ENVIRONMENTAL AND CULTURAL CONTEXTS OF PALEOSHORELINE SITES ON THE NORTHWESTERN OLYMPIC PENINSULA OF WASHINGTON STATE

Gary C. Wessen and David R. Huelsbeck

INTRODUCTION

This article addresses recent research on the northwestern Olympic Peninsula of Washington State that focuses upon archaeological sites that appear to be associated with one or more older sea level stands. The sites are located in forest settings between approximately seven and fourteen metres above the top of the modern intertidal zone. Several are located along the flanks of coastal river valleys that would have been bays when the local sea levels were higher. We present background information on the context of these sites, summarize the work that has been undertaken at them, and place the results of our research within the environmental and cultural histories of this region.

Modern and Past Environmental Settings

The northwestern tip of the Olympic Peninsula of western Washington extends approximately forty kilometres to the south, and a similar distance to the east, of Cape Flattery. It includes most of the Lake Ozette area on the Pacific coast and Clallam Bay along the Strait of Juan de Fuca. The Makah Indian Reservation accounts for the core of this area, but a portion of Olympic National Park and a variety of other state and private lands are also represented.

The northwestern Olympic Peninsula is a rugged landscape marked by dense forests and steep terrain. Elevations of more than four hundred metres above sea level are present within a few kilometres of the coast in the Cape Flattery area, and surfaces greater than 150 metres above sea level are common. There are no major river systems, but a few small coastal river valleys are present. Much of the marine shoreline is steep and rocky, although numerous small "pocket" beaches and a few much larger sections of broader sandy beach are also present. Nearly all of the region's shorelines are exposed and subject to relatively high wave energy regimes.

The northwestern Olympic Peninsula and the immediately adjacent marine waters support a wide range of marine and terrestrial mammals, marine and terrestrial birds, marine and anadromous fish, and marine shellfish (McNulty 2009). More than three hundred species of animals are, or recently were, present. While most of the terrestrial mammals, terrestrial birds, marine fish, and shellfish are year-round residents, many other animals are only present in certain seasons. In particular, many kinds of marine mammals, marine and terrestrial birds, and anadromous fish are present in great numbers in some seasons and virtually absent at other times.

The paleoenvironmental issue of most direct relevance to this article is the local sea level history during the second half of the Holocene. Although significant data on this subject are available for the region as a whole, information from the northwestern Olympic Peninsula is relatively limited. Thus, discussion of this subject draws on studies from elsewhere on the southern Northwest Coast.

The northwestern tip of the Olympic Peninsula was covered by the Juan de Fuca Lobe of the Cordilleran Glacial Ice Sheet in late Pleistocene times (Booth et al. 2003). This ice probably moved into the northwestern Olympic Peninsula around seventeen thousand years ago and was gone by twelve to fourteen thousand years ago. While it is likely that newly deglaciated surfaces had a periglacial character, pollen data suggest that some shrubs and herbs established themselves relatively quickly and that a number of tree species were probably present by about ten thousand years ago (Gavin et al. 2013). A mid-Holocene warm-dry interval probably occurred between around six thousand and eight thousand years ago. Conditions began to cool somewhat after this time. The modern forest of Sitka spruce, western hemlock, and western redcedar was probably not present until sometime between three and five thousand years ago.

Sea levels are strongly influenced by worldwide conditions, but local sea levels in any particular coastal area are also affected by vertical movements of the ground that occur on both local and regional scales. Geological data from the northwestern Olympic Peninsula are limited and therefore we have looked to research from the west coast of Vancouver Island (Dallimore et al. 2008; Friele 1991; Friele and Hutchinson 1993; Shugar et al. 2014). This body of work indicates that rapidly rising sea levels in the early Holocene reached a stand approximately four metres higher than at present by about six thousand years ago and that higher than modern levels persisted until relatively recently. Isostatic rebound appears to have been an important factor early in the Holocene, and tectonic uplift becomes more apparent in later millennia. Although recent research by Engelhart et al. (2015) suggests some differences in the Holocene sea level histories of the west coast of Vancouver Island and the Olympic Peninsula, we suspect that the northwestern tip of the Olympic Peninsula was more like the west coast of Vancouver Island than areas farther to the south.

The Makah People

The northwest portion of the Olympic Peninsula is the traditional territory of the Makah people (Renker and Gunther 1990; Swan 1870). The Makah speak a Wakashan language closely related to those of the Ditidaht and Nuu-chah-nulth on western Vancouver Island (McMillan 1999). In early historic times, the Makah were well known for their prowess in offshore fishing and marine mammal hunting. Resources such as whales, seals, salmon, and halibut played major roles in their economic activities, along with a wide range of other fish, shellfish, mammal, bird, and plant resources (Samuels 1994). They followed a subsistence pattern characterized by a series of seasonal movements determined by the availability of different seasonal resources.

A typical annual cycle of movements included a substantial winter village and one or more seasonal camps that supported such activities as plant or shellfish collecting, hunting, and fishing.

The material culture of the Makah people was very similar to that of their Wakashan-speaking neighbours. They were skilled craftspeople and technicians who produced a wide range of goods from plant, bone, and stone materials. They were particularly well known for their work with wood, bark, and other plant fibres. While they produced a variety of pecked and ground stone tools, they made only very limited use of chipped stone technologies.

Previous Archaeology on the Northwestern Olympic Peninsula

Archaeological research on the northwestern Olympic Peninsula has followed a pattern common to all of western Washington. While the first activities occurred early in the twentieth century, they were limited and were followed by a significant hiatus (Wessen 1990). Most archaeological studies here are relatively recent.

The first published accounts of archaeological sites in this region come from Albert B. Reagan (1917). Although his discussion is limited, Reagan reports the presence of different temporal assemblages based upon their contents. He argues that the area's shell middens contain assemblages representing four distinct periods: "recent, old, very old, and ancient." His "recent" assemblages are marked by the presence of Euro-American goods. The other three units, all thought to date prior to European contact, vary significantly in the presence or absence of stone artefacts. Reagan does not offer any temporal estimates for these assemblages but suggests that they might represent three successive populations.

The first significant and most extensive archaeological excavations in this region were conducted by Richard Daugherty at 45CA24, the Ozette Village site (Samuels 1991, 1994; Whelchel 2005). This effort investigated late pre-contact and early historic shell midden deposits representing approximately the last one thousand years of occupation at a large multi-season settlement. The project crews excavated the remains of three cedar plank houses, where waterlogging had resulted in excellent preservation of architectural elements and house contents, recovering very large numbers of artefacts and faunal remains. Moreover, Daugherty's extensive efforts at this site stimulated other important studies in the area. The most important of these is Dale Croes's work near the mouth of the Hoko River (Croes 1995, 2005), involving work at 45CA213, a riverbank wet site dating from around 2800 to 2200 BP, and at 45CA21, a much more recent shell midden in a rockshelter at the river's mouth. The materials from the combined effort significantly increase the known time depth and offer the first real evidence of temporal changes in archaeological assemblages from this region. Another effort associated with the Ozette work worthy of note is Ed Friedman's testing of late pre-contact and early historic shell midden deposits at ethnographic sites on the Makah reservation. Friedman (1976) sampled both major winter villages and smaller seasonal camps. The recovered materials also represent approximately the last one thousand years of occupation in the area.

Work conducted by the Makah Cultural and Research Center (MCRC) dominates the most recent period of archaeological research on the northwestern Olympic Peninsula. Although some additional investigations of late pre-contact to early historic shell midden deposits have occurred, the MCRC's testing efforts have focused upon older cultural deposits, not sites known from ethnographic sources, that appear to be associated with raised beaches. Research conducted at these sites, reported in this article, considerably extends the known culture history of the northwestern Olympic Peninsula.

