked/stratified' or 'egalitarian' based on even minimal evidence for such social classing (2004:153). This allows more room for variation and interpretation both within and between CHGs in terms of (un)equal access to resources and responsibility for certain tasks.

Ames and Maschner claim that social complexity had been present in the Pacific Northwest long before the Marpole Phase. They argue that the cultural change during this time were structural developments of already existing cultural phenomena, such as social ranking evident in burials dating to 4500 BP (1999:254). Arnold also claims that burials can result in very promising data concerning social complexity, particularly among cultures with ethnographic and historic records (1996:94). However, more caution should be exercised when studying prehistoric and archaic groups where there is a fair amount of ambiguity concerning practices like burials and their associated mortuary goods.

The climate of the PNC underwent changes and shifts in temperatures leading up to the Marpole Phase. This will be discussed further in-depth in the next chapter focusing on the environment of the Marpole Phase, but a brief discussion of the factors that contributed to the development of ranked systems in the PNW is relevant here. Leprofsky et al. (2005) focus on the Strait of Georgia in Southern British Columbia in discussing the climate of the Marpole Phase, so this data is fairly limited in applying it to the entire Pacific Northwest Coast. It should be fairly comparable to the rest of the region, nonetheless. Lepofsky et al. discuss the Fraser Valley

Fire Period (FVFP) and how it is related to climate change. They found that typically fires would occur consistently during climate fluctuations. The FVFP occurred 2400-1200 BP – exactly during the Marpole Phase – and indicates that there were persistent long, dry summers and droughts lasting several years (Lepofsky et al. 2005:277). Terrestrial resources like deer, elk, and berries would have flourished during this time. The warmer, longer summers would help them better survive the winter, and the fires would get rid of any old growth and help encourage new growth, allowing for my diversity (Leprofsky et al. 2005:278).

The warmer climate, causing warmer sea and atmosphere temperatures, had an effect on fish populations. A decrease in certain salmon species, like Sockeye (*Oncorhynchus nerka*) and Coho (*Oncorhynchus kisutch*), as well as herring (family *Clupeidae*), is correlated with warmer sea surface temperatures. The prolonged droughts and long summer also had an effect on the spawning season for fish, where they could predictably be harvested upriver. Fish populations in small freshwater streams were more strongly affected (Lepofsky et al. 2005:280). However, throughout NWC prehistory, salmon populations were very abundant, so any declines caused by the climate would not have significantly affected subsistence patterns (Leprofsky et al. 2005:281). Where fish were spawning in fairly predictable areas due to the FVFP, the Fraser Valley was likely "the most consistently abundant, diverse, and predictable place to harvest resources in the Gulf of Georgia" (Leprofsky et al. 2005:281). Increasing the temperature of water by even one degree can have far-reaching impacts, affecting the life cycles of fish but also the subsistence patterns as well, which will be examined next. Climate is only the beginning strand in the emergence of social complexity for Northwest Coastal groups.

Hunter-gatherers of the NWC are best labeled as "collectors" in that they have some form of food storage and have "logistically organized food-procurement parties" (Binford 1980:10).

These logistical parties would venture out from a camp with certain tools looking out for specific resources. There has been ample evidence of storage use in the Pacific Northwest, and these groups, while sedentary, still maintained a level of mobility (Ames 2005:47). This semi-sedentary life would require logistical parties to venture out and collect resources, such as fish, pinnipeds, or berries. As was demonstrated earlier with the effects of climate on resources, these logistical groups could predict that certain rivers or streams would have more abundant salmon runs during certain parts of the year. This led to the emergence of resource intensification prevalent throughout the Marpole Phase (Butler and Campbell 2004:328). Salmon are referenced frequently in the archaeological literature of the Pacific Northwest as being central to this intensification, but other riverine, littoral, and terrestrial resources were highly valued as well (Butler and Campbell 2004:389).

Other subsistence strategies would include a "prey choice model" and the "patch choice model". The former is hunting a given prey, such as deer, when a logistical party comes across it, and the latter is knowing when and where certain resources like sea lions will be available for hunting (Lyman 2003:377). This touches on human behavioral ecology, the concept of choosing which resources will provide the most nutritional value at the least amount of caloric cost, and it will be further explained in a later chapter. Hodder describes how certain groups will sometimes treat various resources differently, depending on their cultural norms (2012:82). For the NWC, a possible example of this behavior would be the First Salmon ceremony. This is a ritual found among coastal groups today where the bones of the first salmon of the season caught by a family were returned back to the water as a sign of respect (Wray 2015:128). The First Salmon ceremony shows that there is a level of spirituality and cultural belief behind the subsistence patterns. They are not solely for economic purposes.

In relation to subsistence, tool types also underwent change during the Marpole Phase. Again, this will be explained more fully in Chapter 4, but examining the basic developments of technology in the PNW leading up to the Marpole Phase is pertinent to this discussion. Ames and Maschner say that in response to resource intensification, "There is often no alternative but to gear… technologies and economies to make use of the few foods or useful environments available" (1999:128). Archaic PNW groups would have had relatively generic toolkits to accommodate for a broad subsistence diet. Kelly examines how certain bifacial tools were part of a hunter-gatherer's toolkit depending on their reliability and maintainability (1988:717; see also: Bamforth and Bleed 1997; Bleed 1986). For these archaic groups, they utilized generalized yet dependable tools where the stone tools would need to be continuously maintained to ensure productivity, such as re-hafting a projectile point onto a spear or re-sharpening that projectile point.

During the Marpole Phase, however, when subsistence patterns changed and specific resources were gathered (e.g. Coho salmon or herring), those toolkits would become more specialized for processing and harvesting those resources (Ames and Maschner 1999:138). Morin describes how the technological and functional attributes determine what tool type is used for which job, as well as the importance of the materials used for said tool. He references ulu knives from the Northwest Coast and how they are used in processing salmon quickly and effectively (Morin 2004:283). Regarding tool type changes during the Marpole Phase, Ames and Maschner (1999) said that tool materials changed from all chipped stone to mostly ground stone, and then almost entirely bone tools. Their conclusion for this change: "The reasons for this shift are obscure, although it is probably quite important" (Ames and Maschner 1999:144). Examining

more in-depth the reasons behind this obscurity would go beyond this paper but suffice to say that it is certainly a promising area of future study.

Finally, the emergence of ranking during the Marpole Phase was both a cause and instigator for these ecological and technological factors. Maschner and Bentley (2003) discuss the concept of power-law distribution and the ability of headmen in a household to achieve and maintain their high rank. It is a proportional equation related to an individual's power and their access to more wealth. Simply put, power-law distribution is the process of how the rich get richer (Maschner and Bentley 2003:49). They use household sizes along the Northwest Coast to demonstrate this concept: "Households that were able to gather the necessary resources (including people) to grow large first, continued to do so at the expense of smaller households that did not compete well in the initial stages of the transition to ranked households" (Maschner and Bentley 2003:57). The leaders of these households –headmen– compete with others to garner for resources, which can be food, wealth, or people. This is done via competitive feasts and marriage with other prestigious families.

Preceding Euro-American contact, competitive feasts, or the potlatch, were ceremonies practiced throughout the Pacific Northwest where a host will invite members of another community to exchange gifts and partake in large feasts as a means to validate an individual's status and privileges (Suttles 1960:299). It was a socioeconomic system that encouraged marital ties between groups to expand their wealth since kingroups allow family members, whether kin-related or through marriage, to access those resources, such as an oversupply of herring (Suttles 1960:302). Thus, the rich marry the rich, they gain more access to more resources, and this continues on in an ever-growing cycle. Some younger men compete and achieve a higher status to replace the elderly leaders, but it is mainly the ascribed leadership kin groups that

maintain their power (Maschner and Bentley 2003:51). Potlatches are still practiced today, albeit with different intentions than were present in prehistoric groups. Polygyny was also employed among coastal groups to further play into this concept of power-law. Having several wives whose respective families would have access to various resources, as well as having more people help with labor, was certainly advantageous (Walter 2006:43) Walter examined polygyny among historic Northwest Coasts, so caution is required in applying this to Marpole Phase groups thousands of years prior. However, it is not completely outside of reason to believe that polygyny could have been practiced in prehistoric times.

Power-law distribution supports what Sassaman and Arnold have said about the emergence of complex hunter-gatherers. Arnold states that, "The initiation of permanent leadership roles with reinforceable rights to extract labor from non-kin… marks the important shift from Big-Man to simple chiefdom kinds of organization" (1996:93). Enterprising individuals or kinships will rise up, taking advantage of any resources they may control, such as a salmon-heavy stream, and achieve a certain amount of prestige (Sassaman 2004:250). These people, along with who Sassaman labels as "aggrandizers", drive the surplus production of resources. Two types of communities will accommodate for complexity, which are independent household communities and resource-owning groups who focus on exploiting certain, highly productive resources (Sassaman 2004:250).

Sassaman (2004) goes on to discuss the development of social complexity in the NWC during the Marpole Phase, or what he terms the Developed Northwest Coast Pattern. He mentions that economic change preceded social change and that, "Complexity arose where the environment allowed it and the synergistic effects of storage, territoriality, and population growth

demanded it" (Sassaman 2004:241). In context, this means that various factors, social and environmental, had to work together in order for complexity to emerge.

2. Cultural Phases of the Pacific Northwest Coast

The date for the earliest peoples who inhabited the Pacific Northwest continues to be pushed back further and further, with some saying that there is evidence of human activity in Alaska as early as 15,000 BP. A conservative estimate of people living in the region is ca. 12,000 BP., and these earliest peoples would have moved down from the north to the south along the coast compared to having migrated down through the interior of British Columbia (Carlson 1998:31). These early groups were primarily nomadic, egalitarian hunter-gatherers up until the Locarno Beach Phase (Moss & Erlandson 1995:24).

The Locarno Beach Phase (ca. 3500-2400 BP) is when increased social stratification, salmon fishing, and sedentism emerged. More specifically, there is archaeological evidence of resource storage, increased fishing economies, labret use, and developed tool technologies for gathering and processing more specific resources. However, there appears to have been neither signs of hereditary status nor large multifamily villages, key components of the Marpole Phase (Angelbeck and Grier 2012:563; Sassaman: 2004:240).

A quick note on labret use at this time, according to Angelbeck and Grier labrets were used to achieve status (2012:557). This means that while ranked positions were limited, achieving a higher social status was technically open to all members of the group. Later, in the Marpole Phase, labrets –along with cranial deformation– were strictly limited to the elites. Cranial deformation, as practiced by the Coast Salish, here means that babies or very young

children had their skulls bound to either flatten the front, back, or a combination of the two. Done for cultural appearances, this practice did not affect the individual's mental capacities, although some damage could occur to the ear canals (Ames and Maschner 1999: 183; Beattie 1981:45-46). At the Pender Canal site, there were about 40 individuals with cranial deformation, and at the Marpole Midden there were also multiple cases of the practice (Beattie 1981:10; Skinner et al. 1988:280). According to Ames and Maschner, both labrets and cranial deformation are directly indicative of status and social stratification. However, by Historic times both of these practices had become so common that all individuals had them, except for low-ranking people or slaves (1999:182). La Salle points out that ca. 2500 BP, there was a divide between the North and South Coasts regions of the PNC: the North maintained labret wear as status markers, whereas the South replaced them with cranial deformation (2013:144). While labret wear can sometimes be determined through analysis of enamel wearing on the front teeth, cranial deformation is a more permanent, visible form of evidence for social stratification. Regarding the cultural importance of these physical changes, La Salle explains:

> "Such permanent body alteration may have been consciously manipulated as a tactic for naturalizing the social position of the labret bearer and his/her family– a position that, on the Northwest Coast, is intrinsically related to access to resources, both material and incorporeal, the inheritance of which may have been eased as a result of such alteration. During times of social instability, permanent body modification may be used as a tactic to demarcate and to naturalize social distinction and, thus, to secure access to scarce or tightly controlled resources, whatever those may be" (2013:144).

Establishing any form of identity markers or similarities among familial or cultural groups would help maintain control of resources like rivers, berry patches, etc. This developing "us vs. them" mentality may have led to the increased interpersonal violence preceding the Marpole Phase, been a result of this warfare, or possibly some combination of both.

Returning back to the Locarno Beach Phase, it was more of a maritime-based culture, based on the increase of sea mammal hunting tools like composite toggling harpoon valves, as well as fishing tools geared more specifically towards salmon fishing. Salmon storage, while present during this phase, has not been found at all Locarno Beach sites. According to Clark, "A high proportion of salmon cranial elements at Kosapsom I argues for fresh, rather than stored, salmon as the head was traditionally removed for drying of the fish. If salmon storage was present, it was not yet the focal point of Locarno Beach economies" (Clark 2010:76).

Furthermore, while there is no definitive evidence for ascribed status during the Locarno Beach Phase, social stratification was beginning to emerge as seen by grave goods included in sub-adult burials (Clark 2010:259). There is some evidence for warfare at this time, although skeletal trauma indicative of violence is only present in 6% of remains. Angelbeck and Grier point out that there was a small sample size examined in the Coast Salish region, so more bioarchaeological efforts are needed to better determine the presence of violence during the Locarno Beach Phase (2012:558). It stands to reason, however, that as families became more powerful and controlled more resources, inter-group tensions would increase and occasionally lead to conflict.

During the Locarno Beach Phase, elites would have had to affirm their status and power via their personal achievements and through dominance over others. They did this through maintaining and asserting their power through social alliances, as well as rituals like the potlatch where they had direct control over resource allocation and redistribution (Angelbeck 2009:136). These chiefs also could have attained their power and influence via wealth and oratorical skills. Chiefs also could have held some amount of control over neighboring villages, as long as they belonged to the same clan allowing the original, "hereditary" chief this level of power

(Angelbeck 2009:156). Furthermore, feasting and potlatching established a local, autonomous group's proprietorship over a given site, resources, names, ceremonial rites such as songs and dances. This sense of "ownership" over the land was more of a belief that they belonged there since their ancestors originated in the same location as a means of "showcasing and reaffirming prerogatives to relations and neighboring nations" (McLaren et al. 2015:179). According to Prentiss and Kuijt, some Coast and Interior Salish groups had hereditary chiefdoms controlling several villages at a time (2012:44-45). The elite exhibited great organizational power, which further helped them acquire more wealth and power over the larger group. This was not inherited, ascribed status, however, since the power these leaders would have achieved was not passed down to their progenitors (Angelbeck 2009:155-156). These were the foundational steps that ultimately transitioned into the Marpole Phase where chiefdoms and ascribed statuses were fully established along the central Pacific Coast.

Prentiss and Kuijt present an argument as to why hereditary chiefdoms occur in what originally started as an egalitarian group:

> "If we imagine household chiefs before 1200 BP, we think of individuals who were responsible for making good decisions to ensure healthy economies and peaceful communities… However, once resources began to decline (either natural fluctuations, as in the case of salmon, or through overhunting, as in the case of deer and other small mammal and plant species), it is possible that some individuals began to develop strategies to ensure the survival of households… To protect their family members, heads of households perhaps then decided to formalize a system of inheritance, whereby only members of the original family had the right to wealth, places, rank, and even certain household symbols…" (2012:174).

While it is extremely difficult to claim with absolute certainty the causes for inequality in prehistoric groups, the fact remains that the environment and any associated ecological variations

would have had a significant impact. But for as significant as the environment is on human behavior, one should not underestimate the "human factor" for these changes. Heads of households would certainly wish to retain their power, as well as keeping it within the family, and would try to ensure that their relatives were taken care of after death. This also works in conjunction with how certain families have rights to certain songs and/or dances, and how they associate their ancestors with a given area (Ames and Maschner 1999:147; McLaren et al. 2015:177). It stands to reason that multiple factors – ecological and human – would need to be at play in order for people to gradually attain more power over their peers.

Immediately following the Locarno Beach Phase is the Marpole Phase (ca. 2500-1500 BP), which occurred primarily along the central coast of the PNW in what is today known as Washington and British Columbia. The Marpole Phase saw the emergence of social complexity in behaviors such as "institutionalized social restrictions on access to resources" (Grier 2014:240). There was also, "[L]arge-scale production and storage resources… permanent winter villages with large multifamily houses, and… evidence of pronounced social inequality" (Coupland 1998:44). These households held exclusive rights over certain resources and/or territories, granting access usually only to family members. They maintained and cultivated the food, plant, and other species within that given area, and when the occasion called for it, such as the potlatch, they would distribute these resources (Ingram 1995:78).

Developing from the elites of the Locarno Beach Phase, high-ranking individuals were now passing along their wealth and status to their children and other family members. Status and power had been institutionalized or well-established at this point in time. Children born to high-ranked individuals would already have had "[S]ome power over others, that is, over non-elites. Marpole elites organized their power in such a manner as to control the settings for

participation in that eliteness–in other words, they applied structural power" (Angelbeck 2009:157). Here, the transition had been made where children of parents who achieved and accumulated wealth and status no longer had to earn their own status; these children were able to reap the benefits of their socially powerful family. A primary way that these levels of social stratification were present during the Marpole Phase is cranial deformation, labret wear, and elaborate grave goods included with men, women, and subadults (Angelbeck 2009:290).

Coupland et al. argue that inequality and wealth existed throughout the PNC quite some time before the Marpole Phase, during the Late Charles Culture Phase (4000-3500 BP) via thousands of stone and shell beads found interred in burials (2016:310). However, the sites examined by these researchers were very localized, and the use of beads as status markers –as argued by Coupland et al.– only lasted for approximately 500 years (2016:312). There were certainly regional and temporal variations present in the PNW, so the brief rise and fall of beads along the coast comes as no surprise. Dozens of cultures have lived in the PNW for thousands of years, each with their own unique histories and adaptations to their respective ecologies. However, the key point is that social stratification was not well-established during the Late Charles Culture Phase, whereas during the Marpole Phase it was clearly evident. Small bursts of inequality would have naturally occurred and ultimately led to the establishment of chiefdoms by 2500 BP.

Focusing on projected demographics of the Marpole Phase, population levels would have risen at this time, though exact numbers are difficult to ascertain. Overall, though, there was an increase in population density around this time period, followed by a decrease ca. 1000 BP (Trosper 2003:2). At the time of European contact, population estimates claim that throughout the Northwest Coast ranged from 102,100 to 210,00, who would have consumed roughly 50,706

tons of salmon alone (Campbell & Butler 2010:17). However, with the arrival of Europeans came smallpox, which devastated these population numbers. Among the Haida in Alaska, for example, thirty years after the first smallpox outbreak, only 20% of the total population remained, and other groups throughout the PNW did not fare much better (Ingram 1995:79).

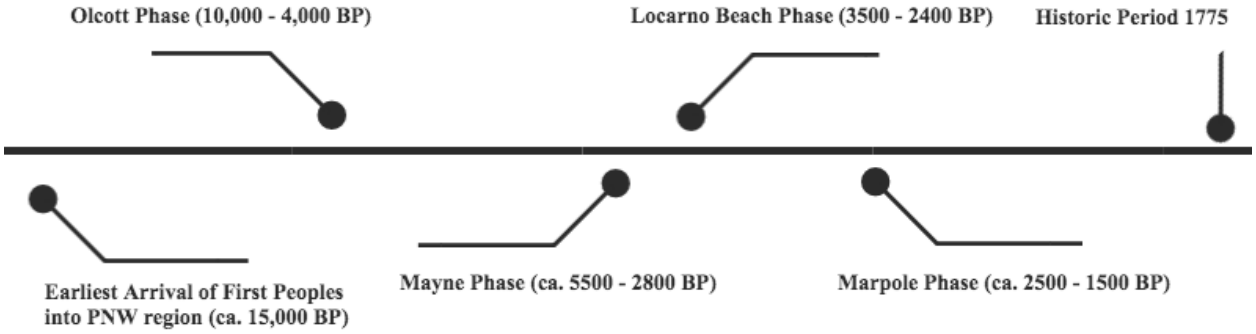

Figure 2. Timeline of Cultural Phases in Pacific Northwest

3. Cultures of the Scowlitz, Pender Canal, and Great Marpole Midden Sites

The main cultural group this thesis will focus on is the Central Coast Salish living in the Gulf of Georgia area, which contains the Georgia Strait, the Strait of Juan de Fuca, Puget Sound, and the surrounding waters from the Olympic Peninsula and Willapa Bay. Even within this group, there are many different subgroups and about ten languages spoken among the Coast Salish (Suttles 1987:29). Halkomelem is the language spoken by the Fraser Valley Coast Salish, or Sto:lo, the Musqueam, and the Nanaimo on Vancouver Island. This chapter will conclude with a brief overview of the culture and social aspects of the three Marpole Phase sites examined in this thesis: The Scowlitz, Pender Canal, and Great Marpole Midden sites.

The ancestors of these three groups would have been present at Scowlitz, the Great Marpole Midden, and Pender Canal, respectively. Clark classifies these groups as Upriver Halkomelem who would have resided at Scowlitz, Downriver Halkomelem at the Marpole Midden, and Northern Straits on the Pender Islands (Clark 2010:44). Sto:lo means "People of the River", referring to the Fraser River located in their territory which is one of the largest rivers in western North America, and it produces the most salmon in the world (Leprofsky et al. 2009:596). Suttles (1987) points out that the Halkomelem-speaking people who lived on Vancouver Island would cross the Georgia Strait to take advantage of the salmon runs of the Fraser River each year. Ethnographically, there has been seasonal movement between the mainland and island groups because the large plank houses on the mainland were the winter residences of the Musqueam and other Central Salishan groups. They would have traveled to other parts of the coast or interior plateau throughout the rest of the year (Suttles 1987:36).

Prehistoric Coast Salish cultures included all of the aspects that have been previously discussed in this chapter, such as tool technology reflecting subsistence patterns of hunting, fishing, and gathering. They utilized the potlatch system as a means to establish and maintain prestige over a kin group, as well as maintained deep, traditional ties with an ancestral area. Coast Salish groups had bilateral descent where an individual could have multiple kinship ties, allowing them access to move in with different family groups. Finally, the heads of kinship groups held a certain amount of control and leadership over their family members and of the various resources found on their territory, sharing access to those resources with affinal and familial ties (Suttles 1987:30-31).

Considering the importance of this ritual to indigenous groups of the region, as well as its relevance as evidence for social stratification and resource control, it is pertinent to provide a

brief explanation of the potlatch. The potlatch is a practice found throughout the Northwest Coast, even among the northern Haida groups, so it is not unique to the Central Coast Salishans. However, for the Coast Salish the potlatch was a means to regulate resources and was not used to establish and maintain the position and rank of chiefs, like it was for the Kwakwaka'wakw of Vancouver Island (Suttles 1987:41). Suttles (1960) explains that the Coast Salish form of the potlatch was a way for chiefs to redistribute wealth. These ranked individuals had accumulated a surplus of food and wealth, and they gave it out to others in proportion to their rank. A guest of a higher status rank would receive more than someone of a lower class. Essentially, the potlatch "converted their surplus wealth into high status. High status enables the potlatchers to establish wider ties, make better marriages with more distant villages, and thus extend the process further" (Suttles 1960:303).

Within a ranked society, the potlatch is a natural development. It serves the dual purpose as a method of redistribution and as a signifier of a ranked leader's prestige and power. These ceremonies were also not restricted to only the upper-class but to all members. Status differences between members of a society is marked by how much they participated in certain rituals or events (Drucker 1939:57). For example, lower ranked individuals would not be at the center of a religious ceremony but would be merely an observer sitting on the sidelines, while leaders heavily participated in the potlatch. Food and gifts would be distributed and exchanged at these events. The potlatch was mainly a symbolic, familial ceremony, affirming not just the wealth and success of a given kinship within a tribe but of their rank and status relative to others. It was a process that allowed chiefs to maintain and affirm their place as the leader of a kingroup, and allowed them to control and redistribute any surplus food resources. During natural patterns of

low-salmon harvesting and other fluctuations and variations in resources, this type of regulatory systems would have been beneficial for the entire group (Suttles 1987:31).

Control over specific patches of resources was overseen by certain families. Within a given community, there were enough different, distantly related family groups that controlled resource production (e.g. fishing spots, rock quarries, etc.), that inter-group or incestuous marriage was not practiced. Affinal ties between neighboring groups would have been encouraged as a means for a given family to have more control over diverse resources. This, alongside the potlatch, would have helped early groups adapt and survive any fluctuations of natural resources (Suttles 1987:42). People also would have moved from one area to the next, not only because of marriage or affinal reasons, but for the productivity of a given area. If a particular resource patch began to produce less while another that was controlled by a relative was becoming more abundant, it stands to reason that a person would move (Suttles 1987:43).

3.1 The Scowlitz Site

The Scowlitz site, also named Qithyil, belongs to the Halkomelem-speakers of the upriver Fraser Valley area in what is now British Columbia. It is located alongside the Harrison River and encompasses about 3 km. First occupied ca. 2700 BP, it was originally a village site with several large plank houses. After abandonment of the site around 1800 BP it was later used as a cemetery for the Sto:lo, and there is evidence for short-term camps there up until the mid-20th Century (Leprofsky et al. 2000:391; 411). Of the multiple buildings excavated at Scowlitz, Structure 3 is the largest and oldest. Charcoal samples place it as the earliest structure dating to 2700-2000 BP, and it could have held up to six families (Prentiss and Kuijt

2012:70-71). This indicates a movement away from the Locarno Beach Phase since people of the Fraser Valley primarily lived in smaller houses. Oral traditions say that the Sto:lo have lived in the Fraser Valley for thousands of years, telling about significant geologic and climatic events that could be about the early Holocene period, and these tradition never reference to other people inhabiting the region (Leprofsky 2000:395). One oral tradition in particular explains that Scowlitz was settled because of the abundance of fish and other resources available there (Leprofsky et al. 2000:396).

The people of Scowlitz employed a subsistence strategy known as complex collecting. The villagers would go out and collect their various resources (fish, mammals, plants, etc.) by utilizing "dense clusters of people based in large house groups", a strategy that was later seen in the Puget Sound and Vancouver Island areas post-2000 BP (Prentiss and Kuijt 2012:71-72). Not only does this demonstrate cultural transmission from inland groups out towards their coastal neighbors, but it also shows the development of subsistence strategies utilized according to households and not based on individuals working together. According to Prentiss and Kuijt, cooperative groups such as those living at Scowlitz were likely the beginning of the "classic Coast Salish house-based lineage system… [where] the larger corporate groups could conduct simultaneous operations, ensuring control of the fishing site while sending smaller task groups into the mountains to get other valuable resources" (2012:71). Social inequality was present at Scowlitz, possibly in conjunction with the rise and declination of salmon populations. As fish densities declined, the heads of households would have built up surpluses and given feasts or potlatches to help ensure their status and control over important resources. This further deepened the divide between the Scowlitz elites and the less-successful kin groups (Prentiss and Kuijt 2012:71).

The Scowlitz site is significant in that the houses were occupied throughout the year and not kept as summer or winter residences as plank houses in other regions were often used for. The close proximity to the river with such abundant fishing and other ecological resources would have been sufficient enough for the villagers to not need to plan any task groups to gather long-distance resources. The site also demonstrates a transition from the Locarno Beach Phase to Marpole. Structure 4 at Scowlitz dates to just before the Marpole Phase and is relatively smaller than the earlier Structure 3, indicating that there was a shift from the multiple family groups residing in the same large house. Shifting household sizes is one of the factors that contributed to the social and economic changes surrounding the Marpole phase (Leprofsky et al. 2000:411). The site was abandoned – or, rather, the region's general population declined – around 2000-1800 BP, possibly due to a warmer climate that negatively affected salmon populations (Prentiss and Kuijt 2012:72). Another possibility is that the residents dispersed more widely throughout the region and were no longer centrally located in one particular site.

As mentioned earlier, the village was later used as a cemetery with significant cultural and spiritual meaning, lasting even among contemporary Sto:lo. Midden burials were a common phenomenon preceding and during the Marpole Phase throughout the NWC. Grave goods and other mortuary practices like cranial deformation are held by many archaeologists to indicate social stratification and the emergence of a wealth starting around 2400 BP (Ames and Maschner 1999:183). Towards the end of the Marpole Phase ca. 1500 BP, however, midden burials were eventually replaced with mound or cairn burials, signifying more of an emphasis on the individual. According to Leprofsky et al., there is yet another shift in burial practices moving away from sub-surface interments to above-ground ones, using tree burials, canoes, or burial houses instead (2000:393). At Scowlitz, there are forty-two mound and cairn burials dating from

1500-1000 BP, the same time period of these shifting mortuary practices. These, in conjunction with burial mounds found at neighboring, contemporary sites, show that, "[T]he mounds were part of a mortuary complex that extended from the upper end of the Fraser Valley to SE Vancouver Island and throughout the Strait of Georgia region" (Leprofsky et al. 2000:394). As will be discussed shortly, the Pender Canal site has these burial mounds, as well as midden burials. The Scowlitz cemeteries also could have brought together different families and kinships, forming a larger, regional social group, as can be seen with the abalone shells and copper interred at Scowlitz burials and their similarities with more distant Halkomelem mortuary complexes (Leprofsky et al. 2000:413).

