REPORT OF 2005 FIELD INVESTIGATIONS AT WOODSTOCK FARM, CHUCKANUT BAY, WASHINGTON

Conducted under Permit #05-11
Office of Archaeology and Historic Preservation

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PROJECT INTRODUCTION

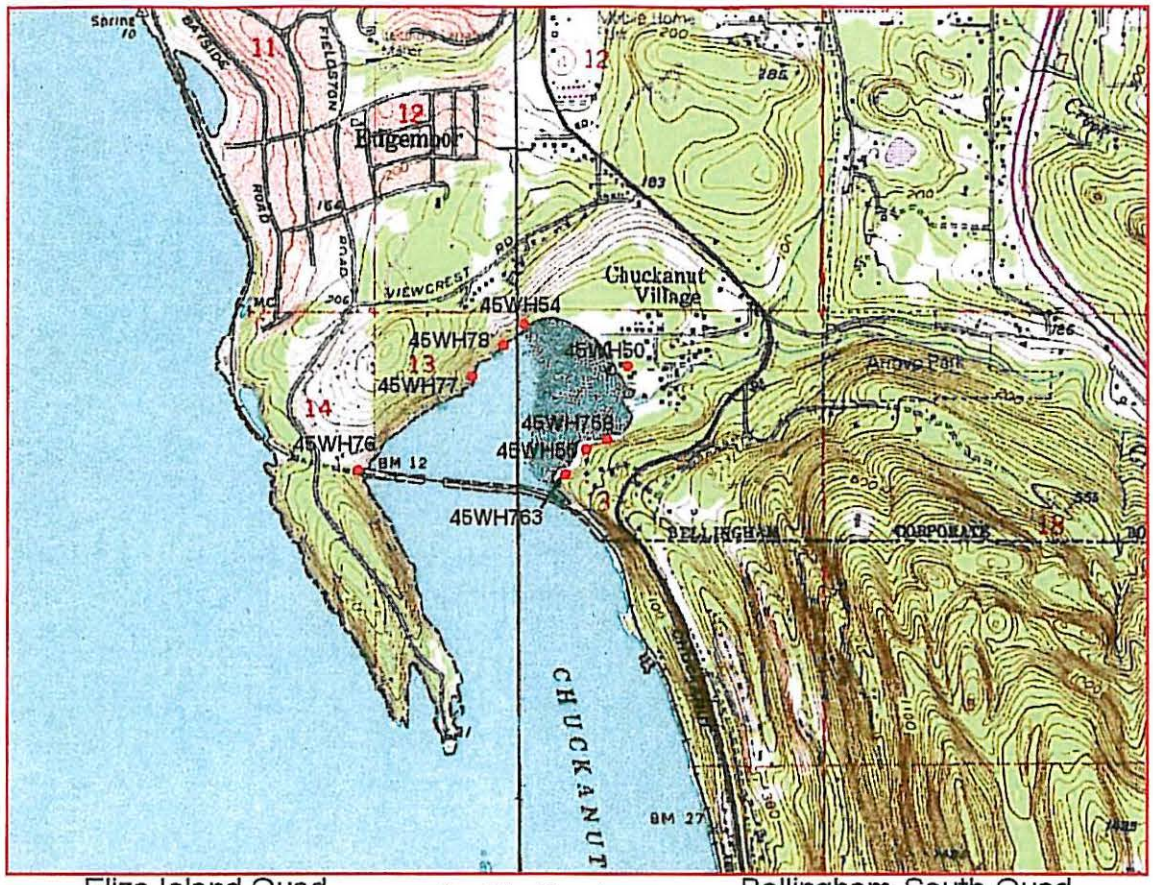
This report describes fieldwork conducted in the summer of 2005 in the area of northern Chuckanut Bay, just south of Bellingham, Whatcom County, Washington (Figure 1). The primary investigation, and the one for which excavation permit #05-11 was obtained, focused on site 45WH55, on the Woodstock Farm property owned by the City of Bellingham Parks and Recreation Department (Bellingham Parks). Additional survey and inventory work conducted in the vicinity are also reported here.