The Late Pre-contact Northwestern Olympic Peninsula Assemblage

The body of work conducted in this region heavily emphasizes archaeological deposits that represent the last approximately one thousand years. All sites in this group appear to be associated with modern sea levels. While differences in preservation, site function, and season of occupation are undoubtedly responsible for significant variations in the recovered collections, there is nevertheless a high degree of continuity in the range and character of the artefacts and faunal remains in collections from late pre-contact sites on the northwestern Olympic Peninsula. This assemblage closely resembles – and is undoubtedly related to – the West Coast Culture Type from the west coast of Vancouver Island, which is considered to be the archaeological record of the Makah's close relatives, the Nuu-chah-nulth (McMillan 1999; Mitchell 1990).

The range of artefacts is heavily dominated by objects made from bone and/or antler. Stone artefacts are present, but they rarely represent as much as 10 percent of any collection. Moreover, pecked and/or ground stone tools invariably dominate the stone artefacts. Chipped stone artefacts are uncommon and usually limited to simple items such as scrapers, utilized flakes, and cobble tools. Chipped stone projectile points are rare. Evidence of stone chipping, such as debitage and hammer stones, is also rare, and this may be an indication that at least some of the chipped stone tools are trade items.

The faunal remains from these relatively late sites, such as Ozette and the other village and camp sites tested by Friedman (1976), bear out the ethnohistoric picture of a fully maritime economy. Bones from marine mammals dominate the recovered assemblages. Bones from pelagic marine mammals such as whales and fur seals are overwhelmingly dominant at Ozette and are more abundant than bones from marine mammals available near shore, such as sea lions and harbour seals, at all but one of the sites tested by Friedman near Cape Flattery. Remains of deep-sea fish such as halibut and other marine species, including lingcod, rockfish, greenling, and sculpin, are abundant. Salmon bones are also common, and it is likely that many of these fish were taken in the ocean rather than in local rivers or streams. The most common terrestrial mammal bones represent deer, elk, and dogs, but these are much less abundant than are the bones of marine mammals. Bird bone assemblages are heavily dominated by marine birds, including such offshore species as albatross, fulmars, and shearwaters. Cormorants, scoters, and murres are also very common. The shellfish assemblages from these sites contain a wide variety of marine invertebrates and are heavily dominated by mussels, barnacles, and other animals that represent rocky, high wave energy settings.

A detailed analysis of seasonality indicators at Ozette supports the ethnohistoric literature in identifying Ozette as primarily a winter village that was occupied to some extent year-round (Huelsbeck and Wessen 1997). Both seasonally restricted resources and resources available year-round were important. Undoubtedly the late pre-contact people of this region practised food storage. Proving food storage in the archaeological record, however, is difficult. In general, storage seems likely when harvested resources, such as whales, are too big for immediate consumption. Thus, the sheer quantity of food that can be inferred from the assemblage of faunal remains at Ozette suggests food surpluses and storage (Huelsbeck 1988).

THE PALEOSHORELINE SITES

We currently know of eight archaeological sites on the northwestern Olympic Peninsula that may be, at least in part, associated with a paleoshoreline: 45CA1, 3, 22, 201, 400, 420, 431, and 509 (Figure 1).[1] Six of these sites are clearly not associated with the modern sea level.[2] Two are located along the outer coast, one is on the Strait of Juan de Fuca, and five are along the lower flanks of small coastal river valleys. Distances to the modern beach range from tens of metres for sites along the outer coast to up to three kilometres for sites in the coastal river valleys. Unfortunately, none of them is located close enough to well established vertical datums to know their elevations with precision. Estimates of their elevations are included in Table 1. Five of the sites are located on surfaces approximately seven to ten metres above the top of the modern intertidal zone. Three more are located on slightly higher surfaces between approximately ten and fourteen metres above the top of the modern intertidal zone. All of the sites in this group appear to be either wholly or partially shell midden deposits. At least four, and perhaps as many as seven, appear to be large, thick, and internally complex, with very high densities of marine shell and bones of marine fish and mammals. In almost all cases,

[1] The cultural deposits at 45CA213 (Hoko River) may also be associated with a paleoshoreline, but both the "wet" and the "dry" portions of this site are sufficiently different from the sites at issue in this article that we have chosen to exclude it from most of the general discussion here. Having said this, we acknowledge that 45CA213 is nevertheless relevant to the sites and issues we address.

[2] The two exceptions (45CA1 and 45CA22) are both complex masses of cultural deposits, including some that appear to be associated with modern sea levels and others that are clearly not. Neither site area is well understood, and further study will probably show that each actually consists of two closely spaced yet discrete separate areas of cultural deposits.

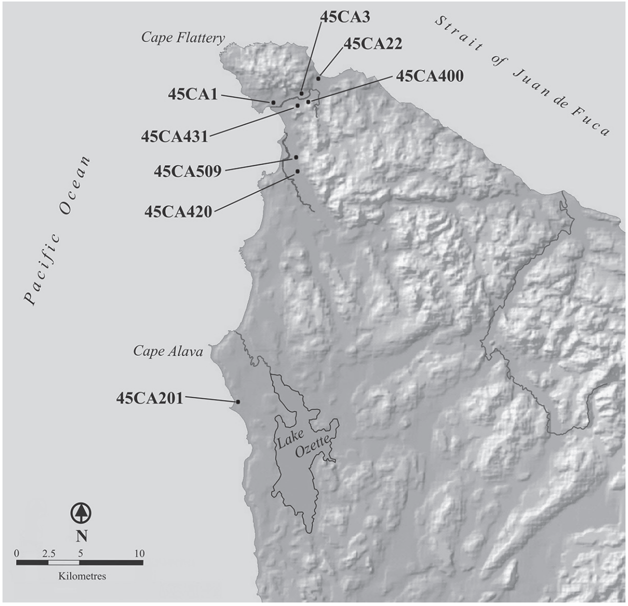

Figure 1. The locations of terrestrial paleoshoreline sites on the northwestern Olympic Peninsula of Washington State.

the shell midden deposits are buried and begin at depths between thirty and seventy centimetres below the ground surface. Further, at least four of the sites located along the lower flanks of small coastal river valleys also have overlying cultural deposits that contain very little marine shell. This condition has not been observed at paleoshoreline sites along the outer coast or the Strait of Juan de Fuca.

Most of these sites are relatively recent discoveries and none is well studied. Most were fortuitously identified in road cuts or other disturbed exposures. Only two were found during archaeological surveys. To date, five of the sites have been subjected to limited test excavations and the rest are known only from brief inspections that included limited, or no, subsurface probing. Given the dense vegetation at all site locations, our appreciation of each site's size and landscape expression (including its elevation) is approximate at best. The first site to be tested, 45CA201, on the open ocean coast south of Ozette, was originally identified during Daugherty's early work at Ozette and was tested by Wessen in 1979 and 1992. The initial findings from the site stimulated an interest in the older cultural deposits of this region, and Wessen subsequently tested 45CA22 in 1988, 45CA420 in 2002, 45CA3 in 2003, and 45CA400 in 2006 (Wessen 1984, 1991, 1993, 2003, 2006a, 2006b). Each effort was limited to a single test pit, and the resulting collections represent sampled volumes that range

TABLE 1
Radiocarbon dates for terrestrial paleoshoreline sites on the northwestern Olympic Peninsula of Washington