3.2 The Pender Canal Sites (DeRt 1 and DeRt 2)

The Pender Canal site, located on Pender Island in the Gulf Islands, was home to the ancestors of contemporary East Saanich and Cowichan– both Coast Salish groups. The site is most well-known for its large cemeteries, dating from 5170 BP to 370 BP (Carlson and Hobler 1993:25). According to Ames and Maschner, cemeteries from this Early Pacific period–including the Locarno Beach and early Marpole Phases– would have had diverse mortuary practices, mainly depending upon the deceased's position within the grave, except for cremations (1999:186). Grave goods were typical, utilitarian tools, and several burials at Pender Canal included carved horn spoons, while others at the site were buried with clam shell bowls.

There are two specific Pender Canal sites that are examined here: DeRt 1 and DeRt 2. DeRt 2 contains midden burials dating from 5170-3000 BP, and DeRt 1 has burials from 3000-370 BP. Unfortunately, these sites have been heavily damaged due to erosion over time, as

well as from construction of the Pender canal in 1984. This has understandably impacted the archaeological and even ecological data recovered from the burials. Early houses on Pender Island were likely built in high-tide areas, so with sea-levels increasing on top of construction, prehistoric settlement patterns are near impossible to determine. As such, there is not as much information for Pender Canal as there is for the Scowlitz site. Thankfully, thousands of artifacts were excavated from the burials, providing sufficient data for researchers (Carlson and Hobler 1993:30).

Occupation at the site, based on midden burial dates, peaked ca. 4430-3050 BP. There are around 105 total burials at Pender Canal: eighteen burials from 4430-3050 BP (indicating the peak of occupation); two burials are dated to 4580 and 5170 BP; and eight are later from 2500-800 BP. Carlson and Hobler believe that there were "strong indications of cultural continuity throughout this period along with evidence of increasing cultural elaboration" (1993:38). While there were many burials ranging across differing time periods, the majority of artifacts recovered belonged to the Mayne Phase, which preceded the Locarno Beach Phase. There are actually very few artifact assemblages or burials that Carlson and Hobbler dated to the Marpole Phase, with only three projectile points which are indicative of Marpole technology. It is likely that any Marpole-era burials or features were located close to the beach, which have ultimately been destroyed via erosion and inundation (Carlson and Hobler 1993:40). The Pender Canal site is still pertinent to this thesis, however, because there are Marpole deposits and burials at the site which prove useful. Also, the rich collection of artifacts found there dating to the Locarno Beach phase, as well as the cultural relationship with other Coast Salish groups, will help demonstrate any similarities or changes that occurred when comparing earlier technologies with Marpole toolkits.

Furthermore, there is strong evidence that one of the main burial midden at Pender Canal indicates an almost fully-developed NWC culture. This midden is dated to 4500-3000 BP, or the Mayne and Locarno Beach Phases, which came right before the Marpole Phase. It shows evidence for funeral potlatching and feeding the dead, as well as elaborate craftsmanship, art, masks, labret use and later primarily cranial deformation, trade in various shells and minerals, wood working, and marine subsistence. This latter, of course, is unsurprising considering the site is an island and the inhabitants would naturally subsist upon marine sources. It is also important to note that flaked stone tools are far more common than ground slate, which ground tools is a defining feature of Marpole technology. Wood-working tools were also not as advanced at Pender Canal as those in following periods since they were used with bone materials and not the better, more effective nephrite tools (Carlson and Hobler 1993:45).

While there are some differences at Pender Canal, there are certainly strong correlations and similarities with other Coast Salish groups in the Central Coast region. Of course, Carlson and Hobler based their publication on data gathered from excavation in the 1980s, and I am not aware if other excavations have been carried out, nor do I know of other articles focusing solely on the Pender Canal sites. Future research may affect the conclusions made by Carlson and Hobler, such as more precise dating methods and more extensive excavations (e.g. underwater archaeological efforts to find potential submerged sites). For now, the information presented in this thesis is the most complete and accurate picture of Pender Canal as is currently possible.

3.3 The Great Marpole Midden

The Great Marpole Midden, or more simply the Marpole Midden, is similar to Pender Canal in that there has not been much research conducted in studying its artifact assemblages and associated cultures, despite the fact that the pivotal Marpole Phase is named after it. Notwithstanding, there have been some discussions and articles written about the midden, which will briefly be presented here.

The Marpole Midden is associated with the Musqueam Band and is located in a suburb of Vancouver, B.C. Many PNW archaeologists consider it the most important site in the entire region. In more recent years, there have been legal issues surrounding the Midden between the Musqueam and the City of Vancouver. According to Roy, "For the Musqueam, the history of excavation at Marpole and the removal of countless skulls, skeletal fragments, and ancient cultural objects over the years is a history of colonialism and dispossession. In the words of Musqueam's treaty director, Leona M. Sparrow, this history constitutes a form of 'cultural abuse'" (2006:71). This statement is in relation to how developers wanted to build condos at the Marpole Midden, which had already been partially destroyed by a hotel built in the 1950s. After many protests and conservation efforts by the Musqueam Band and their supporters, these construction plans were cancelled, and the ancestral remains found at the midden were returned to the Musqueam.

The Marpole Midden was first discovered by Euro-Canadian settlers in 1884 who were building a road that happened to cut right through the midden (Burley 1979:502; Roy 2006:68). This midden contained assemblages of shells, fish, animals, bone and stone tools and jewelry, carved art, and human remains. Since then, there have been around ten excavations conducted

intermittently at the midden from 1892 through 1973, with assemblages housed at multiple museums, including the University of British Columbia. Charles Hill-Tout was the first person to excavate the midden in 1892, where he and his subsequent colleagues gathered materials purely to showcase in museums (Burley 1979:508). It was not until Charles Borden in the mid-20th Century when excavations were more meticulously, more scientifically carried out. He recorded data for not only the artifacts and human remains, but also soil and plant samples collected, even the visitors who stopped by the site. Borden wrote extensive notes and diagrams, as well took pictures of the site (Roy 2006:84).

As has been stated multiple times thus far, the Marpole Midden assemblages demonstrate a developed, stratified society from ca. 2500-1500 BP and has an "elaborate cultural inventory" (Carlson 1960:563). Artifacts dating to the early Marpole periods are generally stemmed leaf projectile points, chipped slate knives, microblades, bilateral barbed harpoon points, and chipped stone tools. Later, more typical Marpole artifacts are stemmed, notched, and triangular chipped projectile points, medium-sized groups points, ground slate knives, unilateral barbed harpoon points, more artistically carved artifacts, and jewelry. Ground stone and bone tools are certainly more prevalent during the peak of the Marpole Midden, although chipped stone tools were still present (Burley 1979:526). What makes the Marpole Midden assemblages so important is the level of craftsmanship utilized, from the carved wooden artifacts to the ground tools – a difficult, time-consuming endeavor (Smith et al. 1950:30). None of the references cited here discussed the state of the human remains (e.g. whether they had evidence of labret wear or cranial deformation to indicate social stratification). Also, considering the Musqueam Band has possession of their ancestral remains, it is unlikely that any bioarchaeological studies will be conducted any time soon. Nonetheless, other scholars agree that chiefdoms were present in this area at this time

period. The Marpole Midden, despite not having many publications focused on it, is a key site to examine when looking at how egalitarian hunter-gatherers transitioned into chiefdoms.

3.4. Discussion

It is important to note that two of the three sites examined here have not had extensive, focused research conducted since at least forty years ago. Pender Canal and the Marpole Midden have been referenced in multiple articles and books and provided as examples of social change and development for hunter-gatherers. However, throughout my research for this thesis, I came across many more publications that focused on different archaeological sites and new excavations conducted. All relied to some extent on various museum collections from previous excavations. This is of course important and crucial to archaeological research and conducting field studies; gathering new data prevents archaeologists from becoming "armchair archaeologists". Unfortunately, this has also created a fairly problematic culture where researchers feel like they must always go out into the field and gather new data. They do so without more fully examining the materials sitting in museum collections, which are often neglected for decades by scholars.

Regarding the situation surrounding the Marpole Midden materials and lack of publications on the assemblage, Roy states that the Musqueam Band has had a good working relationship with archaeologists since the mid- to late-20th Century (2006:71). So it is unlikely that a lack of cooperation or poor communication between archaeologists and the Musqueam is the reason behind any recent studies on the Marpole Midden assemblage. Perhaps the reason why current research focuses on other sites outside of Pender Canal and the Marpole Midden is

due to the destruction or erosion of the sites that makes re-visiting them much more difficult, if not impossible in the Midden's case. It may be easier to simply excavate at new sites where excavation standards and methods can be employed or controlled by the primary investigators. Also, where the Marpole Midden is surrounded by private properties and suburban developments, conducting any follow-up excavations or obtaining the necessary permits is likely very difficult. Either way, Marpole and Pender Canal both demonstrate the importance of re-visiting past assemblages and museum collections. New data is certainly important for anthropology and science as a whole to progress, but that does not mean "old" data is any less important. Re-examining museum collections may also become more common in the near future due to the COVID-19 pandemic where field studies may not be possible, whereas museum studies that take place in relatively socially isolated, non-public areas would be more feasible.

Chapter 3: Environment

1. Ecological Theoretical Approaches

In terms of understanding and contextualizing ecological and social phenomena in the Pacific Northwest, it is essential to explain the various theories and methods that have been applied in studying this region. Traditional Ecological Knowledge (TEK) is the knowledge, understanding, and experience Indigenous groups have of their surrounding environment. These are the systems that have been in place for thousands of years by local groups to best exploit and utilize the environment for various resources. Related to TEK, human behavioral ecology and optimal foraging theory have been used by anthropologists and archaeologists to better understand the behaviors of past groups. Within the past few decades, these researchers have documented instances where foragers and small-scale societies have overexploited their resources. When it comes to the Northwest Coast, TEK has helped researchers better understand how socio-ecological systems (SESs) in the region would adapt and change in response to factors like climate change or shifting weather patterns (Armatas et al. 2016:1). Cultivation is one of these SESs that has been utilized throughout the PNW for thousands of years. Thornton et al. define cultivation as, "[A]ny conscious effort to create specific conditions for advantageous engagements and relations with another being" (2015:191). This is not only a means to care for and utilize resources from their surrounding environment, but it can have ties into "social and spiritual activities that seek to align human and non-human beings within a moral-ecological web of mutuality and independence" (Thornton et al. 2015:191).

The prey/patch choice models and intensification have also informed researchers about prehistoric behavior in this region. The prey choice model expects that resources will be distributed evenly across a given area, and that they will be gathered/hunted/fished/etc. as soon as someone comes across them. A foraging party is not looking for any specific resource, so no energy expenditure is lost since a wide array of resources can be gathered simultaneously. The patch choice model, on the other hand, acknowledges that not all resources are evenly distributed within a given area and instead occur in patches. According to Lyman, "Predators will exploit the patches with highest net returns first, and progressively add patches with successively lower net returns as resources in the initially exploited patch(es) become depressed" (2003:379). Intensification connects with this since it builds upon the idea of exploiting a certain area for as many resources as possible, particularly those that produce enough surplus to be stored (Butler and Campbell 2004:336).

The link between ecology and social behaviors is important when trying to understand past cultivation and intensification practices in the PNW, especially when trying to better understand the sustainability of the large-scale groups of the Marpole phase. Campbell and Butler argue, "Beliefs and social institutions contributed the most to sustainable use, as they place restraints on salmon use as a common-pool resource" (2010:2). They further go on to discuss how this self-imposed, common-pool resource management in a development from Hardin's "Tragedy of the Commons", where people with too much access to a resource will eventually overexploit that resource, harming the group as a whole (Hardin 1968:162). Instead, small-scale groups and/or traditional (i.e. Indigenous) communities have successfully intensified these patchy, unevenly distributed resources (Campbell & Butler 2010:2). Also, since intensification leads to temporary surpluses, it is important to note that in the PNW, "Neighbors

would share their surplus through the potlatch system [which] provided a solution to the 'prisoner's dilemma' of a common-pool resource" (Trosper 2003:3). The proprietorship these Indigenous, First Nations groups had – and continue to have now – helped avoid the "Tragedy of the Commons". It did so in that it encouraged the group to have efficient, sustainable ecological conservation systems in place (i.e. stewardship, husbandry, etc.), allowing for future generations to thrive (McLaren et al. 2015:185). So again, there is an important link between sociological and ecological behaviors that is crucial in better understanding environmental issues in the past and in the present.

Another theoretical approach that has helped researchers is adaptive resource management. This states that the environment is always changing, so people are constantly changing or adapting their resource management – or cultivation practices – to account for these differences. "Adaptive management emphasizes flexible decision making and responsive institutions, incorporation of various sources of knowledge, and an iterative learning process about how management intervention affects SESs" (Armatas et al. 2016:1). This system acts, in a way, like the scientific method: identify a problem, set goals or hypotheses, explore ways to solve or address the problem, adapt and develop these solutions based on results, and then implement them into current ecological knowledge and practices. Community involvement is encouraged in adaptive management strategies and planning, it is not a method for researchers alone (Armatas et al. 2016:2).

Finally, Yesner (1980) provides insight into coastal and maritime hunter-gatherer groups and how their given ecology impacted their ways of life. Hunter-gatherer groups, even when they reside in similar biomes, will have different ecologies that yield various resources (e.g. more pinnipeds in one area while another has more salmon), differing tool technologies, and generally

diverse cultures. Intertidal zones and estuaries are particularly productive, especially when compared to coastal zones in general, since these regions paired with foggy conditions retain more heat that impacts photosynthesis that further helps vegetation (Yesner 1980:727-728). He also points out that food chains in coastal and marine ecologies are shorter and more efficient since, which positively affects sea birds, sea mammals, and anadromous fish. This leads to more species diversity since alternating or cyclical resources are available throughout the entire year within the same region.

Early coastal human populations were affected by these rich, diverse resources. They had access to energetically low-cost, nutrient-rich foods during periods of stress like the winter months. Fluctuations in resources would have influenced the development of certain cultural practices and rituals, such as the potlatch, to help redistribute these resources amongst the group (Yesner 1980:729). Coastal groups experience higher population densities due to logistical collecting behavior of collecting various resources in a given location (Binford 1980:15). This is, of course, dependent upon the diversity and productivity of the coastal or marine area, as well as whether the given area is actually habitable for settlement and/or growth of the population (Yesner 1980:732). Once population levels in a given area cannot grow any further and the local ecology has been fully exploited, Yesner argues that this would, "[S]timulate developmental innovations, leading to the development of more complex group societies" (1980:735). Trade would have been one of these innovations, with elite members of a family (i.e. chiefs) having control over what resources were traded with which groups.

2. Environmental Changes Leading to the Marpole Phase

It is now pertinent to briefly describe the ecology of the Northwest Coast, and give a rough description of what the environment would have been like during the Marpole Phase. First, however, it should be said that determining palaeoecological data is not always very precise:

> "The effects of post glacial climatic, eustatic, isostatic, tectonic, glacial, and other changes on biotic communities in marine, estuarine, riverine, and terrestrial environments…[and] the effects of historic introductions of exotic plants and animals, fire suppression, dam building, logging, dredging, overfishing or -hunting, and other processes have caused major habitat changes in many areas over the last 200 years"(Moss & Erlandson 1995:32)

The coastlines are home to various types of marine food resources, such as sea mammals, birds, shellfish, and obviously marine fish, all due to the nutrient-rich ocean currents (Moss & Erlandson 1995:6). The coasts themselves have undergone various changes through the millennia, and continue to undergo environmental changes, due to effects from deglaciation, tectonic activity, and sea level changes. All of these forces have resulted in prehistoric coastal sites to be submerged under water or even uplifted in some areas, or for the coastline to erode away. Estuaries and river mouths empty out into the sea throughout the NWC, with archipelagos scattered across the coast. Stormy weather would have affected marine travelers along the coast in their fishing or traveling excursions, because of their exposure to heavy surf and seasonal North Pacific storms (Moss & Erlandson 1995:6). The Northwest Coast experiences occasional earthquakes due to the shifting Juan de Fuca and Cascadia Subduction Zone tectonic plates, affecting sea levels over time, which will be further explained later in this chapter.

Around 7400-5800 BP, the climate was drier throughout British Columbia than it is today, and it was not until ca. 3200-1000 BP when there was an increase in climatic moisture, occurring at practically the same time as the duration of the Marpole Phase (Mazzucchi et al. 2003:527). Related to this relative level of dryness, from 14,000-7000 BP the climate was highly variable with frequent and severe fires throughout the region, whereas after 7000 BP the climate became more stable with fewer and less-severe fires. It is important to note that there is an increase in fire activity after 2500 BP, though this was likely due to human activity and not climate change (Armatas et al. 2016; Gavin et al. 2013; Lepofsky et al. 2005). Droughts over the last 1000 years have also become less frequent but have lasted longer. Prehistoric groups would have felt these effects towards the end of the Marpole Phase (Nelson et al. 2011:3873). Climate change also affected stream flow and water temperatures, which ultimately affected regional and local fish populations in terms of distribution and density (Campbell & Butler 2010:6).

Earthquakes are common in the region, and they have had various effects on sea levels. Significant earthquakes occurred near Vancouver and Vancouver Island at 3600 and 1900 BP, affecting not only sea levels but also salinity levels. According to Grier et al., "The earthquake events… resulted… in a slight uplift of the mainland coast near Vancouver and subsidence on southeaster Vancouver Island circa 3,600 calendar years ago (Event 1) and subsidence in both areas around 1,900 calendar years ago" (2009:269). Furthermore, sea levels have changed over the past 4000 years partially because of earthquake activity, with sea levels rising to approx. 1.5 m in the last 1000 years alone (Grier et al. 2009; Yesner 1980). With these changing coastlines and spit land formations along the NWC came changes in ecological strategies like resource intensification that affected everyday life, storage practices, social networks, and even social inequality. These changing shorelines also incorporated middens into the landscape to help

stabilize the shoreline to: "[A]ccomodate fish weirs, the modification of intertidal lagoon to promote freshwater bogs, the alteration and creation of intertidal lagoons to enhance shellfish resource productivity, the terracing of village sites and house features, and the construction of earthen features for defense" (Grier et al. 2009:274). By utilizing an adaptive management strategy, these early coastal groups were cultivating their environment to fit both their subsistence and sociological needs.

2.1 Salmon and Other Resources

Maritime and littoral resources are pivotal to PNC groups, both contemporary and prehistoric. After discussing how certain fauna (particularly salmon) and other ecological processes have affected these cultures, it is important to provide a more detailed discussion about the different salmon species. Other species of fish, as well as both marine and terrestrial mammals, will be discussed since they have commonly been overlooked by academic literature despite playing crucial roles in the PNW (see Figure 3).

Species	Spawn Season	Length	Weight
Pink salmon	August-October	18-24 inches	3-5 pounds
Sockeye salmon	Spring	21-26 inches	4-7 pounds
Coho salmon	Fall-Early Winter	24-28 inches	5-10 pounds
Chum salmon	Late Summer-Spring	21-31 inches	7-13 pounds
Chinook salmon	Summer-Early Fall	28-40 inches	10-30 pounds

Figure 3. Salmon Demographics

Salmon harvesting is advantageous for hunter-gatherers since runs happen at predictable times and locations. Salmon runs in small streams or tributaries are sensitive to any ecological changes or variations, leading to a less-productive harvest. However, for larger rivers like the Fraser River there are often such dense numbers of salmon that any ecological changes would have little effect on the millions of fish in the river. Ames and Maschner state, "Salmon runs, rich in the aggregate, are highly variable species to species, stream to stream, and year to year. They are subject to patterned variation, with some rivers having large runs only every second, third, or fourth years" (1999:115). Prehistoric groups relied upon this variation in salmon runs throughout the year and the seasons, eating both fresh fish during harvesting season and stored, dried salmon to tie them over in the winter when resources were more limited.

There are five species of salmon in the PNW: pink; sockeye; coho; chum; and Chinook salmon. These are anadromous fish, meaning that they are born in freshwater (i.e. streams or rivers), migrate out to the ocean as they mature, and then return to freshwater to spawn and lay their eggs. Each species has different migration and spawning periods, as well as differing physical differences, which will be briefly here.

Pink salmon are the smallest of the salmon species, but they are also the most abundant to harvest. They spawn every two years close to the mouth of streams opening out towards the ocean, weighing about three to five lbs. and average eighteen to twenty-fours inches long. They return back to freshwater typically around August through October. Sockeye salmon spawn in various locations, ranging from shorelines to lakes to upstream hundreds of miles from the ocean, and they usually migrate out to the ocean in the spring. They also spend differing amounts of time in freshwater sometime between three months to three years. Sockeye salmon typically live two to six years, weigh about four to seven lbs., and are twenty-one to twenty-six inches

long. Coho typically stay in freshwater for a year or two and will typically travel less than a hundred miles from their spawning grounds to the ocean for reproduction, although sometimes they can travel up to a thousand miles. Coho live in the ocean for about a year and a half before returning to freshwater to spawn in the fall or early winter. They live three to five years, weigh five to ten pounds, and measure twenty-four to twenty-eight inches long. Chum are the most widely distributed and are the second largest of the salmon species. They typically reproduce near the mouth of their stream by the ocean, and their spawning season lasts from late summer through the spring. They live three to five years, weight almost seven to thirteen lbs., and can get up to twenty-one to thirty-one inches long. Chinook salmon, despite being the largest salmon species in the PNW, are actually the least abundant in the region. They live in the ocean for several years and then return to their spawning grounds in freshwaters in the summer or early fall. Chinook salmon generally live for three to six years, typically weigh ten to thirty lbs., and are twenty-eight to forty inches long, although some Chinook salmon have been known to weigh over one hundred pounds and get up to four-and-a-half feet long (NOAA; SPSSEG.org).

Salmonidae (salmon and trout)	Embiotocidae (surfperch)	Scorpaenidae (rockfish)
Pleuronectidae (right-eye flounder)	Clupeidae (herring)	Hexagrammidae (greenling)
Cottidae (sculpin)	Gadidae (cod)	
Squalidae (dogfish)	Chimaeridae (ratfish)	

Figure 4. Ten Ethnographically Important Fish Species (Butler and Campbell 2004)

As mentioned in a previous chapter, there has been a near-obsession –the "salmonopea"– that focused only on salmon populations while discussing prehistoric cultures of the PNW. Salmon, while crucial to prehistoric and contemporary Indigenous cultures throughout the PNW, are not the only fish and maritime resources gathered. Campbell and Butler (2004:360) list twenty-four different fish species that have been used ethnographically in the PNW (Figure 4). They note that three of these species – eulachon, sturgeon, and lamprey – are rare or absent in zooarchaeological deposits due to poor preservation and sampling biases. Campbell and Butler (2004) note that while salmon are present and abundant throughout the PNW, other species of fish are also dominant in the region, demonstrating that there were other fisheries. It all primarily depended upon the local variation, what fish species were more prevalent, and when those species were harvested (2004:360). As they put it, "Salmon ratios are low in four of the five earliest [archaeological] components, while the highest ratios are after 4000 BP. Yet for every time period, there are a range of values, suggesting salmon was the focus of the fishery in some locations, and only a minor or moderate constituent in others. Site location, especially proximity to salmon streams, is the simplest explanation" (Butler and Campbell 2004:362). This references back to the patch choice model where not all resources are equally or evenly distributed within a given region.

Shellfish are also an important resource that supplemented hunter-gatherer diets. They are a low-energy cost food that were abundant and easily accessible for coastal groups, and they helped tie groups over during times of resource strain. Shellfish are considered a "low-ranking starvation food", and ethnographically only certain members of the group would gather shellfish– typically women. There have been differing ideas concerning the archaeological importance of shellfish. According to Butler and Campbell, "On one hand, their antiquity and

widespread occurrence in the Pacific Northwest suggest they were a consistent staple. On the other hand, scholars have cited the relatively late appearance of large shell middens (after 4500 BP) as evidence that shellfish are low ranked foods" (2004:371). Again, excavation and research bias may have affected the appearance of shellfish post-4500 BP. Regardless of when their appearance in midden deposits occurred, though, shellfish have been a staple of PNC groups for a long time and should not be overlooked.

Finally, mammals – both marine and terrestrial – were an important resource for prehistoric PNW groups. Whales and pinnipeds were common marine resources, although whale hunting was almost exclusively practiced by the Nuu-chah-nulth on Vancouver Island and the Makah along the Olympic Peninsula coastline. As stated in the previous chapter, the Coast Salish hunted sea lions, seals, and porpoises. Terrestrial mammals have also been found in archaeological deposits and discussed in ethnographic accounts. These include various canids, elk, deer, beavers, otters, rabbits, and bears (see Figure 5). Salmon and fish archaeological remains greatly outnumber mammals, which is understandable given the maritime ecology of the PNC. For most faunal analyses of the NWC, fish makeup 90.8%, 5.3% are birds, and 3.9% are mammals (Stewart et al. 2019:5). However, it is still important to note that recovery methods and excavation biases would have impacted these statistics considering the "salmonopea" effect on PNW zooarchaeology (Butler and Campbell 2004:330). As will be discussed later in the chapter, past archaeological studies with different methods and theoretical approaches have impacted the accuracy of pretact accuracy throughout the PNW. Thankfully, this is being rectified by post-processualist and processualist-plus theories guiding more recent studies of the region in order to be more holistic, such as excavating and curating more mammal remains. This trend will

hopefully continue to flourish and develop, allowing future studies to become increasingly more accurate in depicting prehistoric life.

Cervidae (deer, wapiti)	Phocidae (true seal)	Canidae (dog, wolf, coyote, fox)
Castoridae (beaver)	Procyonidae (raccoon)	Mustelidae (river otter, mink, weasel, marten)
Ursidae (bear)	Leporidae (rabbit, hare)	Aplodontidae (mountain beaver)
Delphinidae (dolphin)	Felidae (cats, lynxes, allies)	Otariidae (eared seal)

Figure 5. Common mammals found in archaeological deposits (Campbell and Butler 2004)

2.2 Effect of Climate Change on Cultures

Climate and oceanic change has had a significant impact on salmon populations throughout the entire PNW. Salmon are sensitive to increasing sea surface temperatures (SSTs), and if the water becomes too warm it will prevent the salmon from entering rivers heading out to the sea and many will die if they have to wait too long for cooler water temperatures (Stewart et al. 2019:13). Data has shown that at Orcas Island, British Columbia, from 2400-1200 BP (i.e. the Marpole Phase) the summers were longer and drier, causing warmer water that in turn increased sharks and anchovy populations, which are warm water fish. Considering salmon populations are consistently the most common species in zooarchaeological contexts throughout the PNW, particularly the Marpole Phase, this warming did not have a devastating effect on the species' population densities. It is also important to note that for Coast Salish groups specifically, they

saw a more abundant sockeye and pink salmon cycles and population levels than were experienced by groups further north along the coast (Suttles 1987:38).

In terms of intensification, though, no evidence has been found proving that prehistoric groups throughout the region were harvesting and processing higher amounts of salmon relative to pre-Marpole numbers. This is especially true when compared to other species of fish. The patch choice model and seasonal variations call into question the idea that salmon was equally abundant throughout the entire region for most of the year (Campbell & Butler 2010:3). In fact, herring showed more significant signs of various harvesting patterns with an "increased abundance in coastal sites after 2500 BP and its dominance in some assemblages after 700 BP are evidence of specialized fishing strategies and suggest logistical organization of settlement and land use" (Butler & Campbell 2004:374). Considering that salmon are almost always the most common fish, this demonstrates sustainable fishing and harvesting practices used by prehistoric groups that could support the regional increasing human population. Also, there are regional differences in salmon remains in the zooarchaeological record. Campbell and Butler argue, "Salmon was the focus of the fishery in some locations, and only a minor or moderate constituent in others" (2010:6).

There are important sociological components attached to salmon harvesting even if they were not as intensively harvested as previously believed. Again, this is associated with the patch choice model, since some areas and households controlling those areas would have produced more salmon than others, those with the surplus catches could hold a higher social position and become more highly ranked (Coupland 1998:48). As Thornton et al. put it, "There are positive correlations between salmonid productivity within certain aboriginal territories and the socioeconomic rank of the inhabitants possessing fishing stations" (2015:192). Labor

organization and developments in technology were also necessary to process the amount of salmon and other fish species, not only from a workforce perspective but also as a means of processing efficiency (Campbell & Butler 2010; Elder et al. 2014).

Significant spiritual and cultural beliefs and practices are also associated with salmon harvesting. These mainly come from ethnographic accounts and are therefore difficult to see in the archaeological record, but that does not make them any less significant, nor does it mean these practices have not been around in the NWC for generations. In fact, the Nuu-chah-nulth, Coast Salish, and Tlingit all agree that salmon cultivation practices they use today are similar to the ones used in prehistoric PNW (Thornton et al. 2015:193). An important practice is the First Salmon ceremony. Ethnographically, there was a "salmon chief" or "stream master" who would have presided over this ceremony, as well as any other fish-human interactions and the caretaking of the river (Thornton et al. 2015:193). Tending to the river or stream in itself held both ecological and cultural importance since some groups believed that, "A well-tended stream can attract salmon and assist them on their journey towards reproduction… On the other hand, ill-cultivated streams with too much deadfall or man-made obstructions… could insult salmon, causing them to not return to their natal stream" (Thornton et al. 2015:192). The chiefs or head of households who controlled salmon runs had a responsibility to protect and cultivate salmon populations. These chiefs could control when and how much fish were harvested, placing humans as a "keystone species" in terms of environmental cultivation (Trosper 2003:5). Not only would a failed salmon harvest negatively impact a village's food storage, that kind of failure would indicate that the head of household was unworthy and cause his followers or even family members to doubt his success as a leader, sometimes to the point of killing him to rectify the problem (Trosper 2003:4).