Work was conducted in July and August of 2005 by a Western Washington University archaeological field school under the direction of Dr. Sarah Campbell and Dr. Todd Koetje. Test excavations were conducted at 45WH55, as well as surface survey and shovel testing to define the site boundary (Figure 2). This led to the recognition of two adjacent, but not directly contiguous, shell midden areas which we ultimately treated as separate sites, rather than as part of 45WH55. These were given temporary site numbers WWU-05-01 and WWU-05-03 (now 45WH763 and 45WH758, respectively). Fieldwork at these sites included systematic shovel testing, mapping, and collection of column samples from banks. Survey of the Woodstock Farm property also led to designation of an historic feature as WWU-05-02. This feature, a constructed overlook from the early 1900s, is described in this report, but we decided not to record it formally with the Department of Archaeology and Historic Preservation (DAHP) as a site. Another important activity was revisiting previously recorded sites in the northern part of Chuckanut Bay, which include 45WH50, 45WH54, 45WH76, 45WH77, and 45WH78 (Figure 1). Two of these, 45WH50 and 45WH76, proved difficult to access, and were not investigated further. The others were re-recorded, although only a portion of 45WH54 was accessible to us. Activities were limited to surface investigations with the exception of shovel tests for boundaries and the collection of a shell sample from a bank exposure at 45WH54 for which we obtained verbal permission from DAHP.

CULTURAL AND REGIONAL BACKGROUND

NATURAL ENVIRONMENT

Chuckanut Bay is a long, narrow bay trending North-South. The shoreline is characterized by cobble beaches and backed by steep bluffs of sandstone. Chuckanut Mountain rises steeply to the east. At its northern end, the bay extends towards the east, nearly at right angles to the long axis. This inlet is locally termed "Mud Bay", although the name does not appear on maps. The description is apt, as the bay is shallow, and extensive mud flats are exposed at low tide.



Eliza Island Quad Quad Map Boundary Bellingham South Quad

Figure 1: Northern Chuckanut Bay with site locations (site size and extent not indicated).

The bay undoubtedly had a different character in the past. Local residents state that much of the sediment accumulated in the latter half of the 20th century, with a particularly large influx occurring during the construction of I-5 in the 1970s. Construction of the railroad trestle across the neck of the inlet before 1900 and conversion of the trestle to a continuous causeway with only a small outlet in the 1920s also contributed to a build-up of sediment. The causeway is also thought to have changed the pattern of water circulation, longshore sediment transport, and erosion.

A low beach berm has formed at the head of the bay, with a salt marsh behind it to the east, suggesting possible changes in relative sea level and shoreline position in the past. Chuckanut Creek, a relatively small perennial stream that drains a portion of Chuckanut Mountain, flows into the bay south of the berm. In contrast to the relatively low-lying land at the head of the bay, the bay's other margins are steep bedrock-controlled slopes interrupted by occasional terraces. The area is mapped as Nati Silt Loam. The Nati series soils formed in colluvium and slope alluvium derived from sandstone on foothill back slopes and are moderately deep and well drained (USDA 1992)

Modern land use has altered much of the biotic environment; however, there are still recognizable communities of native plants characteristic of specific habitats within the Western Hemlock Zone. Riparian and salt marsh vegetation occurs at the head of the bay, while the slopes are characterized by those communities common to rocky balds and slopes. The Western Hemlock Zone in general is characterized by Western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), madrone (*Arbutus menziesii*), big leaf maple (*Acer macrophyllum*), vine maple (*Acer circinatum*), alder (*Alnus* sp.), Oregon grape (*Berberis* sp.), oceanspray (*Holodiscus discolor*), snowberry (*Symphovicarpos* sp.), horsetail (*Equisetum* sp.), bracken fern (*Pteridium aquilinium*), Nootka wild rose (*Rosa nutkana*), salal (*Gaultheria shallon*) (Franklin and Dyrness 1973). In the rocky balds and slopes, Madrone (*Arbutus menziesii*), western juniper (*Juniperus occidentalis*), and Garry oak (*Quercus garryana*) play a larger role, and mock orange (*Philadelphus lewisii*) is part of the understory. Many of these plants have specific utility for native cultures and might have been an attraction for people using these sites. The Woodstock Farm area includes orchard, lawn, pasture, and a number of ornamental trees such as magnolia and beech. Himalayan blackberries and English ivy have spread extensively in areas where they are not controlled.