Site	Elevation	Sample no.	Material	C14 age[1]	2-Sigma Cal BP Age range[2]	Comments
45CA1	~+12 metres	Beta-47547	charcoal	1790 ± 70*	1870 – 1560	Top of shell midden component
		Beta-47548	charcoal	3910 ± 61*	4425 – 4090	Shell midden component
		Beta-200361	shell	4560 ± 80	4700 – 4181	Base of shell midden component
45CA3	~+10 metres	Beta-187110	charcoal	1710 ± 60	1813 – 1423	Top of shell midden component
		Beta-200361	charcoal	3460 ± 60	3872 – 3579	Base of shell midden component
45CA22	~+7 metres	Beta-28735	charcoal	2070 ± 70*	2311 – 1945	Shell midden component
		Beta-28734	charcoal	2170 ± 61*	2350 – 2063	Shell midden component
45CA201	~+12 metres	SI-4366	charcoal	1600 ± 75*	1694 – 1340	Top of shell midden component
		OS-85722	shell	2180 ± 25	1570 – 1374	Shell midden component
		OS-85723	shell	2210 ± 40	1645 – 1380	Shell midden component
		OS-85724	shell	2230 ± 35	1662 – 1409	Shell midden component
		OS-85725	shell	2150 ± 30	1540 – 1344	Shell midden component
		OS-85726	shell	2250 ± 30	1686 – 1459	Shell midden component
		OS-85727	shell	2230 ± 25	1645 – 1414	Shell midden component
		OS-85728	shell	2250 ± 45	1695 – 1414	Shell midden component
		OS-85729	shell	2260 ± 25	1687 – 1485	Shell midden component
		OS-85730	shell	2340 ± 50	1811 – 1531	Shell midden component
		OS-85731	shell	2420 ± 55	1910 – 1600	Shell midden component
		SI-4367	charcoal	2270 ± 75*	2488 – 2060	Base of shell midden component
45CA400	~+14 metres	Beta-80923	charcoal	2690 ± 60	2942 – 2736	Top of shell midden component
		Beta-209058	charcoal	2850 ± 70	3164 – 2793	Base of lithic component
		Beta-200363	charcoal	2900 ± 100	3335 – 2793	Top of shell midden component
		Beta-209059	charcoal	3020 ± 60	3369 – 3008	Shell midden component
		Beta-206985	charcoal	3170 ± 40	3476 – 3259	Shell midden component
		Beta-200362	shell	3780 ± 70	3601 – 3230	Shell midden component
		Beta-209060	shell	4380 ± 70	4401 – 3978	Shell midden component
45CA420	~+10 metres	Beta-160527	charcoal	1690 ± 60	1732 – 1415	Base of lithic component
		Beta-160528	charcoal	3070 ± 70	3445 – 3075	Shell midden component
		Beta-160529	charcoal	3090 ± 70	3451 – 3080	Shell midden component
		Beta-160530	charcoal	2930 ± 70	3325 – 2878	Base of shell midden component
45CA509	~+10 metres	Beta-200362	shell	3440 ± 50	3335 – 2793	Shell midden component

1 All dates have been corrected for isotopic fractionation. Dates with an asterisk (*) were determined without a 13C/12C measurement and are reported here with an estimated 13C/12C value of -25.
2 All shell dates are reported here using Delta-R=250±25.

from approximately 2.3 to 6.7 cubic metres. Screening was conducted with six-millimetre (one-quarter-inch) mesh, although limited three-millimetre (one-eighth-inch) screening of selected matrix sampling also occurred during the more recent work.[3] All sampling efforts recovered

3 A great majority of all recent sample recovery efforts also used six-millimetre mesh. However, when screeners reported the presence of very small fish bones, small volumetric samples of the matrix then being recovered were screened using three-millimetre mesh.

relatively large quantities of faunal remains and smaller collections of associated artefacts.

While only five of the sites have been sampled, at least one radiocarbon date is available from seven of the eight sites (see Table 1). Most of the dates were obtained from charcoal, although some shell dates were also run. The dates were usually obtained from aggregate samples collected from a single ten-centimetre arbitrary level, representing a single major depositional stratum. Radiocarbon dates from sites that were not tested are sometimes based upon samples from fortuitous exposures, and their stratigraphic contexts are not always clear. The data are summarized in Table 1. Most of the dates refer to the shell midden deposits rather than to the overlying cultural deposits that contain very little marine shell. Shell midden dates represent occupation between around sixteen hundred and four thousand years ago, with only one date from 45CA1 and one date from 45CA400 being slightly older than this range.

PALEOSHORELINE COMPONENT ASSEMBLAGE CHARACTERISTICS

Although the sampled volumes from the tested sites are small, they provide valuable insights into the character of the represented assemblages. The internal structure of the shell midden deposits at each of these sites is complex, and as many as eleven major shell midden strata were identified within a single test pit. No sampled site was found to contain fewer than three major shell midden strata. Three of the sampled sites and at least one other also contained an overlying cultural deposit containing very little marine shell. These deposits share a number of characteristics that stand in clear contrast to the shell midden strata beneath them. We consider the uppermost cultural deposit with very little marine shell to represent a distinct component (the "lithic component") and the contents of all the shell midden deposits at each site to be a second distinct component (the "shell midden component").[4] Both components are present in the recovered sample from 45CA3, 45CA400, and 45CA420, whereas the recovered samples from 45CA22 and 45CA201 contain only the shell midden component.

[4] Note that these terms are intended to reflect the component's dominant characteristic, but the materials are not mutually exclusive. Some lithic artefacts were recovered from shell midden component deposits, and very small quantities of shell were recovered from lithic component deposits.

The Lithic Component

Our knowledge of the lithic component in the paleoshoreline sites is limited by several factors. It has only been encountered at sites now located in coastal river valleys, and it invariably represents a smaller portion of the sampled volume, as compared to the underlying shell midden component. Further, deposits representing the lithic component are invariably disturbed. Logging and/or other historic activities have disturbed the upper portion of each site and most also exhibit disturbance from burrowing animals and other forms of bioturbation. No intact cultural features have been encountered in deposits representing the lithic component. These conditions have limited our analytical efforts. For example, we have been generally reluctant to date charcoal samples from these deposits and therefore have few chronological controls on this component. Table 1 contains only two radiocarbon dates, one each from the lowest level of the lithic component at 45CA400 and 45CA420, respectively. We have no direct evidence of when the lithic component occupation ended at any of these sites. We do know, however, that the chipped stone objects typical of this component are rare – or wholly absent – in cultural deposits dating to the last approximately one thousand years.

Artefact assemblages from the lithic components consist exclusively of stone objects (Table 2). While this may, in part, reflect preservation bias, small quantities of animal bone are present in all lithic component deposits and so bone preservation is unlikely to be the complete explanation. Chipped stone artefacts dominate all lithic component artefact assemblages. Each of the latter contains more than one hundred specimens and debitage accounts for more than 90 percent of each assemblage. Both bipolar and direct free-hand percussion debitage are common. Evidence of pressure flaking is rare. Bipolar debitage is significantly more abundant than is direct free-hand percussion debitage in two of the three lithic component assemblages. This technique appears to have been largely confined to small locally available quartz pebbles. The resulting materials are indistinguishable from those described by Jeff Flenniken (1980) from Hoko River (45CA213). Flenniken argues that this technique was used to produce small straight microliths that were mounted in wood hafts to create fish-butchering knives. Direct free-hand percussion was applied to a range of locally available igneous and sedimentary materials. The most commonly occurring materials used for percussion flaking include (1) a dark fine-grained stone that is either a basalt or dacite and (2) a coarser-grained more heterogeneous sedimentary stone that ranges from slate to shale. Finished tools made by percussion flaking include bifacial

TABLE 2
Artifacts recovered from lithic and shell midden components at tested paleoshoreline sites on the northwestern Olympic Peninsula, Washington

SITE	45CA3		45CA400		45CA420		45CA22	45CA201
Component	Lithic	Shell midden	Lithic	Shell midden	Lithic	Shell midden	Shell midden	Shell midden
Sampled volume (M^3)	1.77	1.27	3.14	3.56	0.8	1.95	2.33	3.12
Chipped stone								
Bi-polar debitage	379	35	40	1	171	20	1	6
Percussion debitage	269	50	92	49	70	72		18
Pressure debitage	4	1		1		1		
Bifacial points			2		1			
Bifacial knives	1		2					
Bifacial preforms	5	1	4	1	1			
Small unifacial tools	1		2		1			
Flaked cobbles/spalls	1	2						6
Ground stone								
Abraders/whetstones	1	1	7	4	1	3	1	4
Anvil stones	1							1
Hammer stones			3					1
Mauls								1
Slate points/knives	1					1		
Other ground stone			3					
Bone/antler/tooth								
Unipoints		1		2		3	3	11
Bipoints		1						2
Unilaterally-barbed points								6
Indeterminate points				5			2	
Harpoon values								1
Wedges				1		5		1
Worked bone		6		8		3	2	9
Pendants/decorative items				1				3
Shell								
Ground Mussel shell				1				4
Olivella Shell Beads		1		2		1		
Dentalium								1

stemmed projectile points, bifacial knives, and unifacially flaked cobbles and cobble spalls. While the overwhelming majority of chipped stone artefacts were made of locally available materials, the lithic component samples also contain a few small obsidian pressure flakes. Sourcing of these materials indicates that they originated at a number of southeastern Oregon locations, including Newberry Crater, Obsidian Cliffs, Whitewater Ridge, and Wolf Creek.