In light of any failures in subsistence strategies, there were other social systems in place to accommodate for this phenomenon – the "patchiness" of resources – that helped both create and distribute surplus resources. One of the most well-known of these systems is the potlatch. This system has already been discussed in previous chapters, but it is relevant to further discuss how it ties in with PNW ecology. Connecting with the social and ecological responsibilities of leaders as previously discussed, the potlatch's reciprocal system encouraged land cultivation and allowed for "cross-scale negotiations among titleholders, commoners' choices, and belief systems…The reciprocal exchanges of a potlatch system provide a method of social insurance against variation in harvest abundance" (Trosper 2003:3). Furthermore, in terms of the Marpole Phase, Trosper argues that the combination of these political, reciprocal, and economic developments with the resource cultivation and fish surpluses developed together (2003:3). So, while the social complexity of the Marpole Phase may not have been directly caused by salmon intensification, there is still a link between social change and ecological cultivation.

Indigenous peoples have had ecological and social systems in place for thousands of years to ensure that they could take advantage of the various salmon and fish populations without overexploiting or damaging those resources. It is important to note that Indigenous groups changed and manipulated their environment to achieve this level of cultivation; they were active agents alongside the environmental, non-human agents (Campbell & Butler 2010; Elder et al. 2014; Grier et al. 2009; Thornton et al. 2015).

Within the last few decades, researchers are now beginning to realize that there was no salmon intensification that heralded the social complexity of the Marpole Phase, a significant argument. Instead of making a direct connection between resource intensification and immediate social change, incorporating a broader, more holistic approach will help explain how social

complexity developed in the prehistoric PNW. There also needs to be more room allowing for regional variation, as argued by Clark (2010:283-284), and examine more focused, centralized practices between and among sites along the coast. "[Coastal sites] are best understood within the context of their local geography and resources, rather than through socioeconomic complexity" (Stewart et al. 2019:3). Adding to this argument, Grier et al. (2014) state that viewing culture or ecology as being unilinear with constant resource homogeneity is not productive. Instead, there are multiple factors creating a more complex context for traditional groups, prehistoric and contemporary, that researchers need to take into consideration with their studies (Grier et al. 2014:274). This thesis intends to contribute to this holistic approach by examining the tool technology and how it correlates with the zooarchaeological and paleoecological record. The next chapter will go into more detail about how the tool technology of the region developed and changed over time to help the Coast Salish more efficiently exploit their respective areas.

3. Summary of Sites' Ecological Data

Finally, it is crucial to discuss the unique, respective ecology of the three sites that are examined in this thesis. A brief description will be given for each site based upon what has been previously published in academic papers. However, there is a disproportion of environmental descriptions between them, which will be discussed more in depth at the end of this section.

The Scowlitz Site is located in the Upper Fraser River Valley, surrounded by the Coast Mountain Range in the north and the Cascade Range to the south east. There are many streams and other waterways that feed into the Fraser River, and canoes can travel along these various

streams from the ocean to almost 200 km inland. The Fraser River is one of the largest and most productive rivers in western North American and is abundant in fish (especially salmon), mammals, birds, and various flora throughout the year (Leprofsky et al. 2000; Prentiss and Kuijt 2012). The Scowlitz site itself is located at the confluence of the Fraser and Harrison rivers, placing it along a significant trade and transportation route for travelers moving between the inland and the coast. According to Leprofsky et al., villagers at Scowlitz likely acted as "middlemen" in these trading transactions and would have benefitted from these connections (2000:395). What makes the Fraser River Valley villages like Scowlitz significant is that they did not have the population densities along the coast, yet they still had large, permanent villages. As Prentiss and Kuijt argue, "With no large local population to reinforce the rules of residence and intergroup relations, the people of the Fraser Valley had more opportunity to experiment. Unlike their coastal cousins, who relied more on marine foods scattered throughout the landscape, inland peoples began to focus on ecological hotspots" (2012:68-69). It was not necessary for these inland groups to form foraging parties and gather whatever resources they could find when there were sufficient resources in the immediate area.

Leprofsky et al. discuss the relative importance of red cedar in the area that had arrived in the Fraser Valley 6600 BP and how, in conjunction with other ecological factors, they influenced the development of the Scowlitz site (2009:616). Red cedar trees alone may not have led to the development of large plank houses in the area nor the appearance of semi-subterranean houses. A more disciplinary, holistic approach is encouraged that incorporates environmental and non-environmental factors for the establishment of permanent houses and semi-sedentism exhibited at Scowlitz. As the authors argue, "[Houses around Scowlitz] would have linked social groups to particular places and productive resource locales and may be associated with the

emergence of the land tenure system documented among the Sto:lo" (Leprofsky et al. 2009:616). Again, there is evidence for adaptive resource management strategies in place in prehistoric communities.

While the Scowlitz site has had numerous publications describing its ecological context and prehistoric use, there has been relatively little written about the Pender Canal site's environment outside of that it is located on the smaller islands in the Gulf of Georgia near Vancouver Island and DeRt-1 and DeRt-2 are relatively close to the coastline (Carlson and Hobler 1993:29). Even less has been written about the Great Marpole Midden, both archaeologically and ecologically, outside of contemporary books and newspaper articles concerning legal issues involving the Musqueam Band and the city of Vancouver (Roy 2006). This is fairly surprising considering the importance of the site in the region's archaeology and history, considering that an entire cultural phase is named after it. In my research, I have personally not come across any reason or explanation as to why there is so little published research surrounding the Great Marpole Midden (e.g. the Musqueam Band may not support any research surrounding the site, or at least without their approval).

As mentioned in the previous chapter, Euro-Canadian workers happened upon the site while constructing a road in 1884, with subsequent archaeological research conducted shortly after. To put it simply, archaeology was not as advanced and sophisticated in the late 19th Century as it is today. These early archaeologists were not informed by any theoretical perspectives surrounding hunter-gatherers like the ones discussed in the previous chapter, they were not concerned with preserving or writing down any palaeoecological data that the midden would have produced, and they did not ethically excavate the site by discussing their research methods with the Musqueam Band. Their main priority was collecting the artifacts and skeletal

remains they found because that data was easily discovered and examined, not to mention it was more "exciting" for the researchers than preserving sediment deposits.

Furthermore, in the 1950s a hotel was built near the site which all but completely destroyed the midden. The city of Vancouver, B.C. is also a very large metropolitan area, making it difficult to excavate underneath the various roads, buildings, and homes surrounding the site. Thankfully the Marpole Midden was designated a National Historic Site of Canada in 1933, and conservation efforts have been made more recently by the Musqueam Band to preserve and restore their ancestor's remains (Roy 2006:67-68). However, this all contributes to the fact that much data – archaeologically and ecologically – has been destroyed over the past 150 years or so. This combination of subpar archaeological methods and theories and metropolitan growth forces archaeologists and researchers of the region to develop unique approaches to better understand the prehistoric context of this and similarly damaged sites of the PNW.

Comparisons with other, more well-preserved and thoroughly researched sites is a primary way to work through this problem. It also emphasizes the importance for current and future archaeological projects to be as holistic as possible while excavating. All projects have certain research questions and agendas, but data for future, unrelated studies must also be taken into consideration. As can be clearly seen here in this thesis, as well as many other archaeological publications since Steward, Geertz, and Binford's writing on ecological anthropology in the mid-20th Century; environmental context plays a pivotal role in understanding prehistoric cultures (Binford 2008; Geertz 1972; Steward 1955).

Publications involving the Pender Canal site, despite being far more recent than the work conducted at the Great Marpole Midden, also reflect how past archaeologists did not take ecological factors into account. With articles dating from the 1980s and 1990s, researchers like

Carlson and Hobler (1993) delve into great description about the excavation methods and what artifacts they uncovered, but they do not provide even a paragraph to describe the flora or fauna or the sites, whether they are more inland or closer to the coast, etc. For having been written in a "post-Binford academia", they had not yet transitioned into a post-processualist, more holistic approach while conducting their archaeological study. They were focused solely on the archaeological data in front of them and little else. This is certainly helpful and significant to the field and greatly contributes to better understanding PNW prehistoric cultures. Unfortunately, this lack of foresight and holism has led to difficulties and gaps of knowledge in future research. Again, this demonstrates the importance of including ecological data and incorporating different perspectives while excavating, or potentially even in the pre-excavation stages by consulting different specialists (e.g. paleoethnobotanists, geologists, Indigenous groups) to better construct research questions and objectives.

In regards to the Scowlitz Site, the majority of the information provided in this chapter came from a book written within the past decade. It is a holistic book that incorporates different approaches or theories when describing past life of the Middle Fraser Valley region, which includes environmental context. In the twenty or so years since the Pender Canal article referenced here, archaeology as a field has progressed to include different perspectives. This is why so much can be said about the Scowlitz Site; it is the product of holism at work by contemporary archaeologists. While it is outside of the scope of this thesis, further research must be done to generate and contribute more ecological data for more specific regions like the Pender Canal and Marpole Midden sites. The PNW as a whole has a fairly "similar, steady" environment, but just as there are vast differences in cultures within the region, so, too, are there ecological variations on a smaller scale that should be examined. This research will better

describe the cultural variations and similarities as have been previously discussed, and it will help inform future archaeologists on the rise of chiefdoms along the Pacific Northwest coast.

Chapter 4: Tool Technology

As has been established in the previous chapters, developing cultural practices and the environment play a crucial part in tool technology. Those concepts will be explained in-depth throughout this chapter. This chapter will discuss the various tools employed by the Coast Salish ca. 2500 BP, in addition to explaining prevalent theoretical approaches, such as evolutionary archaeology and Human Behavioral Ecology (HBE). Furthermore, there are questions as to whether the technological shifts observed in the archaeological record are the result of real changes or merely because of sampling bias and preservation issues (Ames et al. 2010:52).

1. Theoretical Approaches to Understanding Changes in Lithic Technology

Evolutionary archaeological theory has often been utilized while studying lithic technology. This borrows from Darwin's ideas of evolution, where certain traits from a given organism are passed down to its offspring and subsequent generations that ultimately result in the development –or evolution– of a new species. In terms of archaeology, any variations in artifact traits are the result of natural selection and cultural transmission (Dunnel 1978; O'Brien and Lyman 2000; Johnson 2020). Schiffer explains that evolutionary archaeologists "assume that systems change as a result of people intentionally solving problems, steering their behavior in ways that are 'adaptive', such as intensifying subsistence in response to demographic or environmental stress" (1996:647). "Adaptationists", as Schiffer calls them, believe natural selection processes in archaeology would be the different factors influencing what types of tools or other cultural adaptations would be most advantageous (1996:647). For example, varying

faunal and floral resources, tool stone quality, and environmental patterns all affect whether the people living in that given area should store their resources in caches or wooden boxes, or if they should use harpoons over bows and arrows. As stated by Parfitt and McCutcheon, "Natural selection, or the grain of the environment, favors some artifact traits over others, resulting in differential representation of specific physical artifact traits (e.g., raw material, tool shape)" (2007:38). It is similar to the Traditional Ecological Knowledge and adaptive resource management concepts discussed in Chapter 3, where a given group has to modify and develop their technologies to best take advantage of their surroundings and resources. Bone toggling harpoon technologies were advantageous to the Coast Salish in the Pacific Northwest Coast but may not be as successful for groups living in the Cahokia Complex in Mississippi, for example.

Cultural transmission, similar to biological genetic drift, is the transference of ideas and/or traits within or between cultures. This process occurs vertically or horizontally, the former meaning it is passed down from generation to generation, and the later where ideas are shared between contemporaneous groups (Parfitt and McCutcheon 2007:39). In terms of lithic technology, this would be the development of projectile points from larger, flaked points intended for a generalized toolkit to a smaller, more specialized projectile point intended for certain prey like deer or moose (see Figure 6). As the figure shows, certain traits were maintained for several thousand years, such as the lanceolate point-shape in the middle of the figure where there was direct transmission across several thousand years. Other points developed and then eventually fell out of use with time like the triangular point on the far left side that was only employed from the late Mayne through Marpole Phases. The Marpole phase in particular saw a shift towards smaller, notched projectile points compared to earlier phases. This demonstrates the vertical cultural transmission of evolutionary archaeology at work.

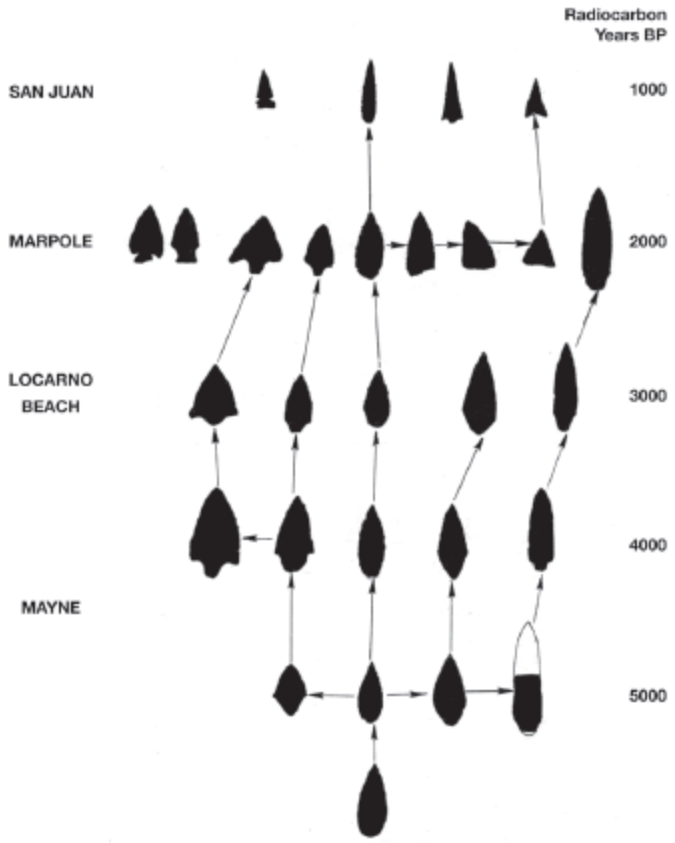

Figure 6. Timeline of Projectile Point Types Found in the Gulf and San Juan Islands (Carlson 2008)

Related to evolutionary archaeology is dual inheritance theory (DIT). This describes how behavior changes are based upon phenotypic plasticity and how the behavior observed in one group will differ from another based on its temporal and geographic context (Collard et al. 2007:204). It is a transmission of information following Darwin's descent of modification (i.e. evolutionary archaeology). Culture change, unlike genetic evolution, can happen consciously, such as where a person "can choose to copy practices from non-kin, and they are also able to modify or discard practices in light of experience" (Collard 2007:205). Therefore, someone could purposefully make a mistake or explicitly choose to do something different when copying someone else's work. Dual inheritance of cultural traits focuses on guided variation and biased

transmission. Guided variation means that any copied behavior can be modified, and then that modification is passed on to someone else. Biased transmission is when individuals choose which behaviors to copy based on their own personal experiences or views and not at random (Collard et al. 2007:205).

Human behavioral ecology (HBE) follows the same idea of the phenotypic plasticity in cultural evolution, but it goes further in describing how certain behaviors will help an individual survive in their given environment (Schiffer 1996; Collard et al. 2007). As Schiffer puts it, "[Human Behavioral Ecologists] seek to explain variability and change in human behavior by emphasizing the study of relationships between people and their artifacts" (1996:644). As with all subfields of archaeology, context is key to HBE. Following this theoretical approach, it explains cultural differences between groups as the result of environmental conditions and how humans adapt to them. Human behavioral ecologists focus more on the relationship between behavioral strategies and environmental conditions and less on how these cultural differences happen (Collard et al. 2007:206). Schiffer argues that, "The artifacts (and even people) taking part in an activity have, by virtue of their material composition and form, specific properties that affect their sustainability for interacting in particular ways" (1996:645). Again, HBE supports the idea that a group living in a given environment will develop and adapt their tools to that specific area's resources, and they would not work as efficiently if they were used in a different environment (e.g. toggling harpoons used in Mississippi). This theory is not concerned with the cultural evolutionary equivalent of drift, where one culture and its behavior could have some effect on another. It also does not accept the idea that certain behavioral traits are more important or significant than others since all of them were inherited as a group or package (Collard et al.

2007:206). HBE focuses primarily on the behavior and relationship between people and their artifacts, particularly their tools.

The dual inheritance-behavioral ecology hybrid theory combines DIT and HBE, as the name clearly implies, and is more helpful and meaningful than cultural evolutionary theory on its own. While processes like natural selection and drift can certainly play a part on culture change, other factors are involved to explain how culture changes so quickly (Collard et al. 2007:206). A main point of cultural evolution is how differential reproduction –how a change in behavior is passed down and reproduced by successive generations– is a force for culture change. It demonstrates how there are multiple relationships between the natural and cultural aspects surrounding archaeology. Regarding dual inheritance, Ian Hodder said, "Relationships between people, things, animals, and places have lots of variables and the chance of reproductive success on which most evolutionary archaeology depends is only one of them" (Harris and Cipolla 2017:166). Evolutionary archaeology certainly has some helpful aspects and has helped push forward archaeological theories, but it does not always provide the most complete, contextual answers regarding tool change.

1.2 Lithic Technology Theories and Methodologies

Collins (1993) discusses how lithic technology changes over time. While examining lithic materials at the micro scale certainly provides vital information, it also comes with the drawback that too much variation occurs. Differences in individual stone flakes, flake scars, use wear, breakage, etc. provide information on who specifically may have created that given stone tool, but it is more difficult to establish general trends and practices for an entire population. This is

why examining large data sets of lithic materials is so important– to establish a statistically sound trend of tool forms, materials, types, etc. Furthermore, there is also preservation and excavation biases surrounding lithic tools where any organic materials associated with these tools are likely no longer present in the archaeological record, especially in the Pacific Northwest's cold, wet environment (Collins 1993:88).

It is important to note that style and function are not mutually related or connected, meaning that any variation observed in lithic tools is not likely the result of any artistic expression from the tool maker. Variation is more often because of minor and major breaks, use wear, skill-level of the flintknapper themselves (Collins 1993:89). By focusing on these differences, researchers are able to sequence the lithic materials into stages or categories, and in turn better understand the "life" of the object concerning transportation, use, resharpening, discarding, etc. (Collins 1993:90). He also points out, "[F]unction based on form should be scrapped and only functions determined by context and analytical findings assigned to artifacts. This includes 'waste' flakes which, by almost every ethnoarchaeological, ethnohistorical, and archeological account, were the most frequently used utilitarian implements" (Collins 1993:92). This means that any discarded or perceived "useless" stone flakes actually held a lot of utilitarian value and reuse. If a flake is large and durable enough, it can be used as a scrapper, chopper, or any other expedient implement that requires little flintknapping or retouching.

Use-wear analysis is a key component in studying lithic tools. This method shows how the tool was used. As Collins puts it, "[U]se-wear analysis can discern areas on a tool where wear has occurred, determine the angles and direction of movement producing the wear, infer the material with which the tool was in contact, and from these findings identify the nature of the wear and the material worked. It is possible also to diagnose such things as haft wear or damage

from transport" (1993:91). Certain types of stone materials used, as well as how the tool is made and curated, influence the durability of the tool itself. Certain stone materials like slate were preferred for making ground stone tools in the PNW because it was not only a more readily available resource, but it produced higher quality ground stone tools than dacite, for example. Selecting particular stone materials affect the use-wear of the tool depending on how sharp, hard, soft, etc. it is, which in turn affect what those tools were used for (e.g. sharp, ground slate ulu knives for skinning salmon, chipped chert projectile points for hunting).

Slate in particular is a useful material when it comes to making ground stone tools, since it is more durable and has fewer manufacturing issues. Furthermore, ground stone points will generally not shatter when dropped – unlike chipped stone points – but will simply chip and can be retouched. Slate points were used in a wide variety of weapon systems, were regionally variable, and were temporally patterned since points gradually became smaller over time (Dinwiddie 2014:5) Ground slate points generally appeared earlier in the northern parts of the PNW like southeast Alaska, and then appeared further south along the Central Coast as time passed (Dinwiddie 2014:50). This resulted in a gradual adoption rather than a sudden shift from chipped stone technologies to ground stone ones. Naturally, ground slate technologies experienced this "gradual adoption" due to the availability of this resource. Slate is generally much more available and accessible than cryptocrystalline materials in the Salish Sea region (Dinwiddie 2014:7). Combined with increased population pressure along the coast, kinships controlling and limiting access to quarries, this would have forced groups or even individuals to utilize whatever stone materials they could find. Furthermore, ground slate points are often correlated with both marine subsistence strategies and increased sedentism practices (Dinwiddie 2014:2).

In terms of stone materials for flaked tools, cryptocrystalline silicates (CCS), or more commonly called chert, are the most common types found in the PNW. These range from volcanic glasses like obsidian, to crystalline volcanic rocks (CVR) like basalt, to siltstones and argillite (Ozbun 2015:2). CCS materials are typically chosen because of their "flakeability", or the ability of a flintknapper to predict how a given stone will react to being flaked – producing a conchoidal fracture, where it will break along certain lines, its hardness and durability, etc. High-quality chert materials are found along the Coast Range, in the Cascade mountains, and throughout the Columbia Plateau. Watt's Peak and Mt. Garibaldi in the Coast Range, for example, are common sources of high-quality dacite and obsidian, respectively (Ozbun 2015; Rorabaugh and McNabb 2014). Obsidian is most commonly used for projectile points, in part because of its sharp, durable edges and how it can shatter in a wound, resulting in a faster death for the victim. Ozbun argues that obsidian also may have "signaled prestige on the Northwest Coast and elsewhere outside of obsidian source areas" (2015:6). Trade is strongly implied for the presence of obsidian points in the Salish Sea region, considering obsidian quarries are most commonly located in central and eastern Oregon. This may have resulted in individuals or kin-groups attaining wealth and prestige via trade routes, especially those that followed along the Fraser River. Villages such as Scowlitz and the Marpole Midden would have benefitted from these trade routes

One other important aspect of use-wear analysis is how insoluble organic residues are often extracted and/or identified from stone tools (Collins 1993:91-92). This can further help identify how the tools were used, such as finding deer DNA on a projectile point or plant tissue on a mortar and pestle. Collins argues, "As desirable as use-wear analysis is, it is time consuming and, therefore, rarely practical on a large scale" (1993:91). Technology and

archaeological methods have greatly improved and use-wear analysis is a fairly common type of research today (Monnier et al. 2013; Stevens et al. 2010; see also Cuenca-Solana et al. 2017; Adams 2012). That is not to say that use-wear analysis does not have some complications, but it is interesting to note how far archaeology and lithic analysis has come in several decades.

Parfitt and McCutcheon (2007) argue that there is an important correlation between lithic source quality and tool technology. In general, low-quality stone materials will be used to make simple, quickly made tools. On the other hand, high-quality stone will be used to make more highly curated tools when it is sourced from a non-local quarry, and it is used to make both "formal" and "informal" tools when it is more accessible nearby (Parfitt and McCutcheon 2007:40). Curated tools are those that have been retouched or reworked in order to maintain utility. Fuld explains curation as, "[A] planned technological strategy executed in stages where tools are manufactured and stored in anticipation of future use and then transported and used at a different time and/or location. Curation anticipates future need for materials and tools at use locations" (2011:2; see also Nelson 1991:62-63). These types of tools are made with the intent of continued use past one-time needs, resulting in more durable and effective tools. Curated tools require time and skill to make an adequate tool, so a flintknapper would need to designate a certain amount of time for this task (Fuld 2011:37; see also Binford 1977). When a tool has not been curated, it typically has a shorter use-life, its shape and form is simpler, and is made from lithic materials that are easily accessible and in ample supply (Fuld 2011; see also Binford 1977).

Curation is different from use-life which refers to how long a tool can be used. Rorabaugh and Fulkerson provide a concise explanation on the differences: "[A] biface with a high degree of retouch, such as a projectile point, may have a low curation value as it has considerable potential use left although it has had a long use-life due to its production processes.

In contrast, a flake tool becomes highly curated after one use, being a highly curated tool with a short use-life" (2015:26). A stone tool that is highly curated means that it has been re-sharpened, refined, reworked, etc., to the point of usability again until its use-life has completely diminished.

When a lithic tool is sourced to a more distant location, it tends to be partially or fully complete, although trade and cultural exchange could be the cause for this (Parfitt and McCutcheon 2017:40). Obsidian lithic materials in the PNW, for example, are sourced to various locations throughout the region. According to Parfitt and McCutcheon, "In some studies, researchers demonstrated that the diversity of obsidian sources in a site appears to decrease over time and become more localized… This pattern of decreasing source diversity and localization may occur as population sizes rise and the mobility of groups becomes limited" (2017:40). In terms of the Marpole Phase and its shift in tool technologies, it is expected to see obsidian tools sourced to more local quarries not only because of increased sedentism, like Parfitt and McCutcheon state, but because of familial groups' respective proprietorship over those areas and resources as discussed in Chapter 2.

As it was also discussed in Chapter 2, mobility among complex hunter-gatherers lies on a spectrum of residential and logistical parties that set out to gather resources, which applies to food as well as stone materials. More mobile groups will have broader, more generalized toolkits that are lighter and easier to carry, whereas more sedentary groups will have specialized tools (Binford 1980; Fuld 2011). When a logistical party is out looking for whatever resources are readily available, they will not have as much time budgeted out for making better, highly curated tools that take several to dozens of hours to craft. They will try to invest as little time as possible and quickly make the tools they need. Even if these tools generally do not last as long, they at

least get the job done (Fuld 2011:43-44). At the other end of the spectrum, more complex, curated, specialized toolkits can be "time savers" themselves in that they have longer use-lives and can be easily curated or have smaller individual parts that can be easily replaced. There is no need to divest the time and effort into grinding a new adze, for example, every day when it is made of a durable material and is well-crafted (Fuld 2011:45).

Furthermore, there may be some level of correlation between material availability and logistic party strategies. If there is an abundance of materials readily available in a given area, more "expedient lithic technologies" may be crafted and utilized, whereas if the materials are further away, then tools will be more meticulously curated and durable (Fuld 2011:44). This follows reason since if a projectile point breaks, for example, it would be easier to walk at most a few miles and find the lithic materials to knap several new points, compared to traveling over ten miles to find a specific quarry for the same purpose. If it is necessary to travel a great distance to gather lithic materials, especially high-quality ones, then it would be more efficient to make a tool with a long use-life in order to avoid making several long trips for low-quality tools. Rorabaugh and McNabb refer to stone materials as "territorialized as opposed to owned… In most cases the spatial patterns of toolstone acquisition may have been influenced by how ownership of other resources patterned seasonal rounds" (2014:372). Those authors conducted tests to see whether geography or a given time period had any effect on the quality of stone materials used, and they concluded that any differences present were caused by geography. Poor quality materials used in the Salish Sea area were present throughout most of the prehistoric time periods, whereas chert materials used in Puget Sound area were of much higher quality. They concluded that direct and indirect control of certain quarries, either through group ownership or material acquisition from seasonal round patterns, were present in this region (Rorabaugh and

McNabb 2014:386). Restriction to certain quarries or even non-lithic resources such as fish traps or clam gardens, may have impacted access to both high- and low-quality stone materials. Rorabaugh and McNabb argue that, "Territoriality induced by other resources, such as salmon, structured procurement strategies. This is not to say that site occupants were limited to use of local lithic sources, but that down-the-line trade is a better model explaining the presence of the majority of high quality toolstones seen in assemblages" (2014:387). If an individual were out hunting, for example, they may not be able to access even low-quality stone for tools since a particular chert quarry may have been located near a berry patch owned by a different family; meaning that toolstone acquisition would have to be either postponed for another day or come from outside sources via trade.

1.3 Bone Tool Technology

Shifting away from lithic technology, bone tools are also a common artifact type found throughout the PNW, although it has not been as extensively studied as stone tools. Lithic tools have been used and found throughout the world, and their use has extended through hundreds of thousands of years, but this should not diminish the importance and prevalence of bone tools (Dinwiddie 2014:49-50). In fact, bone and antler artifacts are some of the most common finds in archaeological sites throughout the NWC. Fuld explains, "The physical properties, accessibility, and transportability of osseous raw materials suggest bone and antler artifacts were essential and likely crucial components of hunter-gatherer toolkits" (2011:47). Bone and antler are easily accessible through hunting, scavenging, butchering, etc.; they are durable, strong, yet flexible materials; they are lightweight and especially advantageous for mobile hunter-gatherers, in

addition to potentially allowing people to be less reliant upon lithic quarries (Fuld 2011:48; Torrence 1983:12). Sea mammal bones were also used in toolmaking, despite being more dense and therefore more difficult to shape. They were used for crafting larger tools – such as whale bone clubs – since they could be formed into a large variety of artifacts in shape, size, and style (Fuld 2011:9, 48; see also Ames 1976; Johnson et al. 2000). Bone, however, is not without its drawbacks and flaws. Long bones tend to splinter and have irregular fractures that cause difficulty when trying to form tool blanks. Furthermore, percussion knapping of bones and antlers is "an inexact, wasteful process", and the bone flakes dull very quickly, and resharpening is not an easy process (Fuld 2011:12).