No specific information is available about the avian or mammalian taxa of the area other than what can be inferred from more general sources about the region. Terrestrial animals such a wapiti (*Cervus canadensir*), deer (*Odocoileus* sp.), black bear (*Ursus americanus*), and beaver (*Castor canadensis*) are likely to have occurred in the Chuckanut Mountain area. The marine invertebrate fauna of today is likely to be different than that which was available in the past, due to the introduction of exotic species and to changes in the substrate from historic sediment buildup. Pacific oyster (*Crassostrea gigas*), auger shell (*Battilaria* sp.), and long neck clam (*Mya arenaria*) are introduced species that may have negatively affected the abundance of native taxa. Native oysters (*Ostrea lurida*) are common in the 45WH55 midden exposed on the beach, but are not evident in the living fauna. Although we did not conduct a systematic survey of the current infauna, the environment seems to favor taxa adapted to mud and sand, such as bent-nose clam (*Macoma nasuta)*, cockle (*Clinocardium nuttallii)*, and sand dollar (*Dendraster excentricus)*, rather than species adapted to exposed rocky shorelines. Barnacle (*Balanus* spp.) and blue mussel (*Mytilus edulis)* are rare, but some small individuals do occur on pieces of wood extending above the mudflats. We have not obtained specific information on fish taxa in Chuckanut Bay, but again would emphasize that the current fauna in the northern part of the bay are possibly much altered. Suttles records a fishing location for silver (coho) salmon (*Oncorhynchus kisutch*) near the mouth of Chuckanut Creek and the run is apparently still in existence.

TRADITIONAL LAND USE/PREVIOUS ARCHAEOLOGY

Throughout northwestern Washington, the shorelines are dotted with evidence of prehistoric habitation and resource use, reflecting thousands of years of use by native American inhabitants. The mainland shoreline from Bellingham south to the Skagit River delta is less well known than that of the San Juan Islands or northern Whatcom County. A number of sites are recorded, but few have been tested or dated, and even the survey level data is incomplete. Investigations in the Chuckanut Bay area can potentially contribute to our understanding of variation in precontact adaptations in this part of the Strait of Georgia.

Occupation of Northwestern Washington is assumed to date back to late glacial/early postglacial times, based on general migration models. The oldest dated cultural remains are in the North Cascade Mountains; Robert Meirendorf (2006) has obtained dates of over 9,000 years ago from a site at Cascade Pass, east of the project area are the oldest in Northwestern Washington. In the lowlands, the Ferndale site (45WH34) has 12 radiocarbon dates between 4500 and 4800 BP (Meidinger 2008) . The site is a shell midden and structure associated with an older shoreline in the modern Nooksack River Valley (Hutchings 2004).

Historic Native American land-use pattern in the Chuckanut Bay area may have been complex and more research based on oral histories is warranted. Suttles (1951) indicated that the mainland here was home to the Nuwaha, who did not continue into the reservation era as an intact entity, and that members of Lummi, Nooksack, and Samish all gathered shellfish resources here (Suttles 1951). He suggested that Chuckanut Bay is at the southern boundary of the Lummi exclusive use area, and at the northern boundary of the Samish exclusive use area. Galloway and Richardson (1983) describe the area as an important saltwater access point for the Nooksack, whose place name for the bay's northeastern corner gave rise to the current name. It is important to note that family lineages may be more important for understanding land-use patterns than identification with post-treaty tribal designations. In other words, individuals with use rights to the area through marriage or descent may have resided in each of the communities, without those use rights necessarily extending to every family in those communities.

One of our goals is to learn whether there was a substantial resident population in the past, or whether the pattern of seasonal use by multiple groups extended back in time, to the extent that this can be determined through archaeological means. The number of sites in this portion of the bay, the depth of midden at 45WH55 and the possible house structure suggest the possibility of a substantial permanent habitation in this vicinity. Another long term goal is to integrate information about cultural land-use with the geomorphological history of the bay. We observed indications of extensive erosion and slumping of site deposits around the northern end of the bay that suggest geomorphological changes, possibly due to tectonic movement. Indications include the deep deposits at the seaward margin of 45WH55 that could not have reached this depth stably without originally having a substantial seaward extent; large slumps evident in the center and at the margin of 45WH55; the shell deposit in the intertidal zone; and the very narrow remnant of midden on a steep slope at 45WH54. Subsidence due to a major earthquake has been documented in Southern Puget Sound (Sherrod 1998), but the tectonic history of northwestern Washington is less well known. Regardless of the cause, the environmental changes that are suggested may have had an impact on the patterns of use of this area by people.