Ground and/or pecked stone artefacts are present in all lithic component artefact assemblages, but they are far less abundant than chipped stone objects. Whetstones or abraders are, by far, the most abundant of these. Hammer stones, anvil stones, and ground objects, including at least one slate point and one bead, have also been found.

Faunal remains are present, yet relatively uncommon, in the lithic component deposits at 45CA3, 45CA400, and 45CA420 (see Tables 3, 4, 5, and 6). Fewer than one hundred bone pieces are available from this component at each site and most are fragments. Thus, significant numbers of specimens with only limited diagnostic value are present. Most bones in each sample represent fish, of which lingcod and greenling are the most commonly identified. Rockfish and small flatfish also occur regularly. Salmon bones are present in the lithic component at 45CA3 and 45CA400 but are not particularly abundant. Marine mammals dominate the small mammal bone samples from all three sites. Fur seal is the most commonly identified mammal. The identified birds are mostly ducks and grebes. Small quantities of marine shell in the lithic component are mostly fragments of bivalves, particularly butter clams.

Although the relatively small sizes of the lithic component samples argue for caution, there are strong parallels between these assemblages and that recovered from the waterlogged deposits at Hoko River (45CA213) (Croes 1995). There are also clear similarities to the lithic assemblage recently recovered from the "Back Terrace" portion of Ts'ishaa (DfSi-16) on the west coast of Vancouver Island (McMillan and St. Claire 2005). Both of these sites contain the same bipolar industry focused on the production of small straight microliths from quartz pebbles. Ts'ishaa also contains a few obsidian objects from some of the same southeastern Oregon sources represented in our sites.

The Shell Midden Component

The shell midden component is represented at all five of the paleo-shoreline sites we have tested. While individual site shell midden component samples are invariably larger than those representing individual site lithic components, it is important to emphasize that the former are also the products of small-scale testing. Most shell midden component samples contain between one hundred and two hundred artefacts, although some are significantly smaller. In contrast, all of the shell midden samples are rich in faunal materials and even relatively small volumes yield large quantities of bone and shell. Individual site samples range from fifteen hundred to seven thousand pieces of bone and similar quantities of shell.

Artefact assemblages from the shell midden components are considerably more diverse than are those from the lithic components (Table 2). All of the

TABLE 3

Mammal bone NISP recovered from lithic and shell midden components at tested paleo-shoreline sites on the northwestern Olympic Peninsula, Washington.

Site	45CA3		45CA400		45CA420		45CA22	45CA201
Component	Lithic	Shell Midden	Lithic	Shell Midden	Lithic	Shell Midden	Shell Midden	Shell Midden
Humpback whale, *Megaptera novaengliae*[1]		1						2
Gray whale, *Eschrichtius robustus*[1]				1				
Blue whale, *Balaenoptera musculus*[1]		1						
Sperm whale, *Physeter catodon*[1]				1				
Indeterminate whale, *Cetacea*		4		2		1		2
Fur seal, *Callorhinus ursinus*		2		19	4	4		518
Sea lion, *Eumetopias jubata*		3	1	1				11
Harbour seal, *Phoca vitulina*		2		6				
Porpoise, *Delphinidae*		1		2				
Sea otter, *Enhydra lutris*			1					
Indeterminate sea mammal	3	24	1	36	4	59	4	96
Elk, *Cervus Canadensis*				1	1	4		2
Deer, *Odocoileus hemionus*				2				2
Black Bear, *Ursus Americanus*				1				
Beaver, *Castor Canadensis*				2		1		
Raccoon, *Procyon lotor*			1			3		
River Otter, *Lutra Canadensis*						1		
Canid, *Canidae*	1			3	1	2	7	
Other Small Mammals		2					1	1
Indeterminate Land Mammal		5		11		8	1	6
Indeterminate Mammal	5	376		63		52	5	

[1] Whale species identifications were obtained by DNA study (Alter, personal communication). An additional whale bone specimen from 45CA509 – an untested site – has also been identified as a humpback whale.

former contain chipped stone, ground and/or pecked stone objects, and objects made of bone, antler, or tooth. Four of the five shell midden component assemblages also contain small numbers of shell artefacts. In most cases, chipped stone forms the most abundant artefact class, consisting primarily of debitage. Both bipolar and direct free-hand percussion debitage are common; however, in contrast to the lithic component, most shell midden component assemblages are dominated by specimens produced by direct free-hand percussion. Finished chipped stone artefacts are uncommon and are usually either flaked cobbles or small unifacial tools. No chipped stone projectile points have been recovered from the shell deposits. Ground and/or pecked stone artefacts are far less abundant than are chipped stone objects. Whetstones or abraders are, by far, the most abundant of these, but small numbers of hammer stones, anvil stones, and other ground objects have also been found. Artefacts made of bone, antler, or tooth are relatively common, and various types of small points or bipoints are particularly well represented. Other tools in this group include small wedges, decorative items, and a single composite toggling harpoon valve. Four of the five assemblages also contain small fragments of worked bone that do not appear to be finished tools. Shell artefacts include purple olive shell beads and fragments of ground mussel shell cutting or piercing tools.

When the artefact assemblages from the shell midden components are viewed as a group, they show many parallels to later materials. The chipped and ground and/or pecked stone materials closely resemble those from the overlying lithic components. In fact, the ground and/or pecked stone artefacts from the paleoshoreline shell midden components are very consistent with both those from the lithic components in these sites and those from much more recent northwestern Olympic Peninsula shell midden sites. Artefacts made of bone, antler, tooth, and shell are also virtually indistinguishable from equivalent items recovered from the more recent shell midden sites.

The relatively large faunal assemblages available from the shell midden components exhibit similar patterns (see Tables 3, 4, 5, and 6). They are much more diverse than are those from the overlying lithic components and they show many parallels with those from the more recent shell midden sites. While some important variations among the shell midden component faunal assemblages are apparent, at least some of these differences probably reflect the environmental settings of different sites. This condition is particularly apparent in comparing 45CA201 (on the exposed outer coast) with 45CA3, 45CA400, and 45CA420 (in the coastal river valleys). The 45CA201 mammal assemblage is heavily dominated by fur seal bones, while terrestrial mammal bone of any kind is rare. The diverse fish assemblage from this site is dominated by deep-water species such as halibut, along with lingcod and rockfish. The bird assemblage is also diverse and contains evidence of numerous offshore species such as albatross, shearwaters, and fulmars. The coastal river valley sites also contain mammal assemblages that are heavily dominated by marine animals, but fur seal bones are relatively less abundant. They also contain the remains of whales, porpoises, sea lions, harbour seals, and sea otters. Terrestrial mammal bone continues to be uncommon. Fish assemblages are also diverse, and while halibut is still frequently present, it is much less abundant. All of these sites contain relatively large quantities of greenling and lingcod bones. All contain salmon bones, but only 45CA400 has large

TABLE 4

Fish bone NISP recovered from lithic and shell midden components at tested paleoshoreline sites on the northwestern Olympic Peninsula, Washington