There are several other advantages to crafting bone tools. They tend to break less frequently, are more easily curated, do not need to be as sharp as lithic tools, and can penetrate prey more deeply and lethally than stone or wooden tools (Fuld 2011:48; see also Knecht 1997). Bone tools also help minimize risk factors when crafting tools or projectile points, as well as using those tools while hunting, fishing, etc. (Fuld 2011:48-49). Since bone and antler are more malleable and easier to work with than stone, they can be crafted to make more specialized tool parts, as well as have more delicate, detailed engravings (Fuld 2011:49; see also Bleed 1986). An experimental study was conducted examining how long it took to craft various bone tools with differing techniques. It was found that it can take roughly the same amount of time, if not more quickly, to craft bone and antler tools as it does to make lithic tools. This of course depends on the complexity of the tool itself and whether it needs to be a well-formed, curated tool or not (Bleed 1986; Fuld 2011). Research conducted by Ellis (1997), as referenced by Fuld, showed that stone projectile points were more often used while either hunting large dangerous prey or during warfare, whereas bone points were used against smaller, less dangerous herd animals

(Fuld 2011:49-50). Temperature also affected the utility and effectiveness of stone versus bone tools: "Organic points were preferred to arm arrows in cold weather, as stone tends to become more brittle and break easier in cold weather. These comparisons of organic points to stone points show that organic points are stronger, durable, have longer use-lives and are reliable, while stone points are more lethal and deadly" (Fuld 2011:49). Again, this demonstrates the necessity for more studies required focusing on osseous materials and artifacts, or at least they need to be included more often in research surrounding tool technologies of hunter-gatherer groups.

While researching and conducting the literature review for this thesis, I was only able to find relatively few articles that discussed bone tools at some length compared to the dozens that focus on lithic tools. This appears to be another occurrence of previous PNW archaeologists focusing only on one particular aspect of prehistoric cultures similar to the "salmonopeia" phenomenon. For several decades archaeologists have primarily focused on salmon processing and the importance of salmon – ignoring the importance of other aquatic and maritime species – in PNW cultures, with several contemporary researchers labeling this obsession as "salmonopea" (Ames and Maschner 1999:116; Campbell & Butler 2010:15). A prevalence of lithic artifacts and the popularity of lithic studies, like the intense focus on dense salmon populations, should not denigrate the importance of other resources that were readily and abundantly available for these groups.

2. Lithic Technology of the Pacific Coast

The following sections examine some of the common tool technologies employed by Coast Salish and Interior Salish groups. As has been mentioned throughout this thesis, a transition occurred from chipped to ground stone tools, but it is important to reiterate that there was no complete replacement of the former by the later. Chipped stone technologies were still used by Indigenous and First Nations groups into the historic period alongside ground stone, osseous materials, as well as any new technologies introduced by Euro-Americans. Ground stone technology had been present in the PNW region before the Marpole Phase, and as Ames et al. explains, "This transition [of chipped stone to ground stone technology] does not so much involve material culture innovation, as it involves an expansion and proliferation of material culture. Although rare, ground stone tools do appear in assemblages on the coast prior to 4850 cal B.P." (2010:51). It was not a ground-breaking, novel innovation to employ ground stone tools during the Locarno Beach and Marpole Phase, but merely resourcefulness that exploited and expanded upon existing technology.

2.1 Hafted tools with chipped and ground stone materials

Hafted chipped stone tools, despite being a common tool found throughout the NWC, are similar to bone tools in that they have not been as thoroughly studied and researched as other tools or even in other regions. Rorabaugh and Fulkerson argue that this is likely due to poor preservation of coastal sites, as well as the general trends of increased bone and ground stone technologies (2015:51). Hafted tools were originally made of chipped stone tools, first appearing

in central and southern NWC sites dating to ca. 10,000 BP (Rorabaugh and Fulkerson 2015:23). By the Charles Period ca. 4500-3200 BP, hafted tools began transitioning towards ground stone points. According to Ames et al., the earliest evidence for ground stone technologies ca. 4500 BP that gradually became more common through time (2010:43). Ground stone points were "large lanceolate points with tapered shoulders and pointed or slightly rounded bases" and were potentially attached to make spears, knives, lances, and harpoon, with chipped stone hafted points were potentially used for darts and harpoons (Rorabaugh and Fulkerson 2015:23). Around the transitionary and often-overlapping Locarno Beach and Marpole Phases ca. 3000 BP, hafted chipped stone tools became more prevalent across the Salish Sea region. By 2500 BP, hafted stone tool morphology became more varied with both stemmed and unstemmed, as well as asymmetrical triangular and barbed, chipped stone points, which are regarded as diagnostic forms of the Marpole Phase (Rorabaugh and Fulkerson 2015:23). Other forms of ground slate hafted tools appeared during the Marpole Phase, with the most unique and "greatest stylistic diversity in hafted tools throughout the Salish Sea [region]" than from preceding and successive periods in the PNW (Rorabaugh and Fulkerson 2015:24).

2.2 Bow and Arrow/Atlatl

Bow technology was a common component in the Marpole Phase toolkit and was preceded in use by atlatls for thousands of years. Atlatls have been found in the Columbia Plateau dating back to 10,800 BP (Ames, Kenneth, et al. 2010:288). Bow technology could have been present in the same area sometime after 8500 BP but was more common after 4400 BP. Both atlatls and bows were used throughout the PNW region concurrently for several thousand

years until sometime after 3000 BP when arrow points became smaller, more prevalent, and more widespread. Atlatls were still in use, but they were no longer a primary tool after 1000 BP, especially when compared to bow and arrows (Ames, Kenneth, et al. 2010:313). According to Rorabaugh and Fulkerson, bow technology first began appearing in the Salish Sea region ca. 3500 BP, saw a significant increase by 2500 BP, and after 1000 BP arrows began outnumbering "larger point technologies" such as atlatls (2015:30). It is important to note that contrary to general assumptions, the atlatl did not entirely disappear after bow technology became more widespread and common.

Darts and arrows alike were part of a specialized tool kit that correlated with "greater logistical and community mobility, food storage, and wealth", although arrows were also associated with increased warfare and interpersonal violence whereas darts were not (Ames, Kenneth et al. 2010:320-321). Arrow projectile points were originally made from chipped slate stone and were generally larger and lanceolate-shaped, but by the Marpole Phase they were smaller and triangular-shaped, and assemblage sizes for chipped points were smaller compared to ground stone and bone technologies. Both chipped stone and ground slate projectile points were used for arrows, composite harpoons, darts, and lances (Rorabaugh and Fulkerson 2015:24).

Rorabaugh and Fulkerson provide several different reasons as to why this shift in technology occurred, such as increased warfare, terrestrial mammal hunting specialization, and individualized hunting strategies to attain more prestige (2015:34). Bows work better as ambush weapons and are more accurate than atlatls, as well as "increased social and environmental circumscription, which led to the emergence of social complexity" (Rorabaugh and Fulkerson 2015:24). Bow hunting can be conducted by an individual who would be taking advantage of the surplus populations of deer, moose, elk, etc., that occurred during the Marpole Phase. This

allowed an individual to experience greater economic autonomy, but bow hunting was an alternative strategy which helped a person gain more wealth and prestige for themselves and their household (Rorabaugh and Fulkerson 2015:34). It is also important to note that individuals hunting terrestrial animals with a bow and arrow did not face the same restrictions as those enforced on marine resources. This meant that a person did not need permission from family or kin groups to hunt in a particular area; they were free to "circumvent more traditional methods of pursuing wealth" (Rorabaugh and Fulkerson 2015:34). In turn, mammal remains in the zooarchaeological record of the NWC and Northwest Interior increased around the time bow and arrows became more common (Butler and Campbell 2004; Rorabaugh and Fulkerson 2015).

2.3. Celts

Celts are a ground stone tool typically used for woodworking. Any variability in different shapes, materials, etc. observed for these tools are likely due to continual reduction and resharpening that help extend their use-lives (Morin 2015:39). Recall to earlier in this chapter the discussion on how ground stone tools tend to be more highly curated because of their durability. This explains why celts are very rarely seen to have been made from flaked stone, since those techniques are not nearly as durable. Few, if any, celts have been found in the Fraser River and Salish Sea regions pre-dating 3500 B.P. Celts are most commonly found dating to the Marpole Phase, and they are abundant at the Marpole Midden site itself, especially compared with other sites. According to Morin, "The Marpole site has… at least 285 total celts and celt fragments from both excavated and surface collected contexts. To put this number into context, it is approximately the same number of celts reported for all of Puget Sound… The large number of

celts from the Marpole site makes it unique among all sites in the southern portion of the Northwest" (2015:106).

Celts can be sorted into different categories: splitting adzes, or common adzes; property celts; and tiny celts. Splitting adzes, as the name implies, were large and heavy tools, usually made from hard, dense, igneous rocks, and were used for splitting wood or for less-precise woodworking tasks, and they are generally found further north in the Prince Rupert Harbor region and south-east Alaska among the Haida Gwaii groups (Morin 2015:91; Morin 2012:438; see also Sanger 1962:30-32). Property celts were long tools (upwards of 500 mm long) made of either nephrite or even jade, were not hafted, few ever showed signs of use, and are usually found included as burial goods instead of in a midden deposit – indicating that these were high-value, prestige goods traded between kinships (Morin 2015:92; Darwent 1998:38). Again, this form of celt was not commonly found in the Salish Sea area, but instead on the Canadian Plateau, although some prestige celts have been found in the Salish Sea region and are not made of nephrite (Morin 2015:92). Tiny celts are very small, narrow tools that are "smaller in diameter than a pencil or screwdriver", and were likely used for finer, more precise woodworking crafts. According to Morin, these celts are most commonly associated with the Marpole Midden and a contemporary site at Port Hammond, so they may have only occurred during the Marpole Phase (2015:94). Unfortunately, Morin does not go into further detail describing this particular tool technology, whether they have been found at other sites, the chronology of their use, etc., nor whether they were simply regular or typical celts that had been heavily curated and reduced. It is still intriguing, nevertheless, to see how celts were so highly varied and widely distributed across the entire Northwest region. Future research into celts would certainly be beneficial in answering these kinds of questions.

There has been some debate as to whether celt styles have shifted over time, with Mitchell (1971) and Borden (1970), as quoted by Morin, arguing that earlier during the Locarno Beach Phase celts were small and rectangular, whereas during the Marpole Phase they varied in size and shape (Morin 2015:102). Burley (1980), however, proposes that celts had always exhibited varying styles and sizes through time with no distinguishing features between the Marpole Phase and earlier or later components (Morin 2015:102). There have been studies examining these temporal differences and similarities (Mackie 1995; Morin 2015) to determine if a correlation is present between celt morphology and time period. Considering the excavation bias along the PNC, though, where only certain areas have been more thoroughly excavated and studied than others, it would suffice to widen the scope of celt morphology studies by conducting more research in lesser-excavated regions like the Interior Columbia Plateau to gain a better idea of temporal celt patterns.

2.4. Maritime Tools

Maritime and riverine adaptation clearly had an impact on the developing tool technologies throughout the region. Yesner says that riverine and littoral resource gathering (i.e., fishing and shellfish gathering) have always required simpler tools and technology, whereas hunting sea-mammals or fishing anadromous fish requires more complex, sophisticated tools (1980:730; see also Kelly 2013). The Upriver Halkomelem – one of the Indigenous groups whose ancestors lived in the Salish Sea region – traditionally used dip nets for salmon fishing, even during mass harvests, and shellfish gathering generally required only a simple digging stick (Clark 2010; Yesner 1980). Deep-sea fishing and sea-mammal hunting are the activities that call

for more composite tools calling for hafted points like spears, harpoons, fishing hooks, barbs, toggles, fore-shafts, and seaworthy boats (Yesner 1980:730). Nets were also popular and commonly used along rivers and the coastline. Dip nets and reef-netting were either attached to long poles or anchored between two boats that allowed the fishermen to gather copious amounts of salmon and other fish. The Straits Salish did not have access to the Fraser River, so they had to rely upon reef-nets for their salmon harvests (Clark 2010:95-96). As was discussed earlier, certain groups and kinships had proprietorship over resources and certain areas, including locations along the river. Use and access to these locations was forbidden without permission or having some connection to that family.

Other maritime technology utilized in the PNW are weirs. Wooden and stone weirs were often built along rivers for fish harvesting, with some prehistoric weirs still visible today (Clark 2010; Elder et al. 2014). Certain tools were crafted with the intent to hunt or fish specific prey: detachable harpoon heads connected to long poles along with buoys made of seal bladders or cedar for sturgeon; U-shaped hooks for halibut; bows and arrows to hunt land mammals and some birds, where special projectile points were knapped for ducks and other waterfowl (Clark 2010:52).

3. Summary of Sites' Tool Technology

Over 5,000 tools and associated artifacts have been unearthed at the Scowlitz site, ranging from hunting tools like points and scrapers, to fishing and processing like knives and weights, to woodworking tools such as adzes and ground stone abraders. There is a mixture of ground, chipped, and pecked stone tools. Chipped stone tools are the most common, comprising

92-94% of the entire assemblage at Scowlitz (Leprofsky et al. 2000:409). This is certainly different from the rest of the central PNC region. Perhaps stone materials best used for ground stone tools were not as readily accessible as those used for chipped stone tools near Scowlitz. Basalt is the most common material present at the site, although there are tools made from obsidian, chalcedony, and chert present as well (Leprofsky et al. 2000:409). Quartz microflakes, one of the most common chipped stone tool types at Scowlitz, increased in numbers over time and may have been used for fish processing (Leprofksy et al. 2000:409). These microflakes are interesting since in the Strait of Georgia region they were replaced by ground slate knives ca. 2400 BP and completely absent from the archaeological record by 2000 BP. According to Leprofksy et al.:

> "At Scowlitz, however, microblades persist in low numbers into the protohistoric era, and here… both quartz microflakes and ground slate knives are abundant in later assemblages. This suggests that trends in artifacts within the Upper Fraser Valley do not mirror those within the Strait of Georgia region. Further, whereas both microflakes and ground slate knives may have been used for fish processing in the Strait of Georgia, their co-occurrence at Scowlitz and elsewhere suggests different uses in the Upper Fraser Valley." (2000:409)

With Scowlitz as a more interior site compared to the Marpole Midden and Pender Canal sites, it is interesting to see these differences in tool technology, despite the trade and other similarities between the Coast Salish and Interior Salish. Leprofsky et al. state that there is evidence suggesting that celts were manufactured in the Upper Fraser Valley and were then traded or transported to lower valleys and coastal sites (2009:610). Also, Scowlitz differs from Coast Salish sites where bone artifacts were excavated at Scowlitz, but they did not become more common until the Proto-Historic Period instead of during the Marpole Phase (Leprofsky et al. 2000:412-411).

Furthermore, there are noticeably fewer ground stone tools at Scowlitz, especially when compared to coastal sites, creating an even further divide in tool technology. Ground slate knives are the most common tool type, although they are primarily fragments. As for the adze blades, or celts, excavated from Scowlitz, no signs of manufacture or associated debitage were found, which could imply trade or they were produced off-site (Leprofsky et al. 2000:410). The majority of the adze blades are made of nephrite, where the closest source would be what is now Hope, British Columbia, roughly 40 kilometers from Scowlitz; or there is a more abundant source about 90 kilometers farther up the Fraser River. Nephrite materials and tools were valued by both Coastal and Interior communities for making adzes, they were traded throughout the region, and they were also present in almost all of the pithouses at Scowlitz and were thus equally accessible to the people there (Leprofsky et al. 2009:610).

As was discussed in the previous chapter, there is unfortunately few accessible data surrounding the Pender Canal site, at least not to the extent that has been provided for the Scowlitz Site. Ames, Christopher et al. wrote in their methods and dataset section of their paper, "For a considerable number of sites we were unable to locate original reports with detailed artifact summaries. In some cases, such as the Pender Canal site… the detailed reports did not include artifact tabulations" (2010:37). Carlson and Hobler do provide some information regarding this site. At DeRt 2, a mound near the canal, there are approximately 3,179 excavated materials, and at DeRt1, a burial mound, there are 1,721 excavated materials (1993:30). Unfortunately, they do not go into any further details about the tool types, the stone materials, temporal changes in the tool technology, etc. In Carlson et al. (2010), however, they do discuss some of the tool types and artifacts included in the Pender Canal burials. These include: sandstone abraders, stone files, antler wedges, chipped stone choppers, flake cores, bone awls,

hammer stones, quartz crystal microblades, small stone line sinkers, bone bard, bone and chipped stone projectile points, scrapers, knives, beads, labrets, and bone ornaments which are also known as "whatzits" (Carlson et al. 2010:9). Beyond this, no further details were provided regarding these materials. The presence of these tools is unsurprising considering the Locarno Beach and Marpole Midden Phase associations of Pender Canal.

The Marpole Midden, simply put, has similar tool types as the previous two sites, albeit with increased ground stone tools than chipped stone ones. Similar to Pender Canal, there is relatively little data published regarding the specific tool types, materials, etc., which is surprising considering the importance of the Marpole Midden. Fortunately, Burley's 1979 doctoral thesis focused on this pivotal site and provided not only information surrounding the assemblage excavated there, but it also answered questions as to why so little research has been done surrounding the midden. There were at least 1,287 artifacts unearthed from the Marpole Midden, made from bone, antler, stone, as well as "assorted historic items" (Burley 1979:515). These included projectile points, harpoons, thin ground slate knife fragments, celts, and many more tool types that will be discussed more in-depth in Chapter 6 of this thesis. Common types of stone materials used are basalt, chert, chalcedony, quartz, and slate, with imported nephrite and obsidian (Burley 1979:521).

In terms of the excavating the Marpole Midden, as mentioned in earlier chapters, there have been several previous excavations conducted there. However, there has been a "total lack of excavation records" for one of these projects that "makes them useless beyond employment as a comparative collection", or else no thorough reports were written beyond preliminary statements to the British Columbia government (Burley 1979:508). Also, major disturbances (e.g., business and residential construction projects and looting) have negatively affected the midden. Even

curation problems have occurred where various items were lost (Burley 1979:514). While it is unfortunate that so much archaeological data has been lost, not to mention the loss felt by the Musqueam community over the destruction of part of their heritage, some records and reports are available to preserve this information. Furthermore, the remaining Marpole Midden materials are well-curated at the Laboratory of Archaeology, UBC. In 2018, the Musqueam were finally given landowner rights to some of the Marpole Midden property, after years of protests against the Vancouver government and land developers.

The Marpole Midden is a clear example of how damage to an archaeological site affects multiple parties, at varying levels of harm. For researchers, vital data is lost, but for the Musqueam – similar to the experiences of other First Nations or Indigenous communities – they lost one more part of their culture and history, having already suffered greatly because of colonialism. These subjects go beyond the scope of this thesis, but again, it is important to keep them in mind when discussing Indigenous and First Nations cultures and their material remains.

Chapter 5: Entanglement and Bioarchaeology Connections

This chapter contains additional information related to what has been previously discussed – culture, environment, and tool technology – surrounding the Marpole Phase. It is information that did not quite fit in with the themes of these chapters, but it is pertinent nonetheless, especially when considering the archaeological evidence and possible explanations for the transition into ranked chiefdoms of the Pacific Northwest Coast. Ian Hodder's concept of "entanglement" helps explain the development and change seen in tool technologies over time and how they relate to cultural shifts such as hunter-gatherer mobile groups to semi-sedentary chiefdoms. The late Pleistocene-early Holocene cultures, such as Butler's Olcott site and its associated tool assemblage, provides a unique comparison and perspective on the drastic changes that lead to the Marpole Phase. Finally, a bioarchaeological examination of two individuals – one from the Old Cordilleran Phase and the other from the Marpole Phase – incorporate a human aspect to these transitions and how they were physically affecting the people who lived during these time periods. All of this information gathered together creates a more complex, holistic image of prehistoric life in the Pacific Northwest.

1. Entanglement

To briefly go over Hodder's concepts, humans depend on things, things depend on other things, things depend on humans, and of course humans depend on other humans. The latter subject is rather straightforward and should not need to be described. Humans depending on things is also fairly clear: a person needs a working car to go to the grocery store five miles

away. Things, according to Hodder, are capable of playing a much larger role in our lives than we give them credit for. Of course, some will have a larger, more direct impact than others, but things are still as much of an agent as people. Things depending on other things would be the various parts and mechanisms, along with the fuel, inside of a car that are all contingent upon each other in order for the car to start and move. How things depend on humans would be worn-down brake pads needing to be replaced or the oil changed regularly to ensure they specifically do not fail and the car overall lasts a long time for the driver (Hodder 2012:108). All of these concepts brought together is entanglement.

Entanglement is the result of these dependencies between humans and things. Hodder gives a relatively simple equation:

$$\text{Entanglement} = (HT) + (TT) + (TH) + (HH)$$

with *T* representing things and *H* representing humans (2012:88). Things, whether physical objects or abstract thoughts, have a deep interdependence on humans and on how humans connect with each other. Instead of seeing things like social complexity as a linear progression of one event leading to another, leading to a new one, etc., all of the factors and processes behind the emergence of complex hunter-gatherers throughout the PNW look more like a web or even a giant, ever-growing Venn diagram. Hodder explains: “Entanglements are difficult to understand and control because they are not contained and are difficult to predict because of the strands that seem to spread out everywhere… They are in continual movements as events happen unexpectedly and are multiplied in their effects along the complex heterogeneous strings and pathways" (2012:110).

Hodder places a heavy emphasis on the importance of things and how they relate to the rest of the world. He does this to prove his point of archaeologists' tendency to view the archaeological record through a human-centric lens. This is why entanglement is such a promising, exciting concept to incorporate with other archaeological methodologies, such as the ones discussed in Chapter 2 concerning complex hunter-gatherers. Taking things, ranging from physical objects to more abstract ideas like familial ties, and examining how they relate to each other and to humans will lead to more meaningful archaeological interpretations.

It is pertinent now to demonstrate how entanglement works with the information given in previous chapters and how they have influenced – and have been influenced by – tool technology in the PNW. As mentioned earlier, there were climate changes that occurred slightly before and during the Marpole Phase ca. 3500 BP, leading to fluctuating sea levels, warmer ocean temperatures, along with long, dry summers and droughts (Leprofsky 2005:277). Terrestrial resources like deer, elk, and berries, as well as riverine and littoral resources, flourished during this time with more predictable harvesting patterns. The warmer, longer summers would help these resources better survive the winter, and the fires would get rid of any old growth to help encourage new growth, allowing for more ecological diversity (Leprofsky 2005:278). In terms of entanglement, this is clearly an example of "Things Depending on Things". Increasing the temperature of water by even one degree can have far-reaching impacts, affecting the life cycles of fish but also people's subsistence patterns as well.

As has been discussed throughout this thesis, tool types underwent change during the Marpole Phase and help further exemplify entanglement. Ames and Maschner say that in response to resource intensification, "There is often no alternative but to gear… technologies and economies to make use of the few foods or useful environments available" (1999:128). The

earliest inhabitants of the PNW ca. 13,000-12,000 BP would have had relatively generic toolkits to accommodate for a broad subsistence diet. For them, these early groups would have needed more generalized, yet dependable tools. Where the stone tools would need to be continuously maintained to ensure productivity, such as re-hafting a projectile point onto a spear or re-sharpening that projectile point, this is a perfect example of "Things Depend on Humans".

During the Marpole Phase, however, when subsistence patterns changed and certain resources were gathered, those toolkits would become more specialized for processing and harvesting those resources (Ames and Maschner 1999:138). Morin (2004) describes how the technological and functional attributes determine what tool type is used for which job, as well as the importance of the materials used for said tool. He references ulu knives from the Northwest Coast and how they are used in processing salmon quickly and effectively (Morin 2004:283). Once again, this is all entangled with the climate, subsistence patterns, and resource intensification. Humans may be the ones making the tools, but they are certainly not the main agents or instigators of this change.

All of these factors – the social ranking, the subsistence patterns, climate change, toolkits, and resource intensification – work together and are entangled within each other. This does not even cover the interconnected influences of trade routes, warfare, religion, mortuary practices, or any other cultural phenomena that were emerging during the Marpole Phase. Earle (1997) describes in the majority of his book, *How Chiefs Come to Power*, on how the combination of economic, military, and religious power contribute to the rise of chiefdoms. He states in his conclusion:

> "Surplus generated through selective control is reinvested to expand the technological base and to further increase surplus. The intensification and reorganization of the economy

> create conditions making control feasible – concentrated (circumscribed) resources, major facilities (such as irrigation), complicated manufacturing procedures, and exchange dependent on transport technologies such as ships… To the degree that the chief builds and controls the flow [of things in the economy], he determines what flourishes and what perishes. Chiefly control over critical nodes of distribution in the material flows of the economy translates into control over the many fields of political action" (Earle 1997: 203-204).

Individuals in the PNW who were able to attain a certain amount of wealth or control over certain resources (e.g., popular fishing streams or hunting grounds) began exerting that power over others, attaining wealth, and then re-distributed that wealth and resources to others within their group. Prehistoric groups relied heavily upon boats, kayaks, canoes, etc. for their livelihood – and still do today – which would have included use for inter- and intra-regional trade. Trade was present in the PNW, as evidenced by the transport of non-local resources such as dentalium shells and obsidian, not to mention how the Scowlitz villages located alongside the Fraser River were likely a central trading post for the region as a whole. Regarding major facilities, agriculture was never utilized before Euro-American colonization. Resource intensification (i.e., fishing), storage, and ecological cultivation (i.e., controlled fires) would fall under this category, however, since these were well-established social mechanisms by the Marpole Phase, which flourished during this time period. This would have required cooperation between clan members and their heads of households to ensure there was enough food, they had the tools necessary for obtaining and processing said food, and that there was adequate housing and protection. Humans depend on humans in order to survive as a community, as a chiefdom.

2. Olcott Culture and Site 45SN14

Shifting away from archaeological theory, examining the cultural origins of Indigenous groups in the PNW will help demonstrate the significant developments in tool technology and cultural practices like sedentism, resource intensification, and the shift from egalitarianism to chiefdoms, and how they flourished during the Marpole Phase. In terms of entanglement, it is important to understand the early strands of this complex, cultural web and how they influenced later actions of prehistoric groups. Furthermore, research surrounding the earliest inhabitants of the PNW has not been as popular or well-examined as that focusing on the Marpole Phase or the Central Coast region. As will be discussed later, the Olcott Site in particular has not been thoroughly studied despite its importance as a type-site for its respective time period. Some perspective on the achievements and growth of human activity within a given region will only help anthropologists better understand the people they study.

As mentioned previously, Indigenous groups have been living in the Pacific Northwest since at least ca. 13,000-12,000 BP. Various researchers throughout the 20th and 21st Centuries came up with their own terminology to describe the archaeological period between the late Pleistocene and early Holocene when people were first appearing in the region. These terms lack any kind of consistency or standardization, ranging from “Early Hunters”, “Archaic”, “Trans-Cascadian”, and “Old Cordilleran”, with “Olcott Phase” being the most recent and most widely accepted term (Schalk 1988). During this time period, the environment underwent changes with warmer, wetter winter months, along with more abundant pine trees and sagebrush populations (Chatters 2014:35). Lithic technology also experienced a transition from the Western Stemmed Tradition to the Old Cordilleran Tradition. The former was a tool technology that was

found relatively frequently throughout the region and lasted from ca. 11,600 BP to 8500-8000 BP (Chatters 2014:36). The Western Stemmed Tradition people were hunter-gatherers:

> "Western Stemmed Tradition people followed an annual pattern of migrations throughout the landscape that exploited different plant and animal resources in distinct habitats by using implements specially designed for each prey type. They were primarily hunters who took their prey with both atlatls and bolas… Old Cordilleran people spent most of their time along major rivers, subsisting primarily on fish, freshwater mussels, and small mountains. In the high mountains they hunted larger prey, particularly deer… Their toolkit was generalized and versatile" (Chatters 2014:41).