HISTORIC LAND USE

The Woodstock Farm property comprises a number of separately platted parcels purchased by businessman Cyrus Gates around 1907 to build a family home. Hiring prominent architect F. Stanley Piper, Gates commissioned the building of a gentleman's farm. Known after this time as Woodstock Farm, the residence consisted of six buildings and a boat house, all constructed between 1912 and 1923, when the main house was remodeled. Although not used as a for-profit farm, cattle and chickens were housed on the property. Historic records and photographs

collected by Tim Wahl, Bellingham Parks, indicate that the Gates family clear-cut and burned many portions of their land, had a garden on the eastern portion of the property, and established an orchard on the southern portion. These records also indicate that the Gates disposed of garbage on the property, later covering it with a cement slab.

In 1944, the property was sold to the Lee family, who resided there until selling to the Bellingham Parks and Recreation Department in 2004. Land use and management plans for the property are still being developed by Parks at this time, but the intended emphasis is on heritage and conservation. More is planned on the pre-Gates ownership and use of the area. The history of the Gates ownership of Woodstock Farm was researched and compiled by Diana Barg, Jennifer Geissen, Sarah Johnson, and Sarah Willis, with the assistance of Tim Wahl as a project for a Cultural Resource Management class.

SURVEY AND SITE RECORDATION AT WOODSTOCK FARM

The work initiated by Western Washington University in the summer of 2005 is intended to be part of a long term research project on the Woodstock Farm property. Many of the officially recorded archaeological sites in Northern Chuckanut Bay are not adequately documented and locational information on many site forms is out-of-date. For the 2005 season, the project area was limited to the northeastern portion of Chuckanut Bay and by landowner permission.

Apart from the more extensive investigations at 45WH55, sites 45WH54, 45WH77, and 45WH78 were revisited and rerecorded (Figure 1, Table 1). Three new sites were recorded with temporary field ID's WWU-05-01, WWU-05-02, and WWU-05-03 (now 45WH763 and 45WH758) (Figure 2, Table 1). As a teaching exercise, students were assigned to relocate the sites, determine the boundaries independently, and fill out new site forms. Site boundaries were confirmed with shovel testing and systematic pedestrian survey.

Table 1: Summary of types of investigations in 2005 by site.

Site	Excavation Units	STP's	Column Samples	Artifact Surface Collection
45WH54	0	5	1	0
45WH55	9*	15	0	3
45WH77	0	1	0	0
45WH78	0	1	0	0
WWU0501	0	15	1	5
WWU0502	0	2	0	0
WWU0503	0	3	7	7