Site	45CA3		45CA400		45CA420		45CA22	45CA201
Component	Lithic	Shell midden	Lithic	Shell midden	Lithic	Shell midden	Shell midden	Shell midden
Indeterminate salmon, *Oncorhynchus* spp.	3	49	3	657		19	30	33
Herring, *Clupea pallasi*[1]			4	557		155	60	
Pacific halibut, *Hippoglossus stenolepis*		21		13			8	503
Indeterminate sole, *Solea* spp.							76	
Indeterminate flatfish, *Pleuronectiformes*	5	66	3	120	1	40	10	41
Indeterminate rockfish, *Sebastes* spp.	1	46	2	173	3	52	248	676
Indeterminate greenling, *Hexagrammos* spp.	15	244	7	1112	8	572	417	64
Lingcod, *Ophiodon elongates*	4	16	3	294	14	133	86	304
Pacific cod, *Gadus macrocephalus*				2			5	41
Tomcod, *Microgadus proximus*							103	8
Cabazon, *Scorpaenichthys marmoratus*		7	3	78		7		16
Indeterminate sculpin, *Cottidae*		2	2	96	1	28	66	43
Indeterminate sea perch, *Embiotocidae*		13		62	1	53	19	22
Dogfish Shark, *Squalus suckleyi*	1	31	2	65		32	17	56
Skate, *Raja binoculata skate*		2						125
Other fish					1	129		42
Indeterminate fish	50	810	25	3565	13	1925	354	1211

[1] All herring bone counts reflect 6 mm (1/4 inch) screen recovery: 3 mm (1/8 inch) screening of selected subsamples at 45CA3, 45CA400, and 45CA420 indicates that herring bones are probably not present at the first site and actually present in far greater numbers at the latter two. On this basis, it is likely that the frequency of herring bones reported for 45CA22 is also dramatically under-represented.

quantities. 45CA400 and 45CA420 also contain very large quantities of herring bones.[5] The bird assemblages are again diverse. The open ocean species that were conspicuous at 45CA201 are also present but are less common; rather, samples from the coastal river valley sites are dominated by a variety of ducks, scoters, and other waterfowl. Finally, while the shellfish assemblage from 45CA201 is dominated by high wave energy rocky substrate animals such as mussels, barnacles, and chitons, these animals are much less prominent in the coastal river valley sites. The most abundant shellfish represented in the latter are lower-wave-energy sandy and gravel substrate animals such as butter clams, littleneck clams, and horse clams.

[5] Herring bone totals in Table 4 reflect recovery using six-millimetre mesh screen. Note that three-millimetre mesh screening of herring-rich deposits indicates that the actual densities of these bones exceed 100,000 per cubic metre in some deposits at both sites.

TABLE 5

Bird bone NISP recovered from lithic and shell midden components at tested paleoshoreline sites on the northwestern Olympic Peninsula, Washington

Components	Lithic	Shell midden	Lithic	Shell midden	Lithic	Shell midden	Shell midden	Shell midden
Short-tailed albatross, *Phoegastria albatrus*		4		2		1		14
Black-footed albatross, *Phoebastria nigripes*								1
Indeterminate albatross, *Phoebastria* sp.		1					2	2
Sooty shearwater, *Puffinus griseus*		1						1
Indeterminate shearwater, *Puffinus* sp.							21	2
Northern fulmar, *Fulmarus glacialis*				3			2	3
Cassin's auklet, *Ptychoramphus aleuticus*				1				
Rhinoceros auklet, *Cerorhinca monocerata*		3						
Common murre, *Uria aalge*				6			5	3
Tufted puffin, *Lunda cirhatta*								1
Pigeon guillemot, *Cepphus columba*								1
Indeterminate alcid, *Alcidae*		1						
Common loon, *Gavia immer*		7		3		2		
Pacific loon, *Gavia Pacifica*		1		8		4		
Red-throated loon, *Gavia stellata*				7				
Indeterminate loon, *Gavia* sp.				4				
Red-necked grebe, *Podiceps grisegena*			1	2				
Horned grebe, *Podiceps auritus*				2		1		
Western grebe, *Aechmophorus occidentalis*				1				
Indeterminate grebe, *Aechmophorus/podiceps*			1	1		2		
Double-crested cormorant, *Phalacrocorax auritus*		1		11			1	2
Pelagic cormorant, *Phalacrocorax pelagicus*				7				2
Indeterminate cormorant, *Phalacrocorax* sp.		3		1				
White-wing scoter, *Melanitta fusca*		9	1	60		3		
Indeterminate scoter, *Melanitta* sp.				9			6	7
Indeterminate gull, *Larus sp.*	1	2		31		4	2	4
Old squaw, *Clangula hyemalis*	3			2		4		
Indeterminate duck, *Anatidae*		15	2	38	1	6	4	9
Canada goose, *Branta canadensis*				6		6	2	
Indeterminate goose, *Anserinae*		2		3		2		1
Bald eagle, *Haliaeetus leucocephalus*				1				
Indeterminate hawk, *Accipitridae*				2				
Raven/crow, *Corvus* sp.				2		4	1	1
Ruffed grouse, *Bonasa umbellus*		1				2		
Varied thrush, *Ixoreus naevius*		1						

TABLE 6
Shellfish MNI recovered from lithic and shell midden components at tested paleoshoreline sites on the northwestern Olympic Peninsula, Washington

Component	Lithic	Shell midden	Lithic	Shell midden	Lithic	Shell midden	Shell midden	Shell midden
Blue mussel, *Mytilus edulis*						7		
California mussel, *Mytilus Californianus*		31	10	1358	2	453	C	1100
Littleneck clam, *Protothaca staminea*	8	49	6	471	3	357	A	586
Butter clam, *Saxidomus giganteus*	35	503	72	2651	8	472	A	321
Indeterminate horse clam, *Tresus* spp.	3	137	28	2495	2	699		81
Basket cockle, *Clinocardium nuttalli*	3	147	14	385	2	187	C	
Bent-nosed clam, *Macoma nasuta*						2		2
Rock scallop, *Hinnites multirugosa*						3		1
Pink scallop, *Chlamys rubidus*						1		
Sitka periwinkle, *Littorina sitkana*	2	166	101	21,639	1	36	C	6
Frilled dogwinkle, *Thais lamellosa*	4	103	6	670	1	217	C	1
File dogwinkle, *Thais lima*				10		4		
Channeled dogwinkle, *Thais caniculata*		1				6		12
Emarginated dogwinkle, *Thais emarginata*		5		36		12		48
Dire whelk, *Searlesia dira*		1		29		2		2
Shield limpet, *Acmea pelta*		12		73		13	C	85
Mask limpet, *Acmea persona*				9		9		6
Plate limpet, *Acmea scutum*		20	1	132		37		86
Indeterminate limpet, *Acmea* spp.				1098		10	C	27
Rough keyhole limpet, *Diodara aspera*		1				1		8
White slipper shell, *Crepidula nummaria*						1		
Hooked slipper shell, *Crepidula adunca*				2				
Wrinkled amphissa, *Amphissa Columbiana*				1				
Purple olive shell, *Olivela biplicata*		1				1		
Wroblewski's wentletrap, *Opalia wroblewskii*						1		
Stellers chiton, *Cryptochiton stelleri*				15		4	P	21
Black katy chiton, *Katharina tunicata*		7	1	38		8	P	3
Mossy chiton, *Mopalia muscosa*			1	1		2		3
Red rock crab, *Cancer productus*				1		3		
Gooseneck barnacle, *Mitrella polymerus*						1		

[1] Shell samples from 45CA22 were weighed rather than quantified in terms of MNI values; A = abundant, C = common, P = present.

DISCUSSION

Although our data are limited by small sample sizes and other constraints, we believe that these findings offer a number of important insights into the environmental and cultural histories of the northwestern Olympic Peninsula. The following sections consider some of these insights and what they suggest.

Environmental History

The principal aspect of environmental history informed by this work is relative sea level history on the northwestern Olympic Peninsula. Only limited local sea level data are available for this area, but research from the nearby west coast of Vancouver Island indicates that higher than modern sea levels occurred during the mid- and late Holocene. Our data offer strong support for the existence of these higher than modern sea levels and indicate that they extended as far south as the northwestern Olympic Peninsula. Levels at least three to five metres higher than at present appear to be indicated. Such higher levels appear to have been present around forty-five hundred years ago and continued until sometime after around eighteen hundred years ago.