These groups used this technology to be fairly versatile in hunting down a variety of prey, as well as fulfill domestic tasks like scraping hides, drilling, cutting, etc. They worked lithic materials to make more complex, composite tools to capture fish or deer more efficiently. These tools took longer to make but made the hunting excursion shorter (Chatters 2014:37). Moving into the Holocene in the Columbia Basin, the Old Cordilleran Tradition appeared ca. 9300 BP and actually had simpler bone and lithic technology than the Western Stemmed Tradition. However, it did have improvements in food processing technology, like grinding stones, stone-boiling, and earth-oven cooking (Chatters 2014:39041). This should not imply that food storage was central to the Old Cordilleran groups, but that there was a cultural migration of people moving away from the coast to the interior, riverine environment (Chatters 2014:41)

In regard to the Olcott Phase and its associated technology, Butler was the first researcher to examine the Olcott site near what is now Puget Sound, Washington (1961:47). It is important to point out that Butler originally was a sociologist, not an archaeologist, so some of his claims and writings do not answer certain questions or issues in the same way that an archaeologist or anthropologist might. In no way does this mean to diminish Butler's findings and contributions

to PNW archaeology, but it is recommended to take his conclusions with some reservations. Upon examining the Olcott Site (45SN14), a private farm near the Stillaguamish River, Butler discovered multiple stone cores, flakes, knives, spalls, choppers, heavy spall scrapers, and projectile points (1961:48; see Figures 7 and 8). Leaf-shaped projectile points are the strongest indicator that this site is associated with other Pleistocene-Holocene period sites with similarly shaped points. According to Limber and Noll (2019), most Olcott Phase materials were gathered locally and are primarily made from crystalline volcanic rock (CVR) or chert. Butler discussed how 45SN14 appeared to have been a quarry, but the lack of nearby raw stone materials ruled out that probability and that cores and blanks would have been transported to Olcott (Butler 1961:48; Schalk and Yesner 1988). Because of its early age and its lithic assemblage, 45SN14 became the "type site" for other sites dating between 10,000-4,000 BP, although some recent studies suggest that the Olcott Phase may have been as young as 7,000-2,600 BP (Chatters et al. 2011:13-14).

While the assemblage has not yet been accurately dated, similarities between the Olcott tools and other Old Cordilleran tools demonstrate the antiquity of Olcott, probably ca. 9310 and 7880 BP (Chatters et al 2011:30). Because of its old age and poor preservation, the daily lives and cultures of Olcott Phase groups is currently not well known. However, Butler did argue that these early groups "[F]irst migrated into western North America down the coast and Cascade Mountains, leaving behind a distinctive stone tool assemblage characterized by long, narrow, thick, laurel-leaf-shaped, often-serrated edged "Cascade" projectile points, leaf-shaped knives, an abundance of cobble tools… named this industry the 'Old Cordilleran Culture.'" (Butler 1971:63; Chatters et al. 2011:29). The Old Cordilleran Culture, or Olcott Phase, was widespread from the Pacific Coast to Central British Columbia to Oregon, to as far east as the Rocky Mountains, making it one of the "best represented periods in terms of numbers of archaeological

sites" in the PNW, notwithstanding the aforementioned lack of consistency in terminology or poor preservation (e.g. highly acidic soil and bioturbation) of archaeological materials (Chatters et al. 2011:31). Generally, Olcott sites are located "some distance from the present shore of the Sound or Straits, and from major river valleys, generally on terraces cut by secondary streams, often 100 feet or more above present sea level" (Schelk and Yesner 1988).

Similar to the Old Cordilleran culture discussed earlier, Olcott Phase subsistence patterns were likely mobile foraging, although researchers have not yet concluded the level of terrestrial versus aquatic resource gathering. While nothing was found directly at or around 45SN14, other Olcott Phase sites in the Puget Sound area show some evidence of faunal remains (e.g. salmon, birds, ungulates, freshwater mussel, and small rodents) and food processing, primarily cooking via an 8000-year-old earth over that could have been used for preparing plants like camas root for eating (Chatters et al. 2011:31). Furthermore, there are issues surrounding Olcott lithic technology. What little has been written about the subject is "often incomplete, lacks consistency of terminology among authors, and, usually, definitions of tool classes… Many of these efforts have been incompletely analyzed, incompletely reported, or ignored certain classes of artifact (Chatters et al. 2011:38). Also, Noll (2019) argues that there is actually little data or identification methods that assign Olcott materials to the early and middle Holocene because there are relatively few materials at these sites that can be accurately dated. This appears to be a trend for PNW archaeology as a whole, where more consistent identification methods for tool technology, as well as using the same terminology for the various phases and/or traditions, is needed.

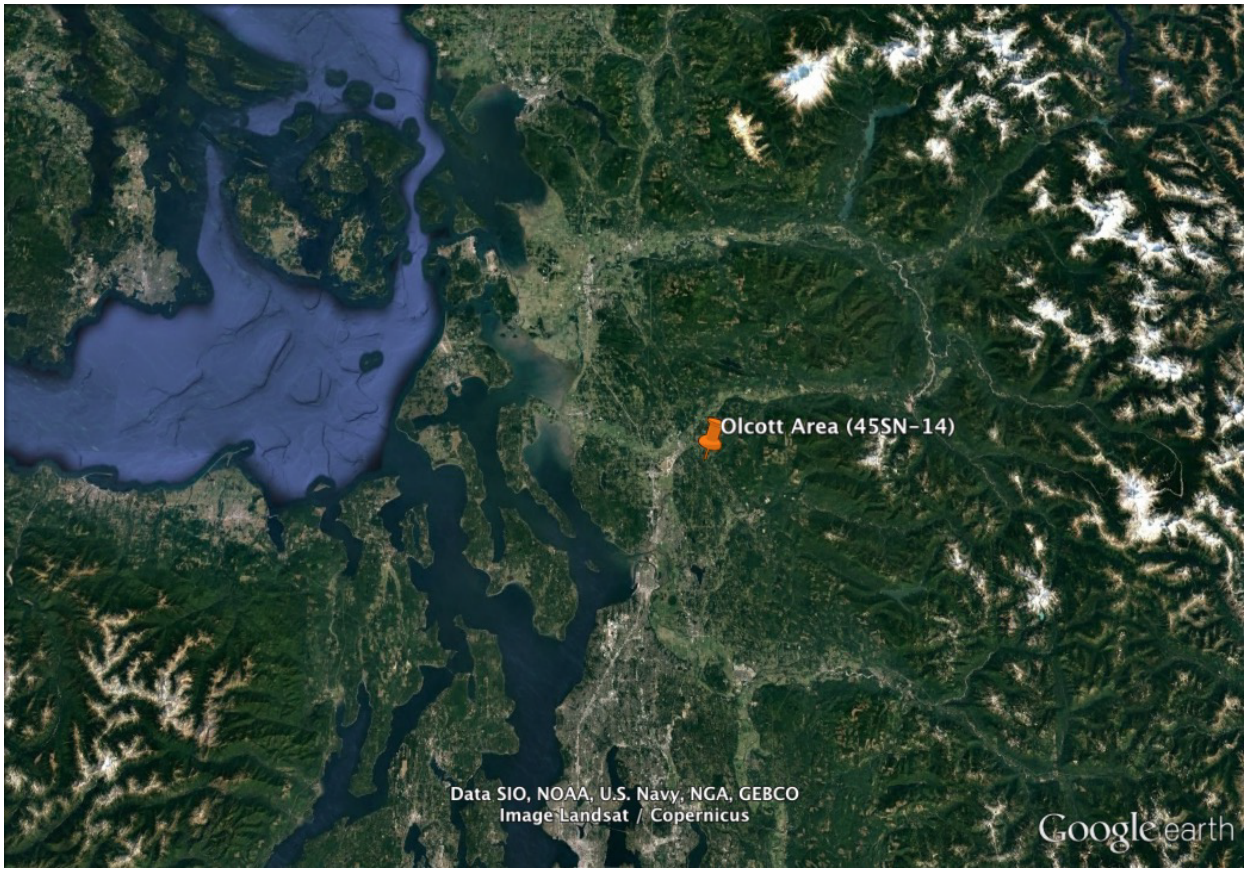

Figure 7. The Olcott Site (45SN14)

Figure 8. The Olcott Site Near the South Fork Stillaguamish River

3. Bioarchaeological Evidence for Cultural Change in the PNW from Olcott to Marpole

Finally, a bioarchaeological approach to understanding cultural change throughout the Pacific Northwest will help produce a more holistic and encompassing picture of these prehistoric populations. This will provide extra support for the social changes from egalitarianism to ranked societies in conjunction with the previously discussed shifts in tool technology. It connects with Hodder's Entanglement theory and how the environment, tools, subsistence patterns (i.e., "Things") and people all influence each other (e.g., Humans depend on

Things). It is easy to get lost in the more abstract or non-human components of archaeology, especially when trying to be subjective and not let human-centric biases interfere with interpretations. However, understanding human behavior is still at the heart of anthropology and archaeology. It is difficult to pinpoint when and how exactly chiefdoms arose via archaeology since those are non-physical cultural constructs. However, by incorporating different perspectives (e.g. ecology, lithics, and bioarchaeology), it is easier to see the effects of these cultural shifts and how they all connect with each other. Examining skeletal remains of the people who lived during transitionary periods like the Olcott and Marpole Phases is one of the most direct ways to see these cultural changes.

Anthropologists have discussed how there is a physical difference for egalitarian hunter-gatherers and agricultural, sedentary, stratified societies. Mortality rates are higher for hunter-gatherers, they have fewer dental caries and infections than agriculturalists, and societies with stratified classes exhibit a difference in access to nutrition and height statures favoring the wealthier individuals (Larsen 1987:378). Foraging populations, such as those in the Pacific Northwest, exhibit high incidences of porotic hyperostosis – spongy or porous bone growths commonly found in the crania and eye sockets – particularly in pre-adults (Larsen 1987:360). While preservation may not always be ideal for the area in general and for archaeological or skeletal remains in particular, a wealth of data has come out of the PNW. Bioarchaeology has been conducted throughout the PNW, but not much has been done looking at a temporal and spatial comparison of skeletal remains as a means to observe social and cultural change. By examining skeletal remains from periods spanning across 5,000 years, starting with Kennewick Man, and ending with a Marpole Phase woman, some light can be shed on the physical effects of these changing times.

Kennewick Man, at least among archaeological circles, is one of the most well-known skeletal remains to come out of the Pacific Northwest. Discovered in the early 1990s, he is a nearly complete skeleton found near Kennewick, Washington in the Columbia Basin, and has recently been repatriated to contemporary Native American tribes. He died ca. 8000-8500 BP during the transitionary Olcott Phase (Chatters 2014:35). He was about 35-40 years old when he died, with several healed fractures across his body. There are two healed depression fractures along the left side of his cranium (Owsley et al. 2014:149). He has several fractures across the right side of his chest that affected at least five ribs. Kennewick Man likely had difficulties breathing from these injuries, such as coughing or shortness of breath, possibly for several months. His lifestyle apparently prevented him from healing and recuperating in a timely manner (Owsley et al. 2014:168). A stone point is visibly lodged in his right posterior ilium or the back of his right hip. The point struck him from the front, and the angle where it hit him implies that he tried to move out of the point's trajectory. The injury had been healed for long enough that researchers believe Kennewick Man experienced this event while he was a young adult or teenager (Owsley et al. 2014:179). One last notable skeletal injury is a glenoid rim fracture on his right scapula that did heal properly. Owsley et al. interpret this as continuous use of his arm in a fast, rapid movement, possibly for throwing an atlatl dart (2014:156-157). Considering the location of the fracture, Kennewick Man likely experienced some pain in his shoulder and potentially affected his hunting and fishing activities.

Kennewick Man retained all but two of his teeth, missing only the right maxillary third molar (lost while he was alive) and the left mandibular third molar (lost postmortem). Tooth wear is present and varies in degrees, with "the highest level of crown wear on the maxillary first molars, first and second premolars, and lateral incisors" (Owsley et al. 2014:152). His teeth have

minimal calculus deposits, but there are, surprisingly, no carious lesions or abscesses present. Considering what Larsen (1987) said regarding the dental health of hunter-gatherers, this is in line with the foraging diet prevalent at this time in the Columbia Basin. However, there is evidence that extreme molar attrition is present for Kennewick Man, who would have chewed on fine abrasives and some coarse particles present in the food he was eating (Owsley et al. 2014:152).

Kennewick Man had high stable carbon and "exceptionally high" stable nitrogen isotopic values (Schwarcz et al. 2014:319). He likely ate mainly salmon, in addition to other varieties of fish, and he could have eaten animals that also consumed said salmon, like black bears or eagles. The analyses show that Kennewick Man's diet did not significantly include terrestrial resources like deer or rabbits, or at least not enough to counteract the high amount of marine and riverine foods he subsisted upon. An explanation for this highly selective dietary behavior is that Kennewick Man had previously lived along the Pacific Coast and subsisted upon the pinnipeds, fish, and other littoral resources of that area. He then would have made the 500 km trek inland and lived near what is now the Oregon-Washington border, dying before his collagen levels assimilated to his new Columbia Basin diet (Schwarcz et al. 2014:319). Kennewick Man may have been one of the Olcott Phase-peoples who decided to travel further inland in search of food and resources. This migration as a whole spanned several centuries, and Kennewick Man may have been traveling alone when he died. There is also the incident with the projectile point lodged in his hip and multiple rib fractures that cannot be clearly explained. The point could have been a hunting accident, or more dramatically, was the result of an act of violence. Warfare was not prevalent in the Pacific Northwest at this early period, so a planned attack is unlikely. Kennewick Man's rib fractures could have been from another incident of violence, such as

someone kicking him, or maybe he fell down a hillside and incurred the injuries that way. If he did travel more than 500 km, an accident is reasonable to assume.

Moving forward in time to the Marpole Phase, a woman from the Pender Canal site helps demonstrate the physical and cultural changes that had taken place since the Olcott Phase, as well as the contemporary practices of the Marpole Phase. The woman (Burial 84-42), amongst 40 other individuals found at the site, is estimated to have been no less than 50 years old when she died. Some degree of degenerative joint disease was observed in bony charges along the spine and knees, and 97% of the protein in her diet came from marine sources. Burial 84-42 likely held a relatively high social status due to the presence of red ochre associated with her burial, and she was also the only individual at that site with deliberate cranial deformation (Skinner et al. 1988:280). Red ochre, at least in the Pacific Northwest, was believed to have protective properties and would be sprinkled over the interred individual at their burial (McKay 1999:91). While red ochre may not have expressly denoted Burial 84-42's high rank, clearly it is a demonstration of some cultural practice and symbolism and singled out this woman from the other burials, who lacked the pigment. Cranial deformation arose as a symbol of social status during the Marpole Phase and was practiced throughout the central coast of the PNW; although it became more common for everyone except slaves to have cranial deformation by historic times (Ames and Maschner 1999:183).

What is remarkable about Burial 84-42 is her teeth. All of her teeth, though excessively worn and the mandibular teeth exhibited severe crown reduction, were present premortem. She also had a severe case of periodontal diseases like gingivitis where her gums would have been very inflamed, and her teeth were beginning to loosen. Abscesses are present on both sides of the jaw, and the roots of two molar teeth exhibit hypercementosis, meaning that both roots were

highly inflamed (Skinner et al 1988:280-281). Beyond the poor state of her teeth, evidence of intense burning is present on the abscessed teeth. Heat therapy for teeth has been observed in various cultures at different times around the world, ranging from cauterizing a tooth socket with heated iron in 5th Century India, to a Haida individual in Queen Charlotte Islands near Alaska who had a decayed tooth's nerve ending cauterized with a piece of flint (Skinner et al 1988:279). The burned teeth of Burial 84-42 have "dark brown to black discoloration [that] can be seen at the junction of the coronal dentine and buccal root surfaces, centered on the distal root of the first left molar… There is little doubt that these teeth have been burned" (Skinner et al. 1988:281). Temperatures around 350-400˚C would explain the cracking in the root and dentine, and the teeth could have been exposed to this extreme heat anywhere between fifteen minutes to an hour (Skinner et al. 1988:281-282).

Seeing as to how it was only on the abscessed teeth this burning is present, it was likely a last attempt to help relieve the pain this woman had been enduring. However, Burial 84-42 likely died during the procedure. Skinner et al. state, "It would be virtually impossible to subject teeth in a live, conscious person to heat of the intensity required to produce dramatic clinical changes in the teeth without killing the person and involving adjacent soft tissues and bone" (1988:282). Also, chunks of charcoal were discovered with the remains 30 cm from the face, and there is no evidence that the burned surfaces were cleaned afterwards. This all suggests that the heated materials were simply left in the mouth after the woman died, where they continued to burn through the soft tissue (Skinner et al. 1988:283).

The burning is present only along the abscessed teeth, and for what it is worth, the authors assert their expertise in discerning experimentally burnt teeth from those found in a historic and prehistoric context. They "reject tissue necrosis as the cause of the tooth blackening

since in our experience this effect is only observed in frankly carious teeth" (Skinner et al 1988:281). Granted, this study was conducted about thirty years ago, so methods and identification have certainly changed since then. Revisiting and re-analyzing the Burial 84-42 woman, if possible, could help resolve any questions still surrounding her. What can presently be said about her is that she is one example of many showing cranial deformation, and thus exhibiting the social stratification not found with Kennewick Man. The medical care provided for her, while ultimately lethal, shows that medicinal knowledge was present in the area. Also, the worn-down state of her teeth indicates that grinding stones were still used for processing food, if not used more intensively given the more advanced state of wear for Burial 84-42. Oral processing of materials like cedar bark for clothes or fish nets, ethnographically common practices, would have also led to dental wear (Skinner 1988:278).

These two individuals spanning across thousands of years throughout the Pacific Northwest region help demonstrate the different cultural changes that developed there. Of course, caution should be exercised since two individuals are not representative of entire populations. Whereas Burial 84-42's cause of death is fairly clear, Kennewick Man experienced some lethal event that is not clearly observed through a bioarchaeological analysis. Nevertheless, these individuals help demonstrate not only the changes but also the similarities consistent through time. Processing food via grinding stones was present from Kennewick Man's time in 8500 BP to the Marpole Phase in 1090 BP, even if they were used at differing intensities. Consumption of marine resources, primarily salmon, is another trait shared by these individuals. They also all died during transitionary periods, whether it was climactic, technological, or both. The most marked differences between the two individuals lies with Burial 84-42's cranial

deformation and her association with red ochre. The fact that more significant differences are associated with her is not surprising considering how revolutionary the Marpole Phase was.

Entanglement can also shed further light and context on the differences present between Kennewick Man and Burial 84-42, as seen by social stratification and differential access to resources. A further piece of evidence showing that the Pender Canal woman may have been an elite is by eating more "premium" resources, like nutrient-rich salmon or other prized foods reserved only for the elite. This in turn may have affected her dental health, similar to how gout is labeled as a "rich man's disease" where royalty consumed wine, red meat, and other foods that commoners did not have ready access to. It is not like in certain agricultural societies where they focused on wheat products and primarily consumed bread and beer. Indigenous peoples were still consuming various terrestrial mammals, birds, berries, as well as marine and littoral foods. For both the Olcott Phase and Marpole Phase, a broad spectrum diet is employed as evidenced through the continued, persistent use of chipped-stone tools and similar tool types through the millennia (described further in Chapter 6). Some of the technology in the PNW may have undergone some changes and developments, such as developing species-specific tools like the U-hook for catching halibut. But where core aspects of technology in the PNW remained the same for so long, Indigenous peoples were still gathering as many different sources of food as they could. The Pender Canal woman would have had this varied diet along with the non-elite, but she in particular may have consumed more salmon due to her status. This in turn could have caused her severe periodontal diseases.

Furthermore, cultural practices like the potlatch may have contributed to this phenomena. Yes, the non-elite would participate in the potlatch and eat the surplus foods, but the premium resources were likely reserved for the elite and visiting heads of households. Where the potlatch

was a ceremony celebrating and confirming the social rank of a new head of household, or even emergent individuals coming into their own power, it makes sense that they would reserve the more highly-prized foods for themselves and their guests. These different "strands" – diet, differential access to resources, dental health, cultural traditions, tool technology – are all entangled within each other. In the case of the tool technology specifically, Entanglement can stretch out beyond a given cultural phase and examine any cultural phenomena across thousands of years. Employing Hodder's theory helps tie together all of the different anthropological connections in any archaeological research.

To date, many bioarchaeological analyses have been conducted in the Pacific Northwest region. Unfortunately, researchers have to work around several biases, such as poor preservation environments for biological remains, and most archaeological studies are conducted along the coast. These human remains are also limited to certain types and amounts of research that can be conducted in order to protect ancestral remains of Native American tribes and adhere to NAGPRA law.

Future bioarchaeological studies, when possible, should continue to examine human remains in a more holistic, comparative way. The authors referenced in this section all primarily focused on the burials in context within their respective site. Little interpretation was given on the cultural climate at large. Providing an overarching interpretation of the life and behavior of a group in addition to a thorough bioarchaeological analysis may not have been accessible for these respective authors. Revisiting the Pender Canal site and Burial 84-42 could produce some new interpretations, as mentioned earlier.

4. Conclusion

The topics discussed here – Entanglement, the Olcott Phase and its type-site 45SN14, and bioarchaeological data of the PNW – gives credibility to this thesis's main argument that there is some level of correlation between tool technology and the appearance of chiefdoms. Entanglement connects all of the varying parts of PNW history, culture, environment, etc., and explains how they all affect each other at some level. Warmer weather patterns resulted in denser fish populations, leading to processing and storage practices led by certain individuals or heads of houses, processes that required more specialized tools to handle this new workload. The Olcott Site, as stated previously, provides unique information and perspective regarding the impacts and changes technology and groups experienced leading up to and during the Marpole Phase. The bioarchaeological analysis given here also provides this unique perspective by including people into the oftentimes artifact-heavy archaeological discussion. It is difficult to argue from only looking at the tools and materials excavated from archaeological sites that abstract cultural phenomena like ranking and chiefdoms were occurring in that area. However, by including other pathways of information like bioarchaeology or zooarchaeology, or by expanding the field of focus to incorporate other regions or time periods, it is easier to form reasonable, plausible conclusions.

Chapter 6: Methods and Results

The questions originally set out by this thesis asked: Why was there a shift in technology from chipped stone tools to ground stone and bone tools? Is there any kind of variation between the different sites examined? How does this correlate with the rise of chiefdoms and increased social complexity along the Pacific Northwest Coast? My hypotheses were that shifts in tool technology work in conjunction with changes in cultural practices (i.e., chiefdoms, controlled fishing grounds) and the surrounding ecology (i.e., warmer temperatures, increased fish populations). Also, since certain families controlled particular areas that included stone quarries, individuals would resort to utilizing more bone from mammals they hunted for their tools and procure stone through more easily accessible materials instead of traveling to a quarry.

Where my three original sites – the Great Marpole Midden, Scowlitz, and Pender Canal sites – are within the same general region with related cultural families, their tool technology would be relatively similar. However, some variation would be expected considering Pender Canal would have relied the most upon marine or littoral resources, the Scowlitz village would have had the most terrestrial mammals remains and/or bone tools, and the Marpole Midden would have had a mix of both marine and terrestrial remains. The Marpole Midden would have the most varied toolkit, particularly one focused on fishing and processing strategies, since the other two sites have materials primarily dating to the Locarno Beach Phase and may not have developed the need for intensified fishing procurement like the Marpole Phase that followed it.

Initially, I intended to examine collections from the Marpole Midden, Scowlitz, and Pender Canal sites, comparing and contrasting the results. I would have asked questions such as: did one site have more ground stone tools? did one have more stone celts? did they all have a

significant number of bone tools, etc.? However, the emergence of the COVID-19 pandemic affected this research plan. The establishments housing these collections –the Laboratory of Archaeology affiliated with the University of British Columbia and the Simon Fraser University Museum of Archaeology and Ethnology– were closed, and the Canada-U.S. border was restricting travel to essential business only as of the Fall of 2020. Through personal communication over several months, I contacted various heads of departments in order to see if there was a way for me to still access these collections, particularly if the materials could be shipped to the Idaho Museum of Natural History. Unfortunately, I either never heard back from different collections managers or was told that no one was available to package the materials to send them to IMNH. Furthermore, neither the Laboratory of Archaeology nor the Museum of Archaeology and Ethnology have online, digital collections that I could access. The University of British Columbia's Museum of Anthropology does, however, have an online collection easily accessible by the general public, but those materials are generally comprised of baskets, shirts, art, etc. As interesting and important as these materials are, they were not pertinent to my studies.

Upon hearing this, I began focusing my efforts into obtaining and accessing as many site reports, articles, and virtual collections as I could, collecting as much relevant data pertaining to my original research questions as possible. In early Fall 2020, I approached Amber Tews, the Anthropology Collections Manager at IMNH, to help me obtain more concrete data involving stone tools of the PNW. This is when I began incorporating the Olcott Site into my thesis; it vastly predates the Marpole Phase by several thousand years, but it was physical and, more importantly, easily accessible data I could obtain. I decided that the Olcott Site would provide some important context for the changes that emerged around the Marpole Phase. It would help as a starting point or baseline for stone tools and how drastically they had changed from ca. 12,000

B.P. to 1500 B.P. Having conducted a basic analysis of the data I have gathered, which will be discussed in-depth for the rest of this chapter, my research questions remain the same albeit with some additional questions: How, specifically, has tool technology changed over time in the Pacific Northwest? Are there any commonalities between the sites, notwithstanding their temporal differences? Does the environment and climate change have an impact on the types of tools created?

1. Research Methods

I was able to gather demographic data on tool technology from the Marpole Midden from a doctoral thesis written by Burley (1979). Despite disturbances, construction projects, and poor early excavation practices around the midden, Burley provided tables that listed the different types of tools, how many there were, what time period they were most likely associated with, and he also listed the different types of materials used for the tools. In all, Burley examined 1,287 stone, bone, antler, and historic components that had been excavated at the midden (Burley 1979:515). He did not break down which tool types were made of what stone, unfortunately, which would have helped determine whether certain materials were more likely used for certain tools; but that will certainly be a source of future research. I transcribed the information Burley provided and created Excel spreadsheets to better organize and create charts of the data. In his thesis, Burley also provided the source locations for the obsidian tools present at the Marpole Midden, for which I created a spreadsheet and mapped in Google Earth.

I was not able to gather any specific data for the Pender Canal assemblages outside of general information gathered from various articles (Carlson and Hobler 1993; Carlson et al.

2010). These articles did mention the various tool types discovered such as projectile points, as well as provided some locations for stone and shell sources. For the Scowlitz site, I also was not able to gather much extensive or specific data on the tools located from there outside of general information. Fortunately, however, Blake provided data on the demographics and source locations for the 33 obsidian artifacts excavated from Scowlitz (2004:105). From this table, I created an Excel spreadsheet and chart, as well as mapped out the source locations on Google Earth.

The Olcott Site has produced the most data since I was able to conduct my own analysis of those materials and could thus control what information I was looking for. At the IMNH I sorted through all the Olcott materials, totaling 94 artifacts. Using basic calipers, I measured the length, width, and thickness of each artifact in centimeters and identified the tool type or style, which was later corroborated by Dr. Speer. After inputting all of this data into a spreadsheet, I photographed all of the materials individually using a digital camera owned by the IMNH, photographing the front and back sides of the artifacts. Butler originally identified the materials found at the Olcott Site as made primarily from basalt (1961:48). However, after consulting with Dr. Leif Tapanila, the Museum Director of IMNH and geologist, he said that they were likely made from either siltstone or argillite.

To further expand upon my measurements of the Olcott assemblage, I accessed the Burke Museum's virtual collection, who houses materials from Olcott and related sites. I searched for Olcott stone materials dating from 1960-1961, around the same time as Butler's original work, ensuring that the search yielded results most closely related to the materials at IMNH. I downloaded the results into a PDF file that included stone type, associated site, weight and length, as well as the stone material it was made from (primarily crystalline volcanic rock).

Although other sites were included in the search results, the majority of the tools come from 45SN14, so I only focused on collecting data from this site. This is Butler's type site for Olcott-related technologies and is from where Tews and I both believe that the IMNH materials originate. In total, I collected data from 714 stone tools, with the majority being flakes and cores. Following Dr. Speer's advice, I only included 10% of the flakes and cores in my results, since such high numbers would affect the grand totals. This leaves 277 total from the Burke that were included in this study, and a total of 371 for all the Olcott-related artifacts. Going through the PDF file of the Burke materials, I inputted the data into its own spreadsheet and then created tables and charts comparing the Burke and IMNH Olcott data. No source locations were provided with the Burke collection, and no work has yet been done for the IMNH materials, so at this time there are no confirmed areas where the stone materials came from.

2. Results

Comparing the different sites proved more difficult than originally anticipated. Not all of the data had common data points: some had weight listed but not width; others had no weight but included thickness; in the case of the Marpole Midden, no measurements were provided at all, but it did have the most detailed and extensive list of tool types present. As far as I know, there is no standardization in data collection or measurements for the Marpole Midden, Scowlitz site, or Burke materials. Considering the complications surrounding these sites that I have already discussed (e.g. poor excavation records, lack of consistent labeling regarding the Olcott Phase, changing archaeological theories), this is not surprising. Nevertheless, I compared what data I could between the different sites and was able to come up with meaningful results. As for the

stone material source locations, there is a fair amount of overlap between the sites, as well as regional similarities – primarily in the Fraser Canyon area. Olcott is the main exception due to its lack of lithic sourcing. It is likely that stone resources were obtained relatively locally and possibly from the same sources as the other sites, particularly the Scowlitz site since it is the closest land-based location to Olcott (approx. 118 km). Pender Canal is the closest at 110 km, and the Marpole Midden is approx. 140 km. from the Olcott site.

2.1. All Sites Results

As previously mentioned, there is a significant amount of variety in the tool types between the Marpole Midden, Scowlitz, and Olcott sites, especially when comparing the Marpole-phase sites with the much older Olcott one. The data from each site will be broken down into their own subsections, but it is first important to describe the total data examined from the three sites. The Marpole Midden is the largest assemblage with 1,287 artifacts (Burley 1979:515), followed by the Olcott site with 371, and then the Scowlitz site with only 33 (Blake 2004:105). As mentioned in Chapter 4 regarding tool technology, there have actually been over 5,000 artifacts excavated from Scowlitz, but I was only able to examine this small fraction of the complete collection. There are drawbacks in making comparisons between these sites, but as the subsequent sections will demonstrate, the Scowlitz assemblage still provides interesting and helpful data.

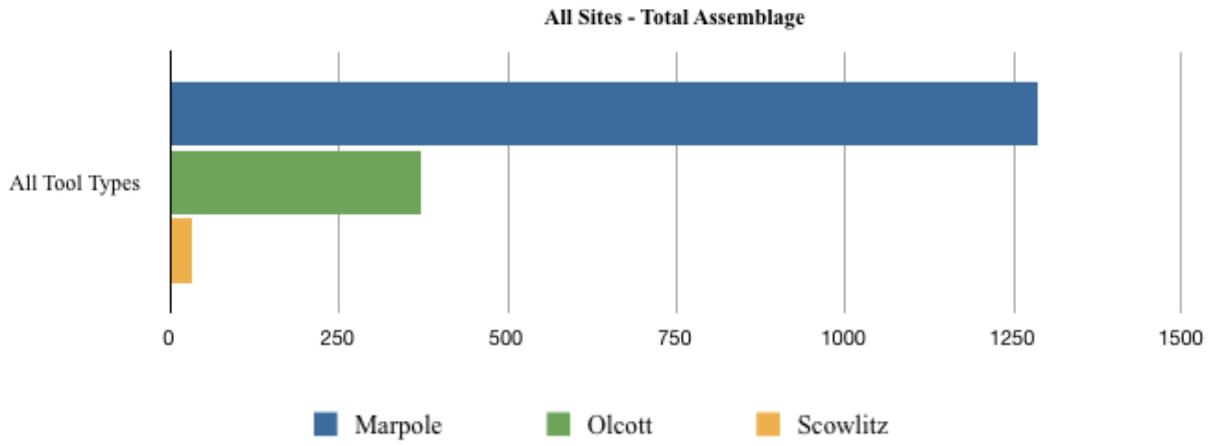

Figure 9. All Sites Total Assemblage

The Olcott site has the most abundant amount of chipped stone tools, followed by the Marpole Midden, and then –naturally– the Scowlitz site, with 371, 241, and 33 artifacts, respectively (Figure 9). As an important side note, Burley discussed the lithic assemblage of the Marpole Midden twice: under the tables of "Assemblage Classification" where he listed each of the tool types present and noted how many there were, and then under "Marpole Component Assemblages" where each tool type was broken down into different time periods (Marpole I, Marpole II, and "Other" or Historic) and listed how many were present in each time period (Burley 1979:517; 531). Under the "Assemblage Classification" table listing the chipped stone tool types, there are a total of 357 tools, but for the "Component Assemblage" table it lists 363 total chipped stone tools. A difference of six tools between the two tables is not significant enough to impact the overall trends between the three sites examined here, and this discrepancy cannot be rectified without having access to the same collection that Burley examined. However, it is pertinent nonetheless to note this slight error. Finally, the Olcott site has the most flakes with 51, Marpole with 36, and then Scowlitz with 10 (Figure 10).

These three comparisons – total assemblage, total chipped stone tools, and total flakes – are the only aspects that the three sites have in common. Beyond this, there is too much diversity of tool type and manufacturing method (i.e. ground stone, bone, and antler tools) to fairly assess the sites together. What can presently be stated is that where the Olcott assemblage is comprised 100% of chipped stone tools, and the Marpole Midden assemblage is only comprised of approximately 27% chipped stone tools. The Scowlitz site is more difficult to provide an accurate percentage of total chipped stone tools, but the 33 obsidian chipped tools examined here comprise approximately 0.66% of the total 5,000 artifacts excavated. With a nearly 70% difference between the Olcott and Marpole Midden assemblages, there is a clear shift in the archaeological record from chipped stone tools to other types of technology, primarily ground stone, as will be further discussed in this chapter.

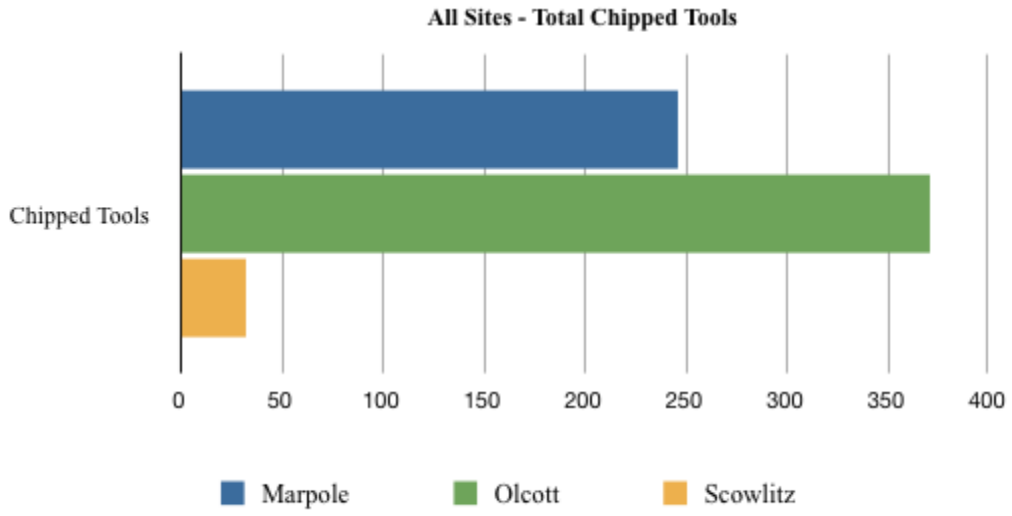

Figure 10. All Sites – Total Chipped Tools

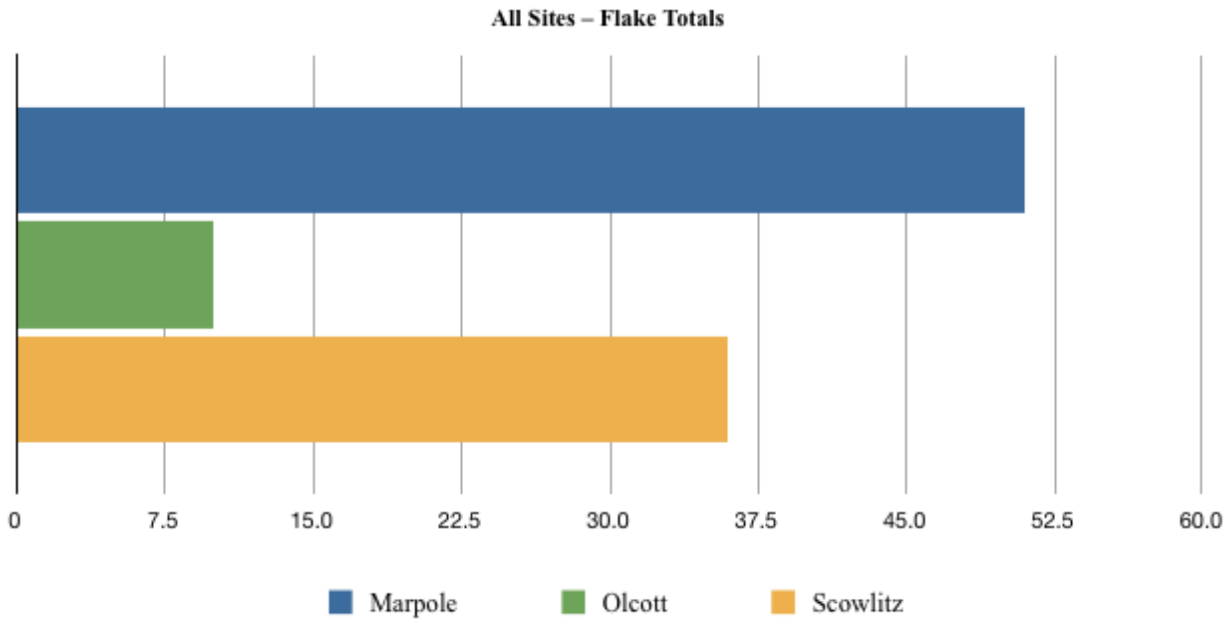

Figure 11. All Sites – Total Flakes

2.2 Olcott Site Results

For both the Burke and IMNH assemblages, the average length for all similar tool types is relatively similar. The IMNH cores average at 8.5 cm, the Burke ones at 8.7 cm; flakes are 7.0 cm and 9.6 cm; bifaces 8.5 cm and 7.1 cm; and projectile points 5.1 cm and 6.7 cm, respectively (Figure 12) This makes sense considering both lithic assemblages come from the same location and time period. There are differences, however, in the types of tools present, in addition to the stone materials used. Only within the IMNH collection are spokeshaves, expedient flake tools, an adze, and a perforator present. The Burke collection, alternatively, has modified bone tools, scrapers, a net sinker, cobble tools, and artifacts labeled simply "lithic" and "modified stone".

As stated above, the IMNH materials were identified as being made from either argillite or siltstone, not basalt as Butler originally claimed. Whereas the majority of the Burke materials

were more vaguely identified as crystalline volcanic rock (CVR), with seven projectile points made of dacite, one obsidian biface, another projectile point made of chert, and a core and chopper made of "stone".

Nevertheless, these minor differences do not distract from the fact that the Burke and IMNH assemblages are similar enough that they can both be considered originating from 45SN-14. Considering the age of culture of the Olcott site, a broader toolkit with faster knapping techniques (i.e. chipped vs. ground) was employed. There are relatively fewer tool types present here than there are during the Marpole phase, as will be illustrated later in this chapter.

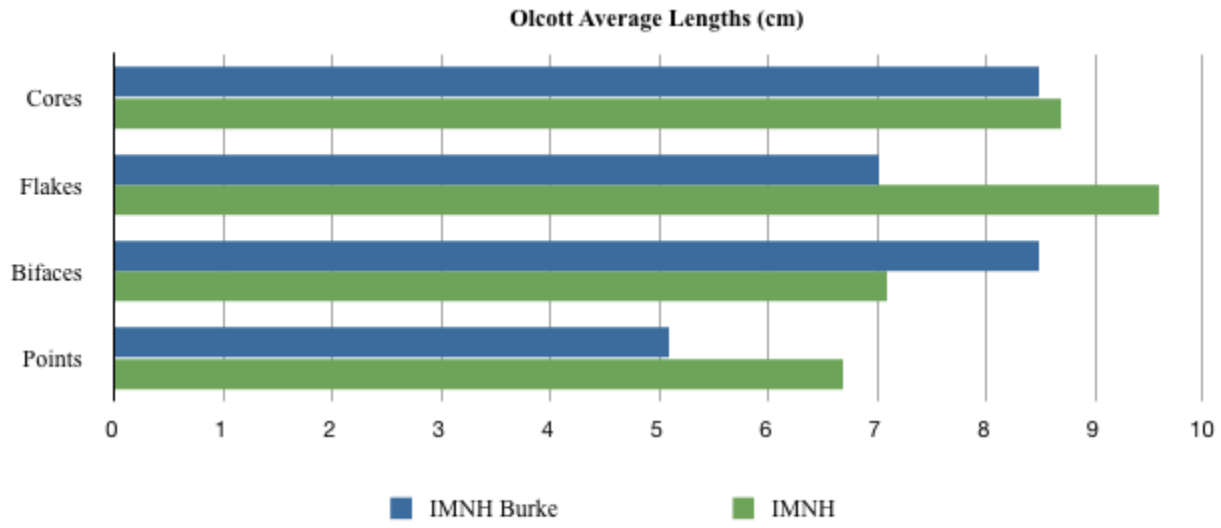

Figure 12. Average Length for IMNH and Burke Materials

Figure 13. Biface point fragment from 45SN-14, via IMNH

Figure 14. Core from 45SN-14, via IMNH

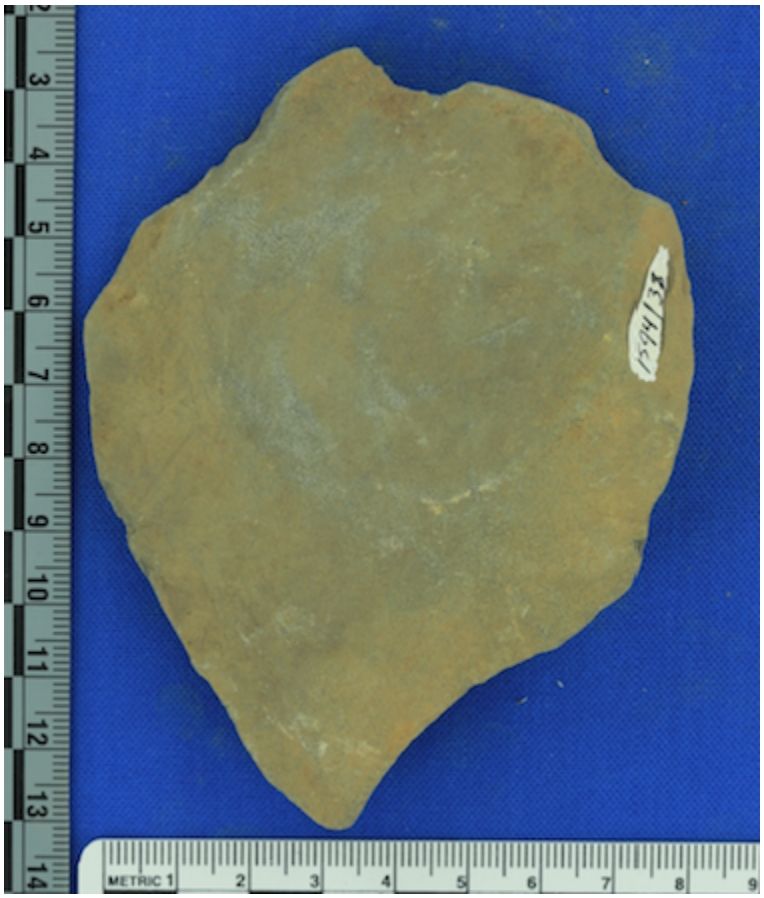

Figure 15. Spokeshave from 45SN-14, via IMNH

2.3 Scowlitz

Where I could only obtain data for ten flakes and twenty-three microblades – all made of obsidian – from the Scowlitz site, few comparisons can be made in this thesis. However, some information can be obtained regarding flake size and total flake numbers between the Scowlitz, Olcott. and Marpole Midden sites. The Olcott CVR flakes are significantly longer than the obsidian ones found at Scowlitz, with the average lengths at 9.6 cm and 1.31 cm, respectively. The width and thickness are also significantly different between the IMNH flakes and the Scowlitz ones, where IMNH flakes are 4.8 cm and 1.9 cm compared to 0.94 cm and 0.34 cm, respectively (Figure 16). These differences are expected, considering it has been well-established that through time lithic technology and projectile points became smaller. The properties of obsidian also explain the small size of the Scowlitz flakes. Obsidian is commonly used to make sharp and small flakes, whereas CVR materials do not always produce such thin and precise flakes.

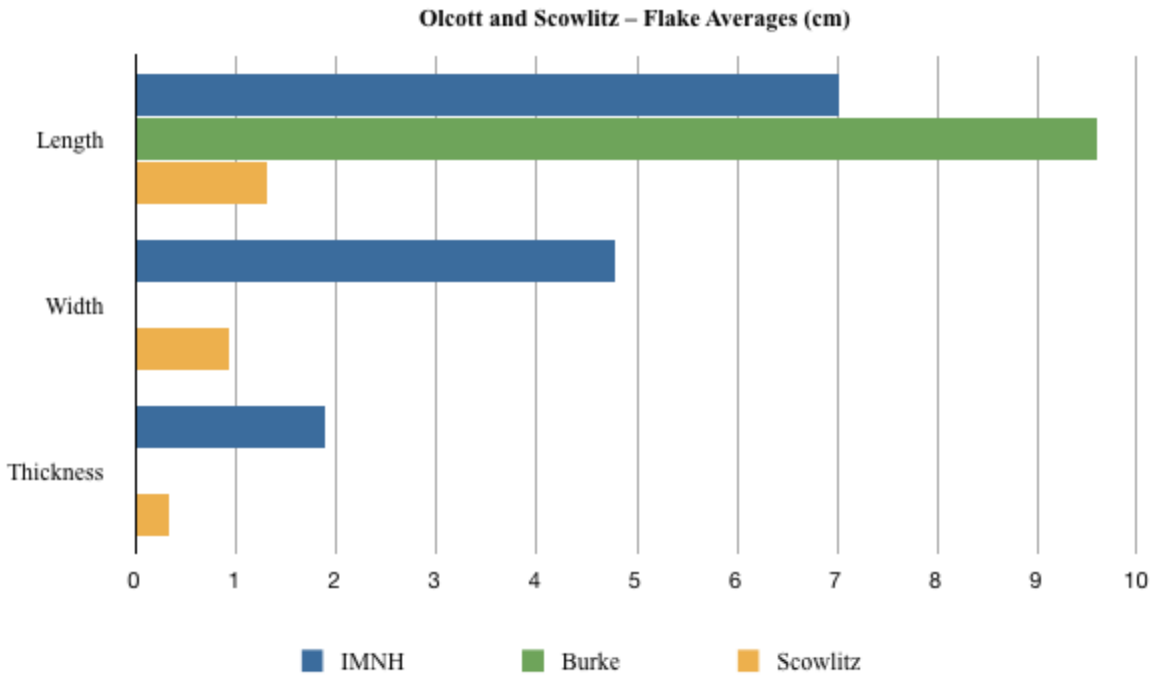

Figure 16. Flake Averages – Olcott and Scowlitz

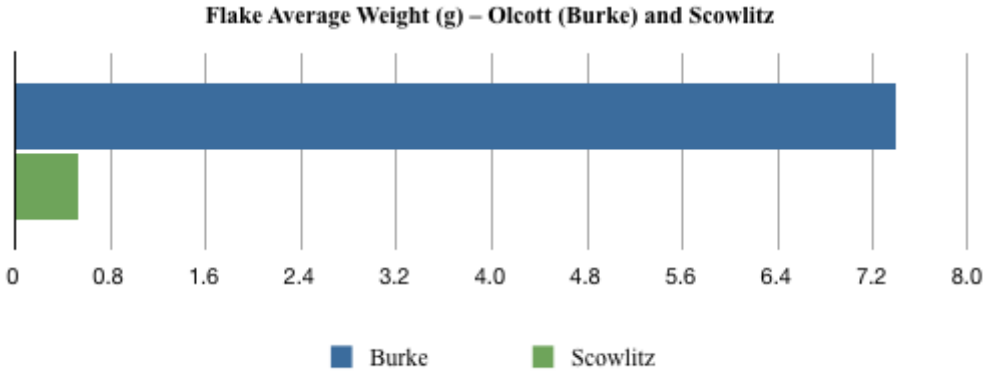

Figure 17. Olcott and Scowlitz Average Weight (Blake 2004)

In addition to the average lengths, the weight between the Burke's Olcott materials is significantly different. The Burke materials weigh an average of 7.4 grams, while the Scowlitz flakes average 0.53 grams (Figure 17). Again, this illustrates not only the different properties between obsidian and CVR, but also that lithic technology was smaller and lighter surrounding the Marpole Phase.

The totals between the Scowlitz and Marpole Midden show interesting results. There are more flakes present at the Marpole Midden compared to Scowlitz, thirty-six and ten, respectively. Regarding microblades, the difference is not as significant, yet reversed where the Scowlitz site has more microblades with 23 and the Marpole Midden only has 10 (Figure 18). Note how microblades are not present in the Olcott assemblages and thus appear to be a relatively new technology employed, preceding and during the Marpole Phase. A closer, more thorough examination of the lithic assemblage at Scowlitz would help reveal whether this pattern of flakes and microblades prevalence between these sites is actually significant, or if this particular set of data presented in this thesis is the result of sampling bias.

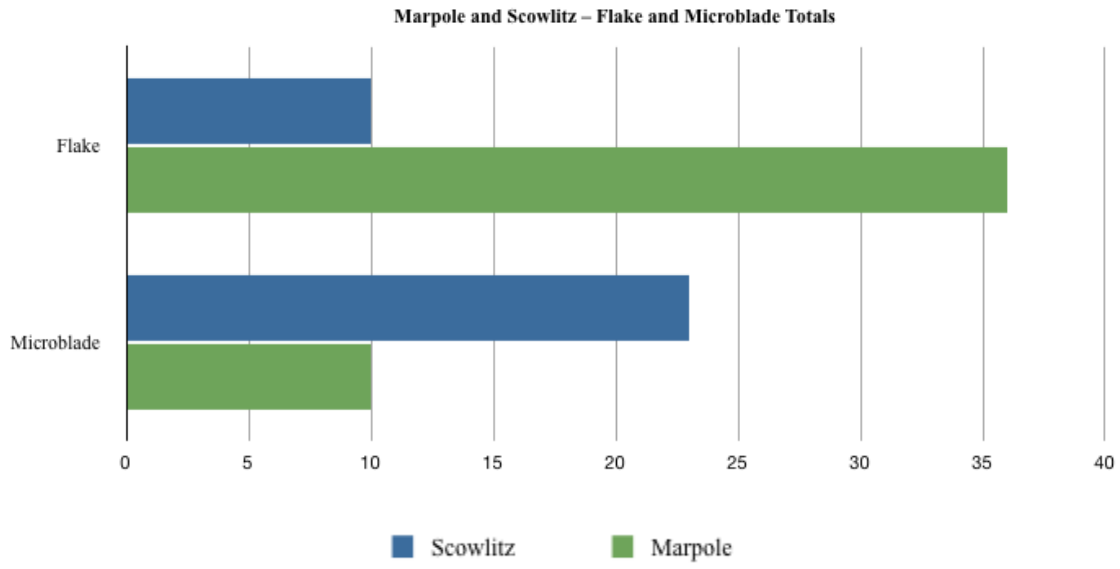

Figure 18. Marpole and Scowlitz Flake and Microblade Totals

2.4. The Marpole Midden

As stated earlier, no measurements were provided in Burley's (1979) doctoral thesis, but he did provide information regarding tool types and their affiliated time periods: Marpole I, Marpole II, or the historic phase. The Marpole Midden assemblage includes chipped, ground, ground/pecked, bone, antler, and miscellaneous types of tools, all present in the three different time frames provided. Of the various tool technology types, ground stone tools are the most prevalent, with 570 materials present during the Marpole II period. According to Burley, Marpole I components date to ca. 2550-1550 BP, and Marpole II components date to ca. 1420-1600 BP. Burley states that Marpole II is, "The Marpole transitional Gulf of Georgia culture type time period" (1979:541). Chipped stone tools are also most prevalent during this

transitional Marpole II period, along with bone, antler, and miscellaneous tool types, with 164, 84, 28, and 3 components, respectively (Figure 19).

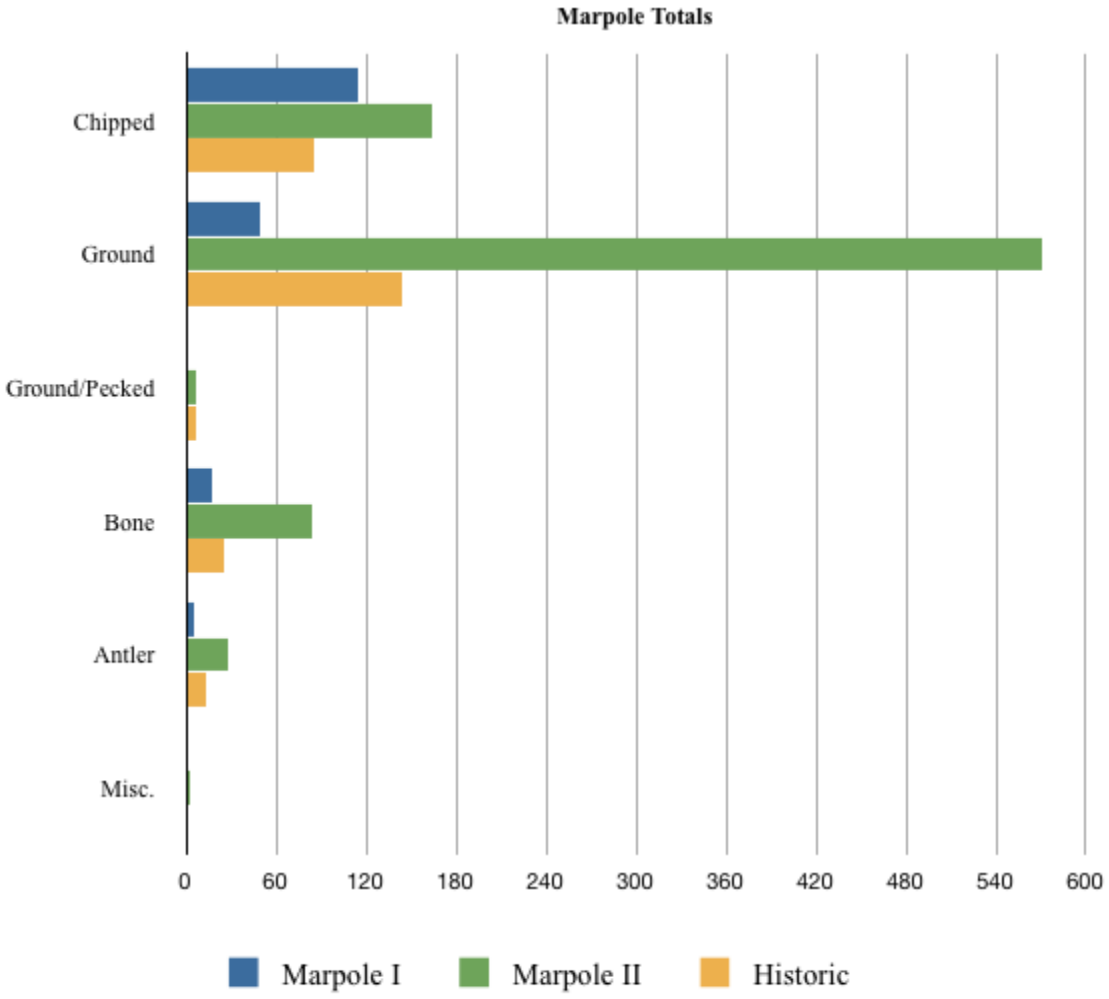

Figure 19. Marpole Tool Type Totals (Burley 1979)

Notwithstanding the significant amount of ground stone tools during the Marpole II period, there is a pattern that chipped stone tools were originally more common than ground stone during the Marpole I period, with 114 versus 49 tools present. Chipped stone technology was still employed and saw a slight increase during Marpole II, but it is not at the same rate that ground stone technology experienced. During Marpole I, chipped stone tools comprised 61.2% where ground tools made up 26.3% of the total assemblage. Comparatively, chipped stone technology made up only 19.2% and ground stone 66.7% during the Marpole II period. The percentage of bone, antler, and miscellaneous technologies stayed relatively the same across the two periods, even if their total numbers increased during Marpole II (Figure 20).

	Marpole I	Marpole II	Historic	Total
Chipped	114 (61.2%)	164 (19.2%)	85 (30.9%)	363 (27.6%)
Ground	49 (26.3%)	570 (66.7%)	144 (52.4%)	763 (58%)
Ground/Pecked	-	6 (0.07%)	7 (2.5%)	13 (0.99%)
Bone	17 (9.1%)	84 (9.8%)	25 (9.1%)	126 (9.6%)
Antler	5 (2.6%)	28 (3.3%)	13 (4.1%)	46 (3.5%)
Misc.	1 (0.5%)	3 (0.04%)	1 (0.04%)	5 (0.04%)
Total	186 (99.7%)	855 (99.1%)	275 (99.6%)	1316 (99.73%
Percentage of Assemblage	14%	65%	21%	

Figure 20. Marpole Midden Totals and Percentages (Burley 1979)

Burley does not provide any more specific dates for the materials from the Historic period. It is worth noting that, despite a decrease in all tool types, ground stone technology is still the most prevalent type comprising 52.4% of the total assemblage. Chipped stone tools are

present at 30.9%, though at the lowest numbers of the three different time periods with only 85 artifacts counted.

Burley broke up the different tool types found within each of the different time periods, which is helpful in determining temporal patterns and changes (1979:531). There are a total of 27 different chipped stone tool types found at the Marpole Midden, with 18 Marpole I affiliated tools, 23 in Marpole II, and 22 in the Historic period (Figure 21). Clearly, chipped stone tools did not decline in density through time, even during the Marpole Phase or the Historic period. During the peak of the Marpole Phase, particularly what would be labeled as Marpole II, human population densities were at their highest, paralleled by booming fish populations. Frequent warfare also occurred at this time, which would have employed more chipped projectile points for those interpersonal skirmishes, in addition to traditional hunting strategies.