Both the lack of precise elevation information and uncertainties about the details of each site's relationship to its associated shoreline limit our ability to reconstruct the local mid- and late Holocene sea level history, but the broad outlines of that history are apparent in this data. Our oldest dates, around forty-three hundred to forty-six hundred years ago, come from sites located on surfaces estimated to be approximately twelve to fourteen metres above the top of the modern intertidal zone. The oldest dates from sites located on surfaces estimated to be approximately ten metres above the top of the modern intertidal zone are in the range of three thousand to thirty-nine hundred years ago. The oldest date for the lowest elevation site in this group, at approximately seven metres above the top of the intertidal zone, is around two thousand to twenty-three hundred years ago.

This raised sea level produced a landscape significantly different from what we see today. The lower portions of the region's small coastal river valleys were flooded, creating relatively narrow saltwater bays and channels. Such features were present in the lower Sooes River and Wa'atch River valleys and probably the Ozette River valley as well. Depending on the actual height of the higher sea stands, seawater may have extended up the Ozette River valley as far the Lake Ozette basin, while the lower Wa'atch River valley may have contained a marine channel that connected Makah Bay on the outer coast with the Strait of Juan de Fuca in the vicinity of Neah Bay. If such a channel existed, the Bahokus Peak massif, including the Cape Flattery area, would have been an island at that time. These water bodies would have been relatively protected low wave energy environments that have no analogs in the region today. Evidence for the existence of such bays can be seen in the shellfish assemblages from the paleoshoreline sites in the coastal river valleys. While sites on the outer coast are heavily dominated by shellfish from high wave energy environments, the river valley sites contain assemblages dominated by species that prefer lower wave energy settings.

We believe that the termination of shell midden deposition at many of these sites may be related to local relative sea level reaching, or at least approaching, the modern stand. Our knowledge of when such deposition ends is currently no better than approximate, but initial review of the available dates appears to suggest an interesting possibility. One or more dates associated with the end of shell midden deposition are available for five of the paleoshoreline sites and, in four of the five cases (i.e., 45CA1, 45CA3, 45CA201, and 45CA420), this activity appears to have ended between around sixteen hundred and seventeen hundred years ago. This apparent synchronicity suggests that a single event might be responsible. Specifically, we suspect that the inferred change in sea level during this interval may have been caused by an earthquake that abruptly raised the ground in this area. While evidence of a significant seismic event at about this time has been reported at various locations on the southern Washington coast (Atwater and Hemphill-Haley 1997) and on the northeastern Olympic Peninsula (Williams, Hutchinson, and Nelson 2005), recent geological data from the Wa'atch River valley indicate that this interpretation is not correct (Peterson et al. 2013). The latter study confirms marine inundation of the valley prior to around fifteen hundred years ago, but it also shows that draining of the valley was gradual rather than sudden. Thus, the apparent synchronicity in the termination of shell midden deposition at four of these sites is probably not evidence of a single seismic event. We now suspect that the principal factor responsible for the change in local sea levels, and the associated landscape and land use changes, is tectonic uplift of the northwestern Olympic Peninsula. At least five different studies report this effect, with estimates of the uplift rate ranging between approximately 1.5 and four millimetres a year (Bird and Schwartz 2000; Holdahl, Faucher, and Dragert 1989; Mitchell et al. 1994; Savage, Lisowski, and Prescott 1991; Verdonck 2006). Given the age of the shell midden components in these sites, tectonic uplift alone may be sufficient to account for their locations in the modern landscape.

The Represented Cultural Behaviours

The paleoshoreline sites considered in this article clearly reflect a cultural system that was strongly oriented towards maritime environments and resources. Bones from marine mammals, fish, and birds dramatically outnumber those from terrestrial animals. In some cases, the bones from pelagic species are more abundant than are those of nearshore species. Beyond this, what can we say about the likely character of the represented culture? An important focus of our consideration is the extent to which a maritime adaptation had developed. Thus, should the adaptation represented by these sites be considered to be a maritime foraging economy or a more sophisticated maritime collecting economy? We believe that answers to these questions can be approached by addressing issues such as the seasonal dimensions of occupation, population mobility, and the generation and use of food surpluses.

The analyses of faunal remains from the sampled sites indicate that all of these locations had multi-season to possible year-round occupation. The strong presence of fur seals and halibut at 45CA201 indicates late spring and summer occupation, but other resources mark the presence of residents in other seasons. Growth rings on littleneck clams from this site demonstrate that clams were harvested during all seasons of the year. Large nearshore fish such as lingcod, which spawn in the shallow subtidal zone in late winter, account for more than 16 percent of the fish assemblage. Birds available during the fall/winter/spring (but not summer) account for more than 18 percent of the bird assemblage. Thus, multiple lines of evidence argue that 45CA201 was also occupied during the winter. The coastal river valley sites also exhibit evidence of multi-season to year-round occupation. While there is a strong presence of marine mammals likely taken in the spring and summer, some varieties of fish and birds indicate other seasons. Large nearshore fish are common at all of these sites. 45CA400 and 45CA420 contain large quantities of herring, abundant in late winter/early spring when spawning. Large proportions of the bird bones from these sites are from not-summer and year-round birds.

The sheer size, volume, and density of these shell deposits and the evidence for multi-season to year-round occupation indicate at least a somewhat sedentary residence. Being sedentary sacrifices the flexibility of mobility and increases the likelihood of food storage. A similar argument, recently supported with DNA evidence, has been made for salmon storage as long as seven thousand years ago at Namu on the central BC coast (Cannon and Yang 2006).

No conclusive evidence of large cedar plank houses like those used by the early historic Makah people has yet been found at our sites, but stratigraphic features consistent with such houses date to around three thousand to four thousand years ago on the west coast of Vancouver Island

(McMillan 1999). Houses would seem to be a reasonable investment of labour for semi-sedentary people and would provide a space out of the elements where food storage would be successful. Wedges recovered from our sites suggest the presence of the woodworking technology necessary for making house planks and canoes.

Regular use of resources too large to consume fresh suggests food storage. McMillan (1999, 121) notes that "whale bone was found in considerable quantities in these [early] sites [on the west coast of Vancouver Island] but is not necessarily evidence for active whaling, as artifacts clearly associated with whaling do not appear until later. The abundance of whale bone in archaeological deposits, however, suggests that whales were important in the economy, and the use of whalebone to cap burials at Little Beach suggests that this importance might have extended into the symbolic realm." Monks, McMillan, and St. Claire (2001, 60) suggest that "whale use [by Nuu-chah-nulth] occurred by at least 4000 BP [and] that active hunting of whales occurred by at least 2500 BP." While our mammal bones samples are not large, fragments of whalebone have been obtained from four of the five tested sites and are also known to be present in at least two additional paleoshoreline sites on the Makah reservation. Four different species of whales have been identified from these sites (see Table 3).

Tools specifically like those used historically to hunt whales (Huelsbeck 1994) have not yet been found in these sites. If this is not merely a sampling error, it is possible that specialized whaling technology was preceded by more generalized maritime hunting implements similar to the bone points and harpoon valves noted during our testing (see also McMillan, this volume). A clear case of such opportunistic whale hunting with general marine hunting implements on the coast of Oregon about fifteen hundred years ago is described by Losey and Yang (2007). Whether hunted or salvaged, the frequency of whale bones suggests that whale carcasses were not rare. The blubber from one whale (even if the meat of a drift whale was spoiled) is likely to be more than one community could consume fresh, suggesting food storage.

Thus, the faunal remains from the paleoshoreline sites of the northwestern Olympic Peninsula indicate the presence of a well developed maritime collecting economy, including the regular use of whales and other deep-water animals. At least some of the occupants of these sites are likely to have been in residence for much, if not all, of the year, and they are likely to have practised some degree of food storage.

Finally, evidence of differences in social status began to appear as early as four thousand years ago on the Northwest Coast, but the nature of this social complexity is debated (Moss 2011). All observers agree that the social complexity characteristic of the early historic cultures in the region was in place by fifteen hundred years ago (Ames and Maschner 1999; Matson and Coupland 1995). Given the degree of economic complexity observed here, we would not be surprised to find similarly early evidence of social complexity in these sites.

Perceptions of Change over Time

The data from these sites allow us to examine the possibility of cultural changes over time on the northwestern Olympic Peninsula at various scales, two of which are considered here. First we consider the possible significance of a change in deposition at some site areas and then we consider possible implications for the culture history of the region.

In the preceding sections, we describe how at least four of the known paleoshoreline sites contain thick shell midden deposits overlain by cultural deposits that contain very little or no shell and are dominated by chipped stone assemblages. All of these sites are located in the coastal river valleys. We also indicate our belief that these valleys probably contained relatively protected marine bays or channels until sometime after around eighteen hundred years ago and that the disappearance of these features could be the result of the ongoing tectonic uplift of the northwestern Olympic Peninsula. This uplift would have moved the marine shoreline of the outer coast farther to the west, creating the lower valley settings in which these sites currently occur. Along the Strait of Juan de Fuca, the uplift moved the shoreline slightly to the north. We suspect that the change in deposition at these sites may be a direct reflection of this change in their settings. These sites appear to have been relatively large settlements when they were located on or near the shorelines of relatively protected marine bays. After the marine shoreline retreated, they seem to have become much less intensively used locations. The site functions appear to have changed as well. What may have been large multi-season villages seem to have become smaller, possibly more seasonally restricted, camps. It is important to stress that we do not believe that any change in population or adaptive strategy is implied; rather, we suspect that this is simply a change in how particular locations were used in response to a major change in their environmental settings.

These changes, however, are accompanied by remarkably little change in material culture. The only obvious distinction between the artefact assemblages from the older sites and those from the late pre-contact sites on the northwestern Olympic Peninsula is the dramatic decline in the use of chipped stone technologies. This same condition has also been observed on the west coast of Vancouver Island (e.g., McMillan and St. Claire 2005). While it might be taken as evidence of a change in ethnic identity, we think that this is unlikely. In fact, what we see is a change in the preference of materials and the technological approach to producing tools for certain functions (i.e., cutting and piercing) that appears to have had little, if any, real consequences for the economic and land use strategies being employed. The represented faunal assemblages, settlement patterns, and other aspects of material culture show no clear changes that can be associated with the decline in the use of chipped stone. Thus, while the decline is conspicuous from an archaeological perspective, we suspect that it may be of only limited importance for our appreciation of the culture history of this region.

Despite the indicated environmental and cultural changes, the major themes evident in our view of the cultural history of the northwestern Olympic Peninsula appear to be continuity and stability. A robust and sophisticated Maritime Collector adaptation appears to have already been present by around three thousand to four thousand years ago, and the populations pursuing this economic strategy appear to have accommodated the late Holocene changes to their landscape – driven by changes in local sea levels – with little, if any, real disruption. While the environmental changes may have affected the availability of some animals, the faunal assemblages from both the older and more recent sites show little change in the species targeted. Similar continuity of what is essentially the same cultural system is evident from the west coast of Vancouver Island, where it has been interpreted as the archaeological record of the Nuu-chah-nulth people (Dewhirst 1980; McMillan 1999). In view of both the strong similarities in artefacts and faunal assemblages and the similarities in long-term continuity between the west coast of Vancouver Island and the northwestern Olympic Peninsula, we believe that the archaeological sites described in this paper represent the closely related Makah people. Thus, in contrast to some earlier ideas (e.g., Kinkade and Powell 1976), it is likely that direct ancestors of the early historic Makah Indian Tribe have occupied the northwestern Olympic Peninsula for a considerable period of time.

SUMMARY AND CONCLUSIONS

Environmental and cultural data from older archaeological sites on the northwestern tip of the Olympic Peninsula suggest broad patterns of continuity with the west coast of Vancouver Island. Of particular significance, these archaeological sites provide clear evidence that higher than modern sea levels experienced during the mid- to late Holocene along the west coast of Vancouver Island also affected the northwestern tip of the Olympic Peninsula. The higher sea levels flooded the lower ends of coastal river valleys, creating protected bays and channels that do not exist in this landscape today. Such features may have been present as early as six thousand to seven thousand years ago. Thus, at that time, the shoreline of the northwestern Olympic Peninsula may have more closely resembled the modern west coast of Vancouver Island and parts of the mainland coast of British Columbia farther to the north. Recognition of this condition has important implications for archaeological research in the region. Notably, it indicates an outer limit to the antiquity of archaeological sites associated with the modern shoreline of the northwestern Olympic Peninsula, and it directs us to a different part of the landscape when searching for older coastal sites.

Although the role that this earlier environmental setting may have had in the rise of the region's historic maritime culture is uncertain, the sites described here demonstrate that its sophisticated and largely stable economic adaptations have been present on the northwestern tip of the Olympic Peninsula for at least three thousand to four thousand years. It is also clear that the tradition was robust, accommodating local environmental changes with only limited alterations to its economic focus, technology, and settlement systems. These conditions closely parallel the archaeological record for the west coast of Vancouver Island and indicate that the pre-contact histories of the two areas are closely related.

ACKNOWLEDGMENTS

The research described in this article has benefited from the support and interest of a number of institutions and individuals. Almost all of this work has been conducted on the Makah Indian Reservation with the generous support and assistance of the Makah Cultural and Research Center and the Makah people. Additional important support has been provided by Pacific Lutheran University, Peninsula College, the Olympic Coast National Marine Sanctuary, and the National Park Service. Helpful comments and other assistance during the preparation of this article were provided by Alan McMillan, Iain McKechnie, and two anonymous reviewers.

REFERENCES

Ames, K.M., and H.D.G. Maschner. 1999. *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. New York: Thames and Hudson.

Atwater, B.F., and E. Hemphill-Haley. 1997. *Recurrence Intervals for Great Earthquakes of the Past 3,500 Years at Northwestern Willapa Bay, Washington*. United States Geological Survey Professional Paper 1576.

Bird, E., and M. Schwartz. 2000. "Shore Platforms at Cape Flattery, Washington." *Washington Geology* 28 (1/2): 10-15.

Booth, D.B., K. Goetz Troost, J.J. Clague, and R.B. Waitt. 2003. "The Cordilleran Ice Sheet." In *Developments in Quaternary Science 1: The Quaternary Period in the United States*, ed. A.R. Gillespie, S.C. Porter, and B.F. Atwater, 17-43. Amsterdam: Elsevier Science.

Cannon, A., and D.Y. Yang. 2006. "Early Storage and Sedentism on the Pacific Northwest Coast: Ancient DNA Analysis of Salmon Remains from Namu, British Columbia." *American Antiquity* 71 (1): 123-40.

Croes, D.R. 1995. *The Hoko River Archaeological Site Complex: The Wet/Dry Site (45CA213), 3,000-1,700 B.P.* Pullman, WA: Washington State University Press.

—. 2005. *The Hoko River Archaeological Site Complex: The Rockshelter (45CA21), 1,000-100 B.P.* Pullman, WA: Washington State University Press.

Dallimore, A., R.J. Enkin, R. Pienitz, J.R. Southon, J. Baker, C.A. Wright, T.R. Pedersen, S.E. Calvert, T. Ivanochko, and R.E. Thomson. 2008. "Postglacial Evolution of a Pacific Coastal Fjord in British Columbia, Canada: Interactions of Sea-Level Change, Crustal Response, and Environmental Fluctuations – Results from MONA Core MD02-2494." *Canadian Journal of Earth Sciences* 48: 1345-62.

Dewhirst, John. 1980. *The Indigenous Archaeology of Yuquot, a Nootkan Outside Village.* Ottawa: National Historic Parks and Sites Branch, Parks Canada.

Engelhart, S.E., M. Vacchi, B.P. Horton, A.R. Nelson, and R.E. Kopp. 2015. "A Sea-Level Database for the Pacific Coast of Central North America." *Quaternary Science Reviews* 113 (1): 78-92.