In almost all its affiliated tool types, Marpole II has not only the most tool types but also the highest number of tools found at the midden. Only in small leaf points, incipient stemmed points, small leaf biface, retouched flakes, unmodified lithic, and a miscellaneous category is Marpole II not the most common time period. In terms of the nine complete projectile point groups, Marpole I is only present in five of them, Marpole II is in all nine, and Historic is in eight of them (Figure 21). Projectile point types became more diversified through time, which again correlates with the increased warfare and hunting occurring at the same time. As groups of people began migrating away from centralized locations, such as the Marpole Midden, around 1500 BP, the density of tools found at the midden would also predictably decrease. However, warfare and hunting would have likely continued, so the range of point types developed during the Marpole Phase would still have been utilized.

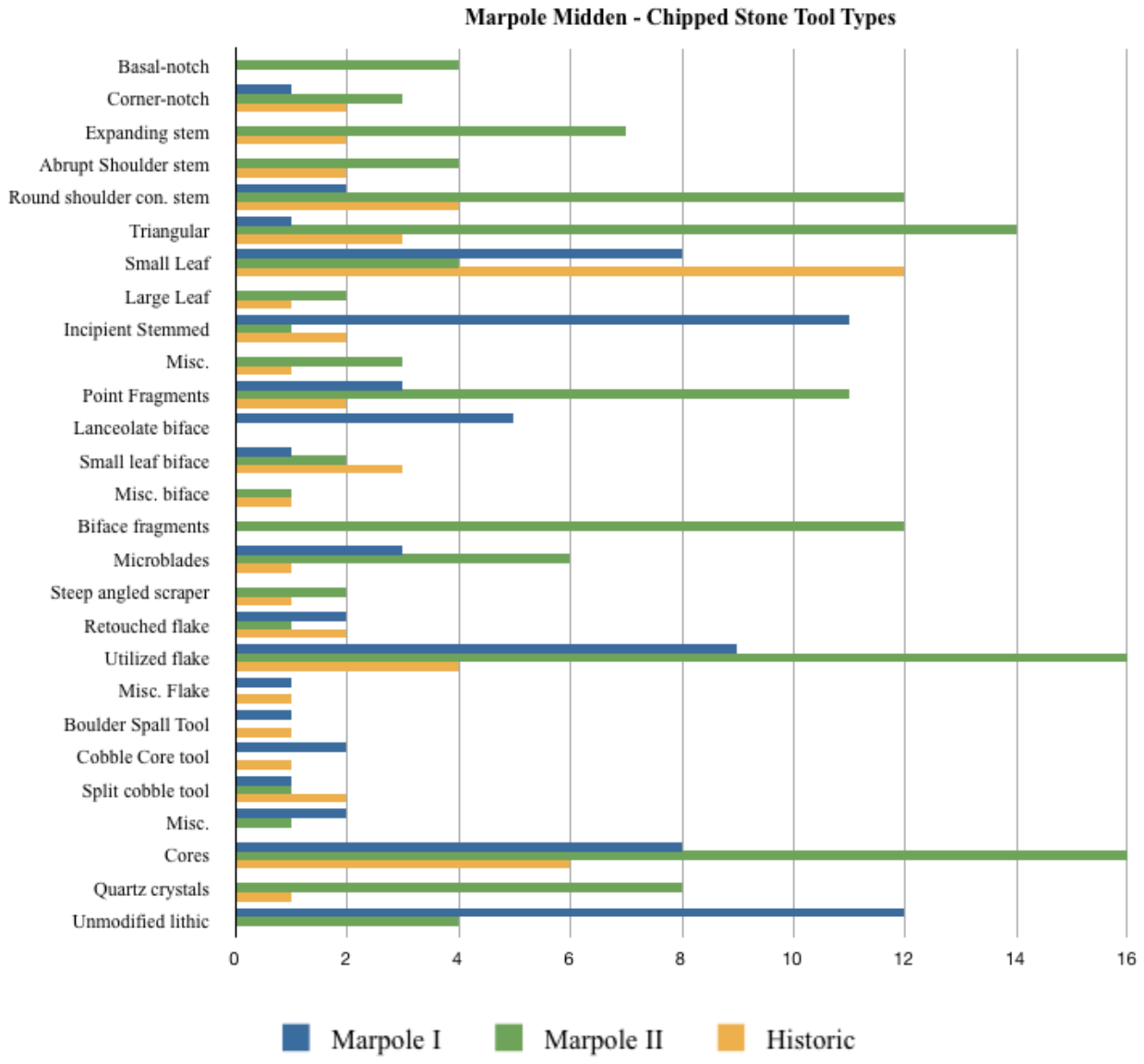

Figure 21. Chipped Stone Tool Types

In regards to ground stone tool types, there are a total of 25 different tool types present: Marpole I has 15; Marpole II has 23; and Historic has 12 (Figure 22). It is predictable that more ground stone tool types were developed over time. As for the decline between the Marpole Phase tools and the Historic period, where Burley (1979) did not provide any specific dates, this is more difficult to discuss. The most likely explanation is the introduction of Euro-American technologies and the increase in metal tools replaced the ground stone ones.

Marpole II has both the most tool types and highest tool densities, except in the few instances where it is tied with one of the other time periods. It also has the highest number of thin knife fragments with 390 compared to Marpole I –that had only 15– and the Historic period with 81. These data were excluded from Figure 19 because they greatly skewed the graph to the point that the other types were barely visible. Irregular abrasives were also excluded for the same reason, where Marpole II had 86, Marpole I had 8, and Historic had 36. Nevertheless, it does not detract from the fact that ground stone tools are the most common during Marpole II. Celts, grinding stones, and other woodworking tools became more popular or developed at this time, decorative artifacts like earspools, beads, and awls used for sewing also occurred primarily only during this period (Figure 22). Again, this shows how the cultural aspects like woodworking, artistry, and personal adornment were progressively developing during the Marpole phase and that new, alternative tools were introduced during the historic period to replace ground stone technologies.

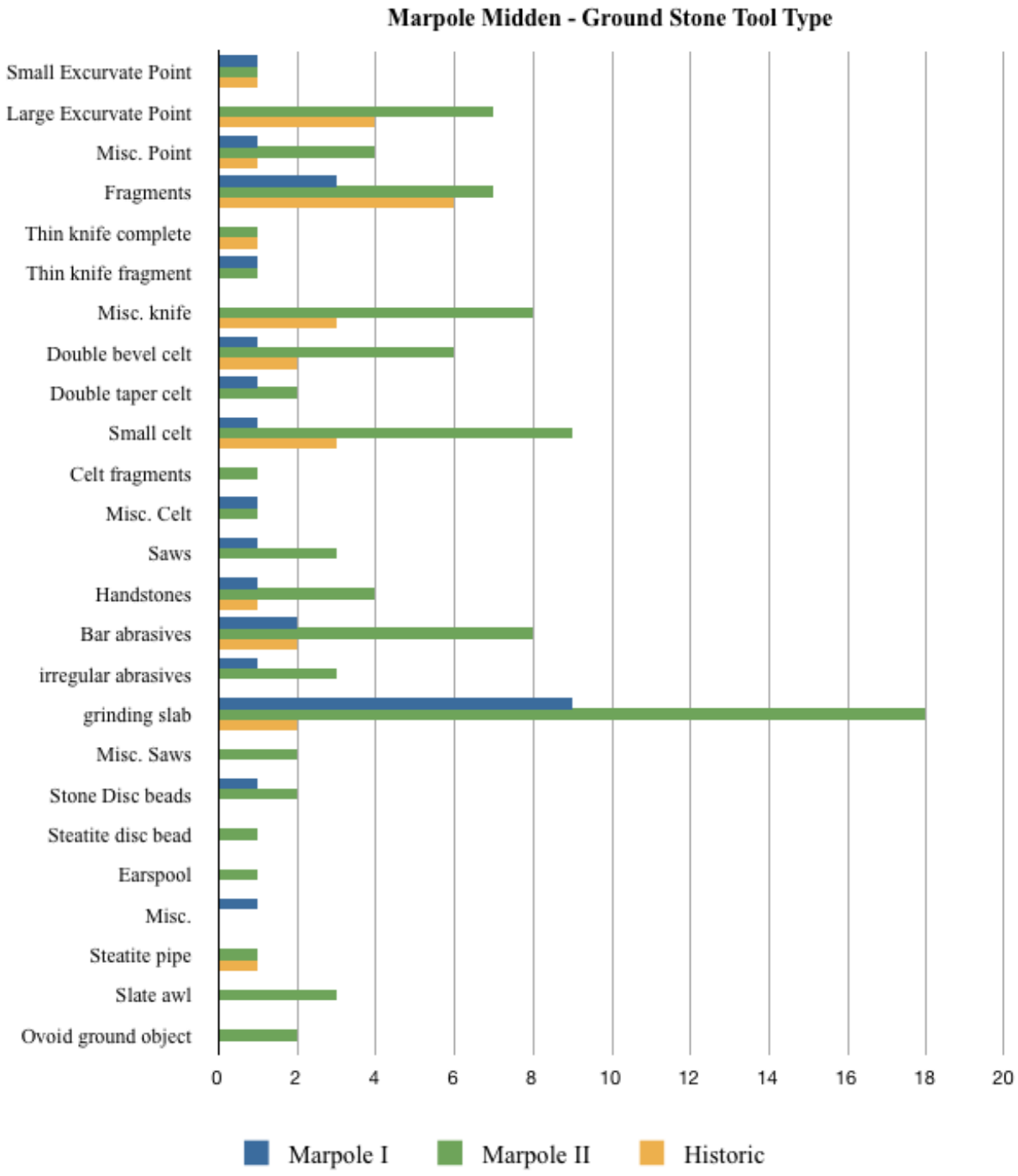

Figure 22. Ground Stone Tool Types

Bone and antler tool technologies have the fewest total numbers, especially when compared to the chipped and ground stone tool types and densities. The pattern is still the same, however, with Marpole II having the most tool types and highest tool numbers: Marpole I has 7 out of 13 bone types, Marpole II has 11, and Historic has 10 (Figure 23). Awls became more popular from Marpole I to Marpole II, particularly with splinter awls where there was only one in the preceding period compared to six in the later. Split bone awls and bird bone awls also increased in time, there were no ulna awls associated with Marpole I, though there were no split metapodial awls at all during Marpole II. All these awl forms were present in the Historic period, though never at the same level of abundance as during Marpole II. The fixed points are unique in that, unlike the rest of these bone tools, they are at the least abundant during the Marpole II phase with only one point. Alternatively, there are two associated with Marpole I and three with the historic period, making this one of the very few times where the Historic period is the most abundant assemblage found at the Marpole Midden (Figure 23). Of course, these are such low numbers that no significance can currently be placed on these differences. It is nevertheless important to point out this pattern, especially as reference for future studies of the midden. Overall, it appears that the bone tools were primarily used for woodworking, sewing, or for decoration. Awls are commonly used for puncturing leather or even wood and considering the different types of awls present – particularly as they diversify from the Marpole I to Marpole II period – specialization in woodworking or textiles correlates with the general trend during the Marpole phase of increased artistry. The inscribed bones and bead also attest to some level of decoration, likely for personal adornment.

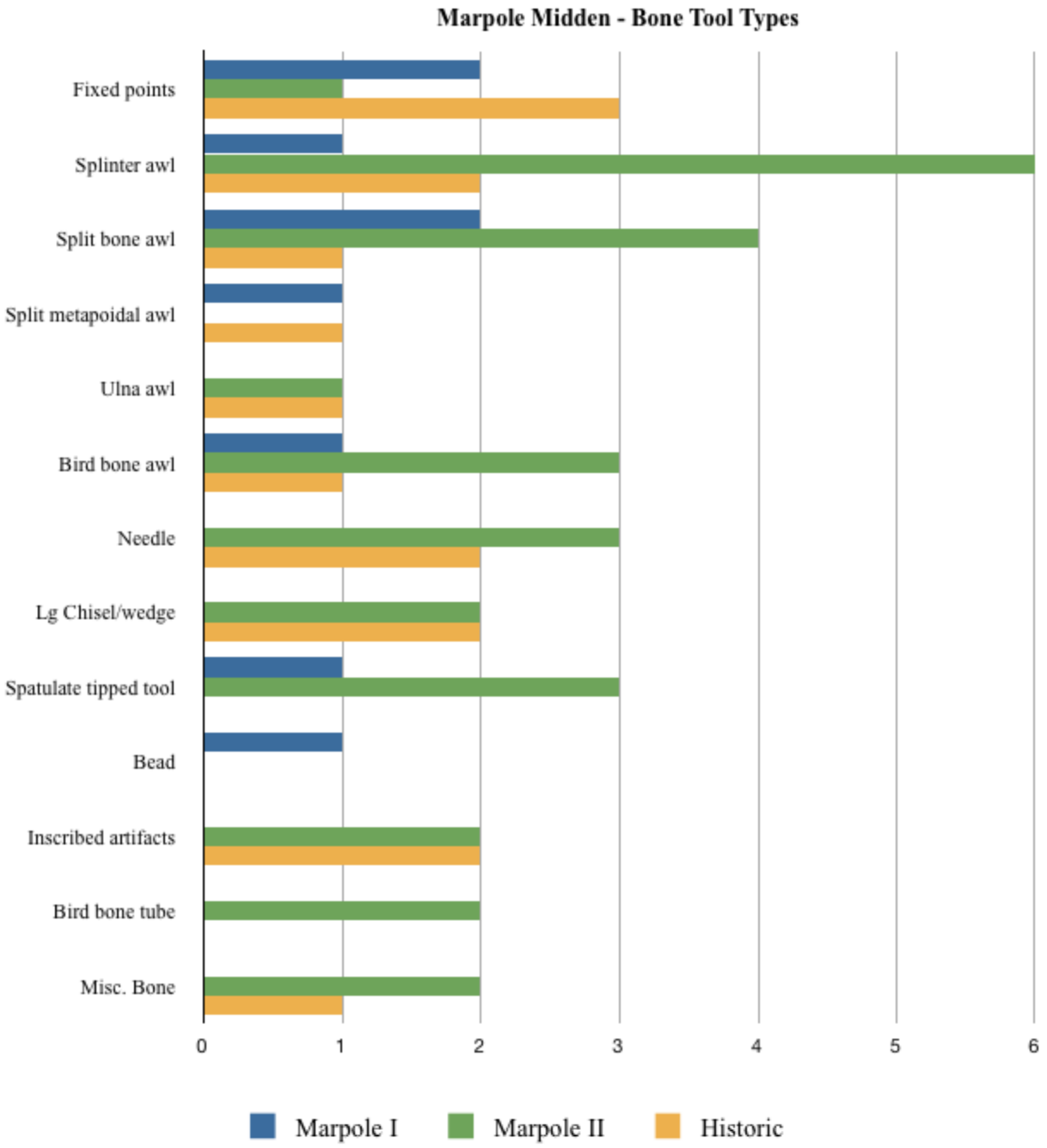

Figure 23. Bone Tool Types

As for the antler tools, the pattern remains the same where Marpole II has the most tool types, followed by the Historic period, and then Marpole II, with respectively 10, 7, and 4 types out of 13. There are fewer than three components for each antler tool type, with two exceptions: there are 13 unilaterally barbed points, associated with Marpole II, compared to only two points from the Historic period; and there are four antler detritus components associated with the Historic period whereas during Marpole I and II there are three (Figure 24).

Similar to the bone tools, however, nothing significant can be said regarding any differences between the time periods due to the low abundance of the tools. What is significant is that the different antler harpoon styles (unilateral, bilateral, one-piece toggle, and miscellaneous) were only produced or associated with Marpole I and II and never the Historic period. Alternatively, the beam wedges, unilaterally barbed points, pendants, antler sleeve hafts, pointed artifact fragments, and antler detritus are all associated with the Historic and Marpole II periods, and Marpole I is absent from all of these tool types except for the antler detritus (Figure 24). A blanket pin excavated from the midden is associated with Marpole II. One possible explanation for the lack of antler harpoon components during the Historic period is the adoption of metal tools and/or Euro-American technology, similar to the ground stone tools. Of course, preservation and excavation bias are also likely explanations for these patterns, and research at other Marpole Phase-related sites could provide completely opposite results. As has been mentioned throughout this thesis, little research has been conducted examining the bone and antler technologies of the PNC, particularly relative to lithic studies. So, future research would help develop more meaningful and useful data.

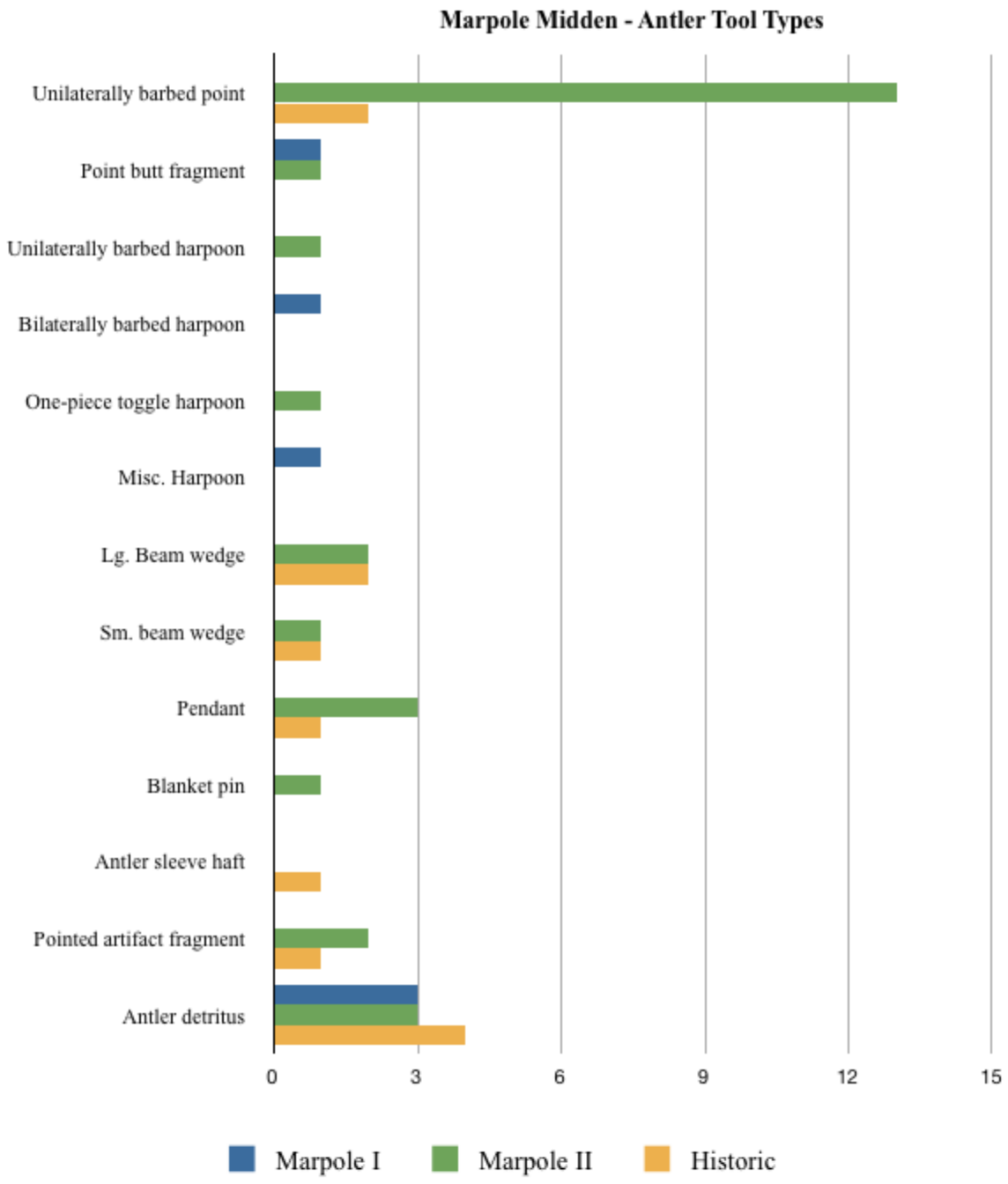

Figure 24. Antler Tool Types

3. Location of Sites and Lithic Sources

The four sites examined here are within the same general region of what is now southern British Columbia/north western Washington. They are all 100+ kilometers from each other, with the Olcott Site being the furthest from the Marpole Midden at approximately 140 km, the Scowlitz site is approximately 87.5 km. from it, and Pender Canal is the closest to the midden at approximately 50 km (Figure 25).

Figure 25. Location of Sites

Sourcing the lithic materials used for the stone tools present at these sites was conducted by previous researchers (Blake 2004; Burley 1979; Carlson et al. 2017; Prentiss and Kuijt 2012). The majority of locations given are for obsidian sources, although some CVR quarries were mentioned as well. The Google Earth data shows a surprising amount of overlap for the different sites when combining this information and plotting out the different source locations, alongside the variety and differences of locations. No sources are definitively connected to the Olcott site since little, if any, research has been conducted on sourcing the lithic assemblage from there. Butler did not believe that the site was a quarry but instead that the "the roughed-out cores, nodules, and blanks may have been brought to the site and the finishing work completed there" (1961:48). Depending on the migration patterns of the Cascade Phase (ca. 9000-2300 BP) hunter-gatherers, they may have gone as far north as the Fraser River where there are quarries and sources rich in CVR materials, such as the ones associated with the Scowlitz Site lithics, but that is conjecture until future research locates the sources of the Olcott assemblage (Ozbun and Fagan 2010:1-22).

The following figures are screenshots of the sites and their lithic sources. All yellow points and lines correlate with the Marpole Midden, red for the Scowlitz Site, orange for the Olcott site, and blue for Pender Canal. Any green points are locations that are used by two or more locations. Figures 26 and 27 show all the sites and locations, and the following figures are for each individual site and its respective sources. As these figures demonstrate, the great majority of the sources fall in the now-Washington and Oregon areas, with several locations alongside the Fraser River (Figure 26). There are outliers associated with the Scowlitz site, where some obsidian materials were sourced as far south as the Sugarloaf Mountain range in southern California and as far north as Anahim Peak in British Columbia (Figure 27). Blake

stated that the obsidian flake sourced to Sugarloaf Mountain was only 800 km from Scowlitz, whereas the measurement used on Google Earth shows that it is closer to 1,723 km (Blake 2004:105). Regardless, this particular flake was transported a great distance to have been excavated at Scowlitz, likely due to trading. Black abalone pendants were also present at Scowlitz, and the primary source of black abalone is in the San Francisco area, further implying trade associated with the village.

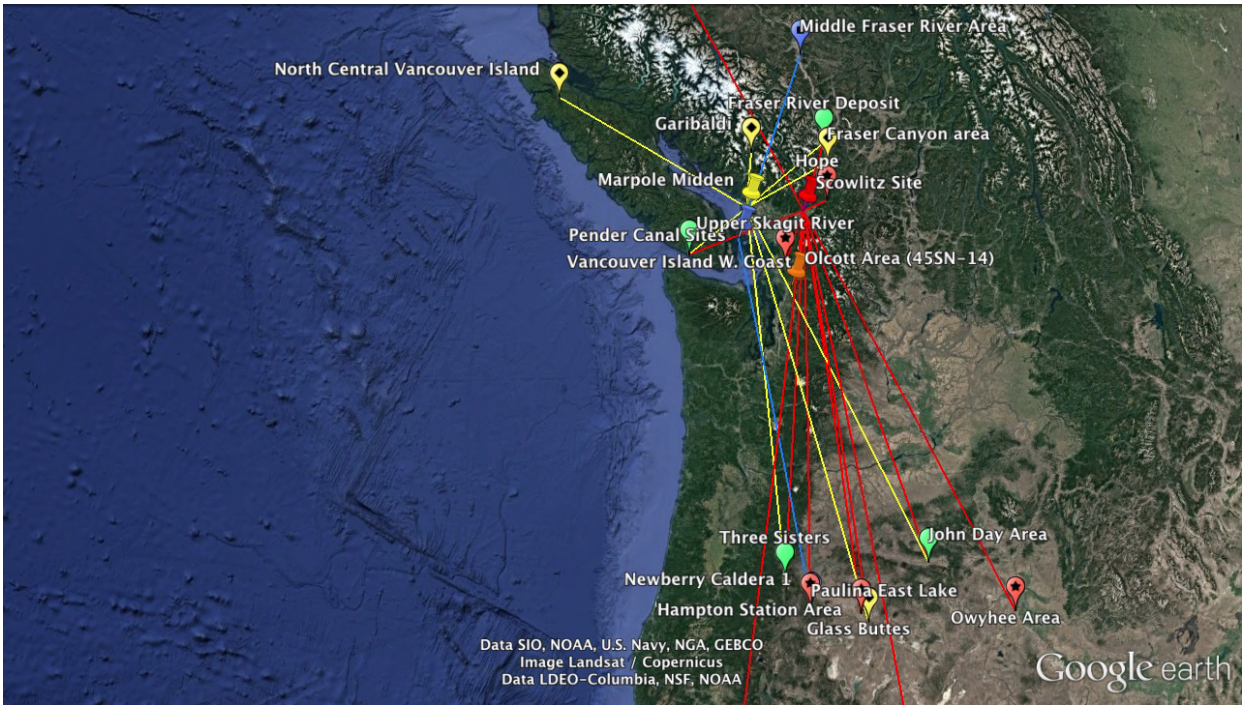

Figure 26. Sites and Source Locations (Without Outliers)

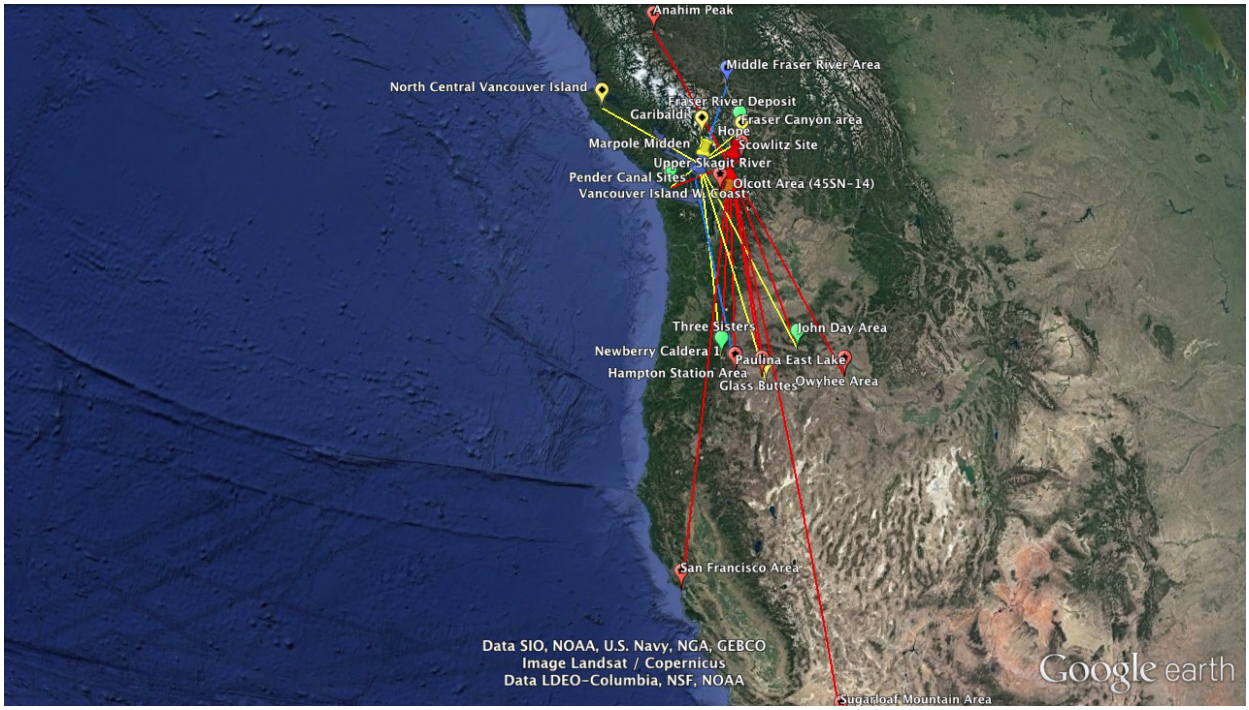

Figure 27. Sites and Source Locations (With Outliers)

3.1. Scowlitz Site Sources

There are thirteen sources linked to the Scowlitz site: Anahim Peak; a Fraser River deposit; Hope; Glass Buttes area; Hampton Station Area, John Day, Newberry Caldera 1; Owyhee area; Sugarloaf Mountain; Upper Skagit River; West Vancouver Island; and San Francisco area (Figure 28). Blake provided data on what specific tools were sourced to their respective sites: one obsidian microblade from Three Sisters, OR; an obsidian microblade from Anahim Peak, B.C.; two obsidian flakes and six microblades from the Glass Buttes area, OR; four obsidian microblades from the Hampton Station, OR area; three obsidian microblades and one obsidian flake from the John Day, OR area; one obsidian microblade from the Owyhee, ID area; one obsidian flake from Sugarloaf Mountain, CA (Blake 2004:105; Figure 29). West

Vancouver Island is a common source of dentalium shells in the area, making it the most likely source for the shells found at Scowlitz. As mentioned previously, San Francisco is the closest, most likely source of black abalone. The Upper Skagit River and the Fraser River Deposit are common sources of nephrite and are a likely source for the nephrite tools found at Scowlitz, the Fraser River is also a traditional territory of the Interior Salish (Blake 2004:107). Finally, Hope is another possible source of nephrite close to Scowlitz.

Microblades	Flakes
Anahim Peak, B.C. (1)	Glass Buttes B, OR (1)
Three Sisters, OR (1)	Glass Buttes A, OR (1)
Newberry Caldera 1 (1)	John Day, OR (1)
Glass Buttes B, OR (4)	Sugar Mountain 2 (1)
Glass Buttes A, OR (2)	
John Day, OR (3)	
Hampton Station, OR (5)	
Owyhee 1, ID (1)	

Figure 28. Scowlitz Sources and Associated Lithics (Blake 2004)

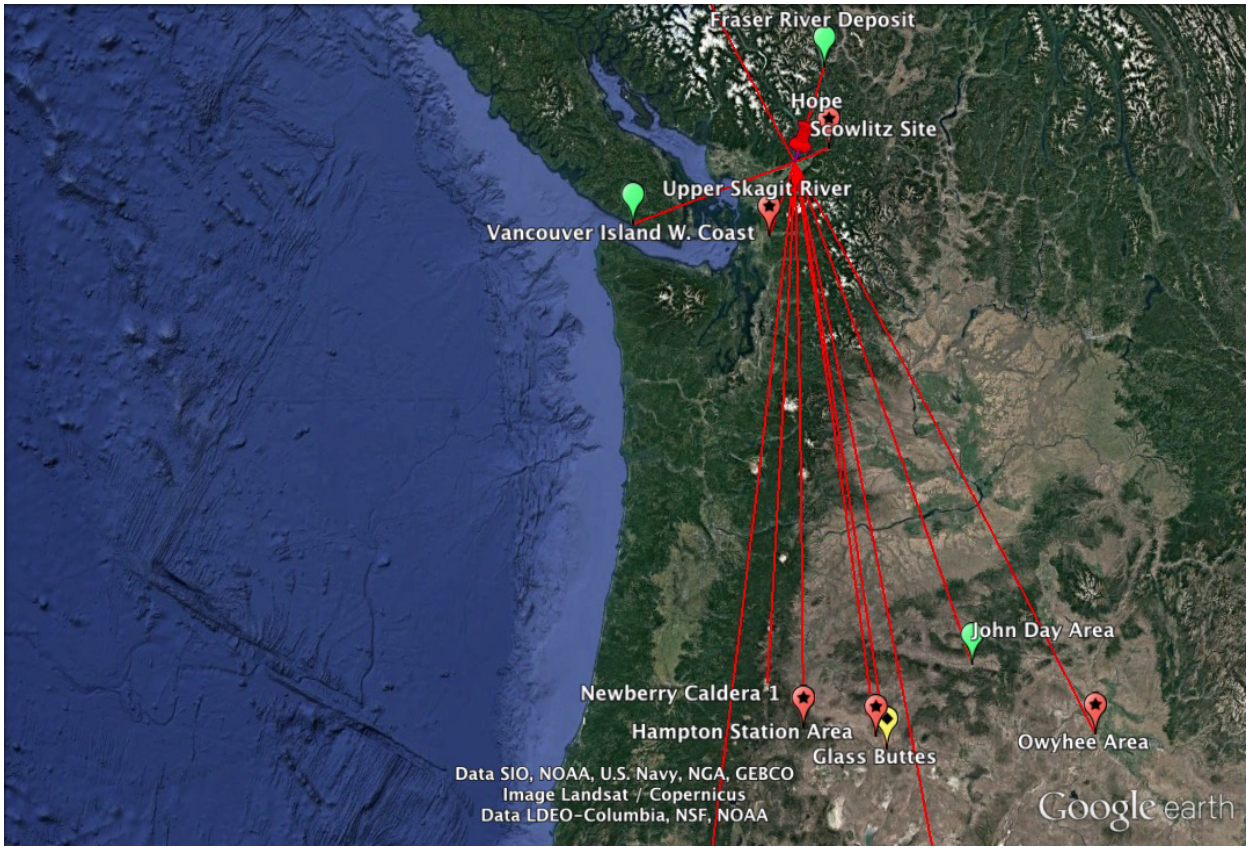

Figure 29. Scowlitz Site and Lithic Sources (Without Outliers)

3.2. The Marpole Midden

There are eight lithic source locations associated with the Marpole Midden: North Central Vancouver Island; Fraser River Deposit; Fraser Canyon area; Vancouver West Coast; Three Sisters; Glass Buttes; and John Day area (Figure 31). Burley (1979) did not provide as detailed of information regarding the lithic sourcing of Marpole obsidian lithics as there is for the Scowlitz site. Nevertheless, what information he does give shows there is considerable overlap in obsidian sites between the two sites: both use Three Sisters, John Day, Glass Butte, OR areas for obsidian; possibly the Fraser Canyon, Fraser River Deposit areas for nephrite; and Western Coast

of Vancouver Island for dentalium shells (Burley 1979:521-523; Figure 30). An obsidian flake associated with the Marpole I period was sourced to Garibaldi, B.C., an obsidian microblade and end scraper that are also associated with Marpole I were sourced to the Glass Buttes area, and an obsidian microblade from the Marpole II period is from the John Day area.

Microblades	Flakes	Other
Glass Buttes, OR	Garibaldi, B.C. (1)	Glass Buttes– End scraper
John Day, OR		North Central Vancouver Island
		– Hydrocarbon
		West Coast Vancouver Island
		–Dentalium
		Fraser Canyon – Nephrite
		Fraser River – Nephrite

Figure 30. Marpole Midden Sources and Associated Lithics (Burley 1979)

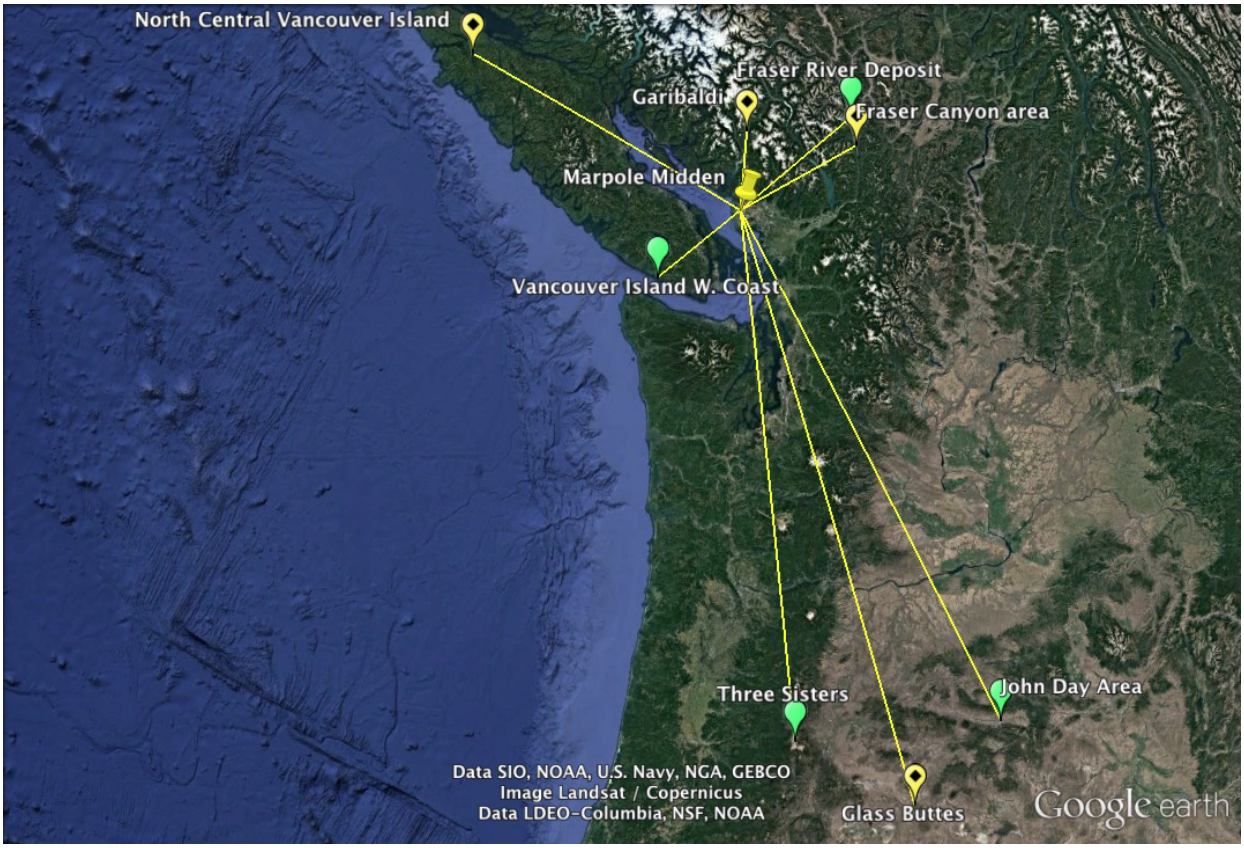

Figure 31. The Marpole Midden and Lithic Sources

3.3. Pender Canal

Of the three Marpole Phase-related sites, Pender Canal has the least amount of information concerning lithic sourcing and lithic data in general. According to Carlson and Hobler, around 3,719 items were excavated from Pender Canal, though they do not go into any specifics of whether these were stone – chipped or ground – tools, bone harpoons, personal ornaments, etc. (1993:30). Other materials found at Pender Canal are what are sometimes referred to as 'whatzits': labrets, ear ornaments, beads (e.g. shale disc and small shell disc) (Carlson et al. 2017:9). Also found at Pender Canal were stone files and abraders, contracting

stemmed projectile points, three triangular projectile points, as well as various littoral and marine remains (Carlson et al. 2017:9; Carlson and Hobler 1993:39-40). According to Carlson et al., soapstone ornaments were likely imported from the Middle Fraser River Area, one dentalium that possibly originates from Vancouver Island, and one obsidian microblade was sourced to Paulina East Lake in Oregon (2017:20; Figure 32). The Middle Fraser Area is approximately 304 kilometers from Pender Canal, and Paulina East Lake is approximately 581 km. As with the previously discussed sites, trading was likely present for those living at Pender Canal to have even one obsidian microblade sourced to Oregon. Trade, resource-gathering logistical parties, or possibly both, would explain the presence of soap stone from the Fraser River region several hundred kilometers away. Groups would have had to either travel from their Pender Canal homes for lithic resources themselves or traded with their culturally related neighbors, potentially living at the Marpole Midden or Scowlitz village, for these resources. It is also likely that Pender Canal lithic materials – such as points and adzes – would share source locations as the aforementioned sites, considering the popularity and abundance of those sites, as well as belonging to Coast or Interior Salish cultures. This is all open to interpretation, however, until further research is conducted that focuses on the material sources of the Pender Canal assemblages.

Figure 32. Pender Canal and Lithic Sources

Chapter 7: Conclusions

My main research questions for this thesis were: Why was there a shift in tool technology during the Marpole Phase from ca. 3,000-1,500 BP? How does this correlate with the social and ecological transitions occurring before and during the Marpole Phase? Furthermore, my research objectives were: to determine any cultural transitions evident in the lithic technology of the PNW; to determine why there is a shift from flaked stone to bone and ground stone tools; and to produce more data surrounding how and why these prehistoric hunter gatherers shifted from migratory egalitarians to more sedentary chiefdoms. This chapter will discuss how these questions and objectives were met with varying degrees of success. However, there are still gaps in data that need to be researched in future studies of Pacific Northwest archaeology.

Question #1: Why was there a shift?

Technology had to have been adapted to accommodate for different jobs, not to mention a need for more durable tools for jobs (e.g. ground stone adzes). Bone and antler tools are demonstrated here to have correlated with specific jobs like detailed carving or for personal adornment. As several authors have pointed out, particularly Clark (2010), there was no sudden shift from chipped to ground stone tools; chipped stone technology was still present even through the Historic period. It is more like that there was a very gradual development in stone tool technology. It would be like comparing our technology of today to that of the 1970s; at first glance, comparing the size of computers of 2020 to those in 1975, for example, there is naturally a significant difference. However, comparing the computers across time (i.e. 1975, 1980, 1985,

1990, 1995, etc.), one could see how subtle changes took place that eventually resulted in the technology we have today. That is why in archaeological contexts, it is important to examine the transitionary periods between the more "major" periods.

Saying that there was a "shift" in tool technology preceding and during the Marpole Phase is not the most accurate description for what occurred in the Pacific Northwest Coast. A shift implies that there was a movement away from one type of cultural norm to another, and as has been demonstrated in this thesis, chipped stone technology did not give way to ground stone and osseous tool technologies. It would be better to say that there were concurrent developments in tool technology where the separate tool types developed separately yet were influenced by the others. It is one thread of Entanglement. The ground stone tools generally did not replace the chipped stone tools, and the antler tools did not replace the ground stone ones, either. They all had specific jobs to perform.

It also reflects on the cultural changes that were occurring that required these different tools. As mentioned earlier, osseous tools appeared to have been primarily for more delicate crafting and artistry, cultural aspects that were not clearly present at the Olcott Site or for Kennewick Man. The highly curated, more durable ground stone tools reflected how more time could be diverted into crafting these tools compared to the more easily replicated and retouched chipped stone tools of the migratory egalitarians. A more variable, less specialized toolkit was required for logistical parties for these early hunter-gatherer groups in order to exploit as much of their surrounding environment to ensure their hunting excursions were successful. Over time when resources – primarily fish – became more predictable and abundant (depending on the spawning cycle), tools like fishhooks, nets, and fishing weirs were developed in order to catch specific species of fish, instead of relying upon generalized fishing technology that would have

been less effective. Again, this would not have been a sudden, overnight development but rather the innovation and experimentation of technology over centuries of "cultural evolution" at work.

Question #2: How does this correlate with the social and ecological transitions occurring before and during the Marpole Phase?

In terms of the bioarchaeological evidence presented in Chapter 5, there is physical evidence for an emerging stratified society preceding the Marpole Phase. Cranial deformation – the binding of a young child's head to alter its appearance to look flatter – is visible in the skeletal remains unearthed at both Pender Canal and the Marpole Midden. This practice was used to differentiate those who belonged to a higher status from slaves, and was well-established by the time of Euro-American settler contact. Labret wear is also associated with status differentiation, though it was more commonly practiced further north along the coast and not in the Gulf of Georgia or Salish Sea region. Also, it is not always clearly evident in the bioarchaeological record. Dental wear patterns between the Kennewick Man from the Old Cascade Period and Burial 84-42 at Pender Canal dating to the Marpole Phase further demonstrate the various lifestyle changes in the region. The early hunter-gatherer groups from ca. 12,000-8000 BP had fewer dental caries and infections than agriculturalists, although Kennewick Man did exhibit some amount of molar attrition from chewing on fine abrasives and coarse particles from his food (Larsen 1987; Owsley et al. 2014). Burial 84-42, however, had abscesses and molar attrition – as well as periodontal diseases like gingivitis – from chewing on fine abrasives, processing cedar bark, or a combination of the two (Skinner 1988:278; 280). There is some medicinal knowledge and practice present with Burial 84-42 where there were

attempts to try and care for the abscesses via burning them with charcoal. While this is an extreme case, and this level of treatment may have been present during the Old Cascade/Olcott Phase, but it is nevertheless important to point out that this example of medicinal knowledge was present during the Marpole Phase.

Trade was clearly evident at all three Marpole Phase sites, as well as other authors confirming that Scowlitz used to be a trading hub since it was right along the Fraser River. It is difficult to say whether certain kin groups had proprietorship over certain quarries or resource patches. That would require lithic sourcing of the stone tools across various sites to see whether there is correlation if certain sites used certain sources whereas other sites used different materials, or if there were any common sources or quarries among them all. Althought that could imply inter-tribal trade, or perhaps family relations networks. As has been demonstrated here, however, is that the three Marpole Phase sites had common quarries, especially when it comes to obsidian sources. These three sites are all Salish cultures, so that could be why they have so much in common, or again, they traded among themselves. Examining more Interior Plateau and/or First Nations groups further north (e.g. the Haida Gwaii or Tlingit) to see if their stone technologies shared similar quarries as their Central Coast neighbors. Even other Coastal groups like the Kwakwaka'wakw of Vancouver Island may have used different quarries. Further lithic sourcing is needed in order to answer these questions. The lack of lithic sourcing or identification for the Olcott Site materials is problematic where there is still a fair amount of ambiguity and misinformation (e.g. Butler stating they were all made of basalt) regarding them. The Central Coast and Marpole Phase have been the primary interest of PNW archaeologists for decades, but comparatively little research has been conducted in other regions or for other periods. This does not mean that all work should immediately stop concerning the Central Coast or Marpole Phase;

it simply means that there is a large gap in knowledge, with issues involving research and sampling biases, that are finally being addressed in the last ten years or so. Noll and Limber (2019) are just some of the researchers that have begun widening the scope for PNW archaeology through their work examining Olcott Period sites.

Ecologically speaking, as was discussed at length in Chapter 3, many changes occurred preceding the Marpole Phase that resulted in a "perfect storm" of warmer, wetter weather, increased flora and fauna, and dense fish populations. During the Fraser Valley Fire Period (FVFP) ca. 2400-1200 BP, summers were longer and warmer, which led to increased populations for terrestrial and marine resources alike, not to mention increased fires that got rid of old growth in the forests, allowing younger and healthier plants to grow (Leprofsky et al. 2005: 277). Furthermore, there is evidence for controlled, cultural burns during the Marpole Phase that helped develop the production and cultivation of their immediate ecological area (Armatas et al. 2016; Gavin et al. 2013; Lepofsky et al. 2005). Compare this ecology with that of the Olcott Period, where the warmer, wet winters did not help the local flora and fauna reproduce to the same density levels as those during the Marpole Phase. This is why a more generalized toolkit was utilized during the Olcott Period, as well as explains why early groups were still mobile, egalitarian hunter-gatherers; the different pieces of the puzzle, or the "threads" of the Entanglement web, had not yet connected. Site 45SN14's materials demonstrate that there were multiple types of stone tools employed (e.g., spokeshaves, scrapers, a net sinker, etc.). This slight diversity of tools, even if it is not to the same extent as that present in the Marpole Midden collection, laid the foundation for prehistoric Indigenous groups to develop their toolkit to exploit the PNW's various resources.

For this thesis, because I could not examine the different Marpole Phase sites' respective collections due to the COVID-19 pandemic, it is more difficult to examine and demonstrate the cultural shift that occurred even from Locarno Beach to Marpole, as was originally planned. Unfortunately, this was one of my original questions and research objectives that I was not able to fulfill. This is where my primary thesis question of "How do tool technologies correlate with the shift from mobile egalitarianism to sedentary chiefdoms?" cannot be fully answered. We know this transition occurred, but it was a difficult question to attempt to answer without access to archaeological collections.

However, similar to the concurrent developments of tool technology, it is reasonable to state that the development of chiefdoms and kin-groups would have been gradual over time (i.e., thousands of years) and not a swift change. Earle (1997) explains how three separate chiefdoms arose in three different parts of the world and how various components had to blend almost perfectly in order for that system of government to come into being, which again, those systems (i.e. War, Politics, Ideology) were not suddenly created on a powerful leader's whim. For the Marpole Phase and the PNC, there is clear evidence of developments in the lithic technology, environment, and the people themselves, which determined changes in cultural aspects such as ranked societies and chiefdoms. Unfortunately, without more precise data concerning the Locarno Beach Phase, which was present at both the Pender Canal and Scowlitz sites, providing the crucial data for examining the similarities and differences in lithic technology – or even bioarchaeological data for the Marpole Midden burials compared to those at Pender Canal – it is difficult to ascertain what these transitions looked like.

Were My Research Objectives Fulfilled?

My research objectives were generally met and fulfilled, to an extent. As with any research project, there were complications and nuances with the data and results. Revisiting this particular line of research of tool technology and how it correlates with the increase in ranked chiefdoms in the Pacific Northwest Coast is encouraged for future studies.

My first research objective – determine any cultural transitions evident in the lithic technology of the PNW – was discussed and proven via the research I could conduct on lithic materials. Between the Olcott and the Marpole Midden materials, there is clearly a shift in what types of tools were being made, let alone how they were made. Olcott consists primarily of chipped CVR tools with approximately 12 types of tools, compared to the 27 different types of chipped stone tools alone, notwithstanding the 25 groundstone, 13 antler, and 13 bone tools from the Marpole Midden. The number of tools present at each site – 371 at the Marpole Midden and 241 at the Olcott Site – also demonstrate a significant change in the lithic technology. Increased density of tools reflects that more tools were needed, as well as the fact that there were more people to use those tools. Of course, there was likely an increase in lithic debitage and flakes with the Marpole materials compared to Olcott, which may have skewed some of the results. Nevertheless, the simple fact that the number of chipped stone tool types doubled over almost 10,000 years, and new tool materials and technologies were added as well.

The main drawback here is the lack of data from the Scowlitz and Pender Canal sites. Where both of these sites dated primarily from the Locarno Beach phase, it would have been helpful to have seen if they had similar results in terms of tool types and tool density as that from Marpole. Scowlitz particularly would have had promising results due to its relatively large size,

length of occupation, and role as a trading hub, all of which could have shown a unique diversity in tools, materials used, etc. Examining materials from these sites would have helped more specifically define the transitionary, cultural phenomena that took place in the region. However, comparing the 45SN14 materials with the Marpole Midden data adds further knowledge to the drastic changes that took place in terms of the PNC's tool technology.

My second research objective – determine why there is a shift from flaked stone to bone and ground stone tools – was ultimately fulfilled. My research via literature review and analysis of lithic materials shows that there was actually not a shift from flaked stone to ground stone and bone tools. As mentioned earlier, these later tool types arose alongside chipped stone tools and did not replace them. This goes against what Ames and Maschner stated about changes in tool technology:

> "The beginning of the [Marpole Phase] is marked by a significant technological shift in many parts of the central and southern coasts. Previously, chipped-stone tools and waste were numerically significant portions of many artifact assemblages. Around AD 500, however, this changes, and chipped stone becomes comparatively rare, almost completely replaced by bone and antler tools…The reasons for this shift are obscure, although it is probably quite important" (1999: 144).

There appear to be no complete shifts in technology like Ames and Maschner describe here (see Clark 2010). However, the data presented in this thesis help further demonstrate that significant changes were present in the PNC around the Marpole Phase, albeit not in the same manner as was previously believed by various PNW researchers. It also demonstrates the need for further studies examining the lithic assemblages of the PNW. The data presented here is only a fraction of the lithic materials that have been found along the coast and within the Interior Fraser Plateau region. Changes in lithic materials further inland may not have similar results as

their coastal neighbors, for example, and maintain a relatively smaller tool type inventory, like that found at 45SN14 and other Olcott sites.

On a related note, re-visiting museum materials like Marpole Midden or Pender Canal is important to update our collective understanding of prehistoric groups of the Pacific Northwest Coast. This thesis has found the great utility of digitized museum collections; these need to be placed on equal footing as conducting new excavations with the amount of data and review which can be accomplished remotely

Finally, my third research objective to produce more data surrounding how and why prehistoric hunter gatherers shifted from migratory egalitarians to more sedentary chiefdoms in the PNW has been both successful and not. This thesis has primarily been built upon the hard work and publications of other researchers that has helped demonstrate how and why the Marpole Phase came about (e.g., climate change, Entanglement, increase population densities). My research here has shown that changes in tool technology were significant and correlated with some of the cultural changes of the time (i.e., bioarchaeological evidence for ranking). What may not have been as effectively or efficiently proven as was originally hoped was examining the changes and processes of the transitionary period between migratory egalitarians to sedentary chiefdoms.

Conclusions and Future Research

There are multiple avenues for future research following after this thesis. Due to limitations from the COVID-19 pandemic, I was not able to examine the Locarno Beach, Scowlitz, or Marpole Midden materials as originally anticipated. Re-visiting these collections

would certainly help resolve the issues of dating, stratification, etc., as well as any questions surrounding the zooarchaeological, palaeoecological, and other aspects of archaeology beyond the settlement patterns or even lithic technology. Examining Locarno Beach-associated or any post-Marpole Phase sites would yield intriguing results. Furthermore, comparing Gulf of Georgia sites with those beyond the immediate region, like the Fraser River Canyon, Olympic Peninsula, or Vancouver Island, would produce interesting data regarding the extent of the Marpole Phase culture, the differences in tool technologies, ecological patterns, etc.

Another avenue for future studies is delving more into osseous tools of the PNW. As I mentioned in Chapter 4, bone tools have not been studied nearly as extensively as lithic technology, despite being quite common in archaeological assemblages in the PNW. My analysis of the Marpole Midden showed that osseous tools were made for components such as toggling harpoons, awls, needles, beads, etc. This was all based upon Burley's dissertation from 1979, so typology and identification methods may have changed in forty years, or perhaps re-visiting any zooarchaeological materials from the Marpole Midden could yield previously overlooked or misidentified osseous tools. The wealth of data which can be produced from examining bone and antler tools from other sites or regions is clear: whether certain animal bones were preferred for tools; the differences between bone and antler tools types and uses; any trade routes that could be inferred from the bones (e.g. if polar bear bone tools were found in the Olympic Peninsula). Osseous tools do not preserve as well as lithics, so naturally they are more difficult to study, due to either preservation complications or simply handling the materials. Therefore, it is necessary to address this important part of prehistoric tool technology before these resources are lost to time and degradation.

I feel that this thesis shows the importance of utilizing museum collections more often in lieu of conducting new fieldwork for future research at either the collegiate or professional level. Museums house an almost innumerable amounts of archaeological materials across the United States alone, most of which sit on shelves for decades and are never used. Until I examined them in August 2020, no one had looked at, measured, or documented the Olcott Site materials despite having been housed at the Idaho Museum of Natural History for several decades. This is relatively surprising considering they were taken from an important type site of the PNW. Also, any efforts in digitizing museum collections would be greatly beneficial for future research. Accessing data from non-local museums has been helpful in recent years, but now in this post-COVID 19 world, it becomes more essential with each passing day. It would not have been possible for me to conduct certain portions of my research without the few digital collections to which I had access. Long-distance studies would be made immensely easier – and cheaper – if more museums had the means and resources to digitally preserve their collections.

The results of my research confirms that there was no complete replacement of chipped stone tool technology by ground stone or osseous tool technologies. It is also established that multiple factors contributed to the Marpole Phase culture or were all entangled within each other as Hodder would argue. As discussed in the introductory chapter of this thesis, there was a "perfect storm" of events that resulted in the Marpole Phase with climate affecting the local flora and fauna, leading to increased densities of resources like fish and terrestrial mammals, and in turn resulting in increased human populations. This led to developments in cultural aspects like kinship groups limiting access to certain resources, specialization of tool technology, the emergence of artistry and craftsmanship (e.g., decorative tools, beads, property celts), social stratification, etc. As is usually the case, there are more than one, or even two, explanations for a

solution, which is why the concept of Entanglement works so well and reveals far more interesting and complex insight than any straightforward, single explanation for human behavior. Ames and Maschner were accurate in saying the shifts in tool technology around the Marpole Phase were "quite important", and hopefully the reasons for it are no longer quite so obscure.

However, I agree with Clark (2010) in that there are far too many differences and variations to apply the term "Marpole Phase" to the phenomena occurring in the Salish Sea region, or even the PNW as a whole. There were dozens, if not hundreds, of different tribes, kinships, cultures, etc., living along the Central Coast, and many still reside there. They may all have shared ancestry, languages, and cultures, but there are just as many differences that make them equally unique. This may all be a simple matter of semantics in labeling what is and is not "Marpole". Nevertheless, it is still important to re-evaluate why we as anthropologists use certain terms when describing our research, or if they are even accurate or respectful. On a related note, in academic discussion of the PNW, there is the idea of Indigenous groups "owning" or "controlling" certain resources that led to the emergence of chiefdoms, which is terminology that does not truly fit in with Indigenous perspectives. First Nations and Native Americans do not have the same concept of "owning" the land as Western European groups. While it may be fair to say that prehistoric Coast Salish kinships had proprietorship over particular ecological niches or resources, it would be a good idea to re-examine this terminology through an Indigenous perspective. Including Indigenous voices in anthropology has been a fairly bumpy, difficult journey, no thanks to past grievances caused by Euro-American settlers and anthropologists alike. It is important that continued and sustained efforts are pursued to work with Indigenous leaders, scholars, tribes, etc. if any further anthropological research is to occur in the PNW. It is easy to adhere to long-standing schools of thoughts or beliefs, to continue using the same

descriptions and labels, especially in academia. Self-awareness and positionally are central to anthropology. We must continuously question ourselves to better understand and interact with the people we study.

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