Flenniken, J.J. 1980. "Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site." PhD diss., Washington State University.

Friedman, E. 1976. "An Archaeological Survey of Makah Territory: A Study in Resource Utilization." PhD diss., Washington State University.

Friele, P.A. 1991. "Holocene Relative Sea-Level Change: Vargas Island, British Columbia." MA thesis, Simon Fraser University.

Friele, P.A., and I. Hutchinson. 1993. "Holocene Sea-Level Change on the Central West Coast of Vancouver Island, British Columbia." *Canadian Journal of Earth Sciences* 30: 832-40.

Gavin, D.G., D.M. Fisher, E.M. Herring, A. White, and L.B. Brubaker. 2013. *Paleoenvironmental Change on the Olympic Peninsula, Washington: Forests and Climate from the Last Glaciation to the Present*. Port Angeles, Olympic National Park.

Holdahl, S.R., F. Faucher, and H. Dragert. 1989. "Contemporary Vertical Crustal Motion in the Pacific Northwest." In *Slow Deformation and Transmission of*

Stress in the Earth, eds. S.C. Cohen and P. VaníEk. Washington, DC: American Geophysical Union, Geophysical Monograph 49.

Huelsbeck, D.R. 1988. "The Surplus Economy of the Central Northwest Coast." In *Prehistoric Economies of the Pacific Northwest Coast*. Research in Economic Anthropology, Supplement 3, ed. B. Isaac, 149-77. Greenwich, CT: JAI Press.

—. 1994. "The Utilization of Whales at Ozette." In *Ozette Archaeological Project Research Reports*. Vol. 2: *Fauna*, ed. S.R. Samuels, 265-304. Reports of Investigation No. 66. Pullman: Washington State University, Department of Anthropology.

Huelsbeck, D.R., and G. Wessen. 1997. "Late Prehistoric Settlement and Seasonality in Makah Territory." *Archaeology in Washington* 4: 63-72.

Kinkade, D.M., and J.V. Powell. 1976. "Language and the Prehistory of North America." *World Prehistory* 8 (1): 83-100.

Losey, R.J., and D.Y. Yang. 2007. "Opportunistic Whale Hunting on the Southern Northwest Coast: Ancient DNA, Artifact, and Ethnographic Evidence." *American Antiquity* 72 (4): 657-76.

Matson, R.G., and G. Coupland. 1995. *The Prehistory of the Northwest Coast*. San Diego, CA: Academic Press.

McMillan, A.D. 1999. *Since the Time of the Transformers: The Ancient Heritage of the Nuu-chah-nulth, Ditidaht, and Makah*. Vancouver: UBC Press.

McMillan, A.D., and D.E. St. Claire. 2005. *Ts'ishaa: Archaeology and Ethnography of a Nuu-chah-nulth Origin Site in Barkley Sound*. Burnaby: Archaeology Press, Simon Fraser University.

McNulty, T. 2009. *Olympic National Park: A Natural History*. Seattle: University of Washington Press.

Mitchell, C.E., P. Vincent, W. Rau, and M.A. Richards. 1994. "Present-Day Vertical Deformation of the Cascadia Margin, Pacific Northwest, United States." *Journal of Geophysical Research* 99: 12,257-77.

Mitchell, D.H. 1990. "Prehistory of the Coasts of Southern British Columbia and Northern Washington." In *Handbook of North American Indians*. Vol. 7: *Northwest Coast*, ed. W. Suttles, 340-58. Washington, DC: Smithsonian Institution.

Monks, G.G., A.D. McMillan, and D.E. St. Claire. 2001. "Nuu-chah-nulth Whaling: Archaeological Insights into Antiquity, Species Preferences, and Cultural Importance." *Arctic Anthropology* 38 (1): 60-81.

Moss, M.L. 2011. *Northwest Coast: Archaeology as Deep History*. Washington, DC: SAA Press.

Peterson, C.D., K.M. Cruikshank, M.E. Darienzo, G.C. Wessen, V.L. Butler, and S.L. Sterling. 2013. "Coseismic Subsidence and Paleotsunami Run-Up Records from Latest Holocene Deposits in the Waatch Valley, Neah Bay, Northwest Washington, USA: Links to Great Earthquakes in the Northern Cascadia Margin." *Journal of Coastal Research* 29 (1): 157-72.

Reagan, A. 1917. "Archaeological Notes on Western Washington and Adjacent British Columbia." *Proceedings of the California Academy of Sciences* (4th ser.) 7 (1): 1-37.

Renker, A.M., and E. Gunther. 1990. "Makah." In *Handbook of North American Indians*. Vol. 7: *Northwest Coast*, ed. W. Suttles, 422-30. Washington, DC: Smithsonian Institution.

Samuels, S.R., ed. 1991. *Ozette Archaeological Project Research Reports*. Vol. 1: *House Structure and Floor Midden*. Reports of Investigation No. 63. Pullman: Washington State University Department of Anthropology.

—. 1994. *Ozette Archaeological Project Research Reports*. Vol. 2: *Fauna*. Reports of Investigation No. 66. Pullman: Washington State University, Department of Anthropology.

Savage, J.C., M. Lisowski, and W.H. Prescott. 1991. "Strain Accumulation in Western Washington." *Journal of Geophysical Research* 96: 14,493-507.

Shugar, D.H., I.J. Walker, O.B. Lian, J.B.R. Eamer, C. Neudorf, D. McLaren, and D. Fedje. 2014. "Post-Glacial Sea-Level Change along the Pacific Coast of North America." *Quaternary Science Reviews* 97: 170-92.

Swan, J. 1870. *The Indians of Cape Flattery, at the Entrance to the Strait of Fuca, Washington Territory*. Smithsonian Contributions to Knowledge, vol. 16. Washington, DC: Smithsonian Institution.

Verdonck, D. 2006. "Contemporary Vertical Crustal Deformation in Cascadia." *Technophysics* 417: 221-30.

Wessen, G.C. 1984. *A Preliminary Report of Archaeological Investigations at 45CA201, a "Second Terrace" Shell Midden Near Sand Point, Olympic National Park, Washington*. Report prepared for the National Park Service Pacific Northwest Regional. Burien, WA: Wessen and Associates Office.

—. 1990. "The Archaeology of the Ocean Coast of Washington." In *Handbook of North American Indians*. Vol. 7: *Northwest Coast*, ed. W. Suttles, 412-21. Washington, DC: Smithsonian Institution.

—. 1991. "Archaeological Testing at the Presbyterian Church in Neah Bay (45CA22) Washington." *Reports of Investigation No. 1*. Neah Bay, WA: Makah Cultural and Research Center.

—. 1993. *Archaeological Activities at and Near Sand Point (45CA201), Olympic National Park, Washington*. Report prepared for the National Park Service Pacific Northwest Regional. Burien, WA: Wessen and Associates Office.

—. 2003. *Archaeological Site Testing Activities at 45CA420, Makah Indian Reservation, Washington*. Neah Bay, WA: Makah Tribal Historic Preservation Office, Makah Cultural and Research Center.

—. 2006a. *Archaeological Site Testing Activities at 45CA3, Makah Indian Reservation, Washington*. Neah Bay, WA: Makah Tribal Historic Preservation Office, Makah Cultural and Research Center.

—. 2006b. *Archaeological Site Testing Activities at 45CA400 Makah Indian Reservation, Washington*. Neah Bay, WA: Makah Tribal Historic Preservation Office, Makah Cultural and Research Center.

Whelchel, D.L., ed. 2005. *Ozette Archaeological Project Reports*. Vol. 3: *Ethnobotany and Wood Technology*. Reports of Investigations No. 68. Pullman, WA: Washington State University, Department of Anthropology.

Williams, H., I. Hutchinson, and A.R. Nelson. 2005. "Multiple Sources for Late-Holocene Tsunamis at Discovery Bay, Washington State, USA." *The Holocene* 15 (1): 60-73.