* Two units were aborted due to disturbance

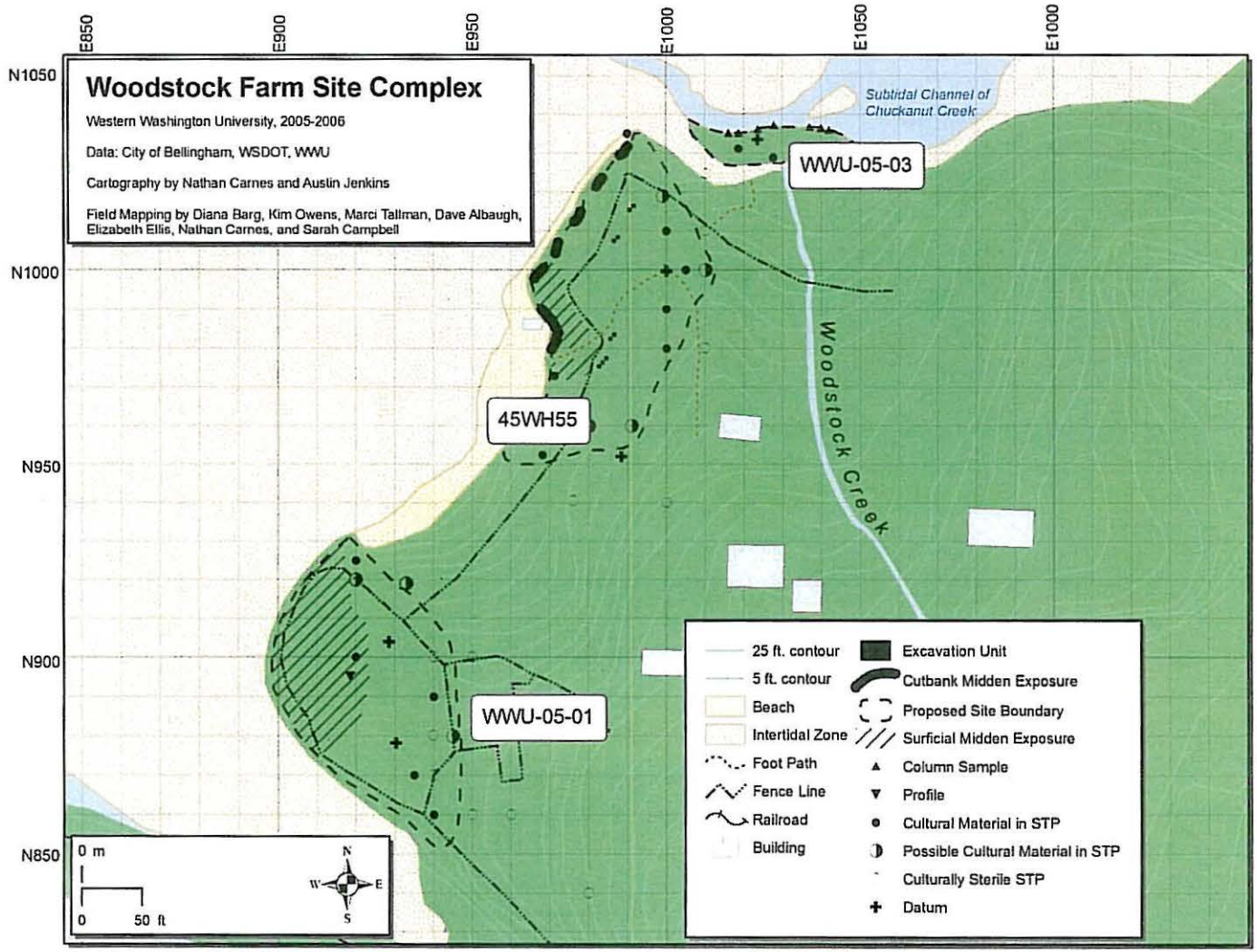


Figure 2: Woodstock Farm shell midden sites, 45WH55, 45WH763 (WWU-05-01 on map), WWU-05-02 and 45WH758 (WWU-05-03 on map).

45WH763 (WWU-05-01)

Site 45WH763 is a precontact shell midden which possibly has an associated non-shell component at the uphill margin. It is on a rocky headland less than 50 m south of 45WH55. Shell and FMR are visible on the gently sloping lower surface of the headland, which rises approximately 20 feet above the southeast corner of Chuckanut Bay (Figure 3). Because the existing 45WH55 site form (Gaston and Swanson 1974) did not describe the inland extent of cultural materials, it was uncertain whether the deposits in this area should be included in that site or not. The primary goal of fieldwork was to determine and describe the materials on this headland for recording either as part of 45WH55 or as a separate site. We found no indication that the cultural deposits had ever been contiguous across the ravine (i.e., no evidence of eroded deposits at the edges of the ravine) and decided to treat this area as a separate site.

The slope above the site has been modified during the historic era. The hillslope was graded to create a level area for a tennis court for the Gates family, according to Georgie Bailey, one of the Lee family members who still lives on site. A pile of large rocks was left at the south end of this terrace. Currently the level area is used for a sheep pen; the adjacent grassy slope is used as sheep pasture, closed in by fencing. An unpaved road that cuts down to the northwest, providing access to the lower part of the headland, has cut into the shell midden at its lower end (Figure 4).

Field Methods

The goal of fieldwork was to determine the horizontal boundaries of the cultural material on this headland, and gain some idea of the nature of the deposits. The extent of the site along the bluff was readily apparent from surface exposures where the vegetation was sparse. A road cut and a tree tip-up provided slight subsurface glimpses. Surface visible midden became intermittent and disappeared on the uphill side of the road. As a result, much of the fieldwork involved shovel testing to try to determine the uphill extent.

One half of the field school crew received their training performing shovel tests at this site. The initial shovel testing began on the hillside well above the visible shell midden, and moved toward the midden to define site boundaries. Three shovel tests were placed at 5 m intervals along the N860 line, and eight at 5 m intervals along the E940 line (Figure 3). A ninth shovel test was placed further up the hill at E950, N900 to provide a comparison. Two groups of students later worked on mapping the site for their class project; between them they dug an additional nine shovel tests to better define the midden boundary. Historic and precontact artifacts noted on the surface were recovered after their location was mapped.

A bulk sample of the shell midden was taken from the bank above the road cut, where the exposed midden could be sampled with minimal impact (Figure 4). A 20 cm wide vertical face was cleared and a sample 10 cm deep was removed for radiocarbon dating and analysis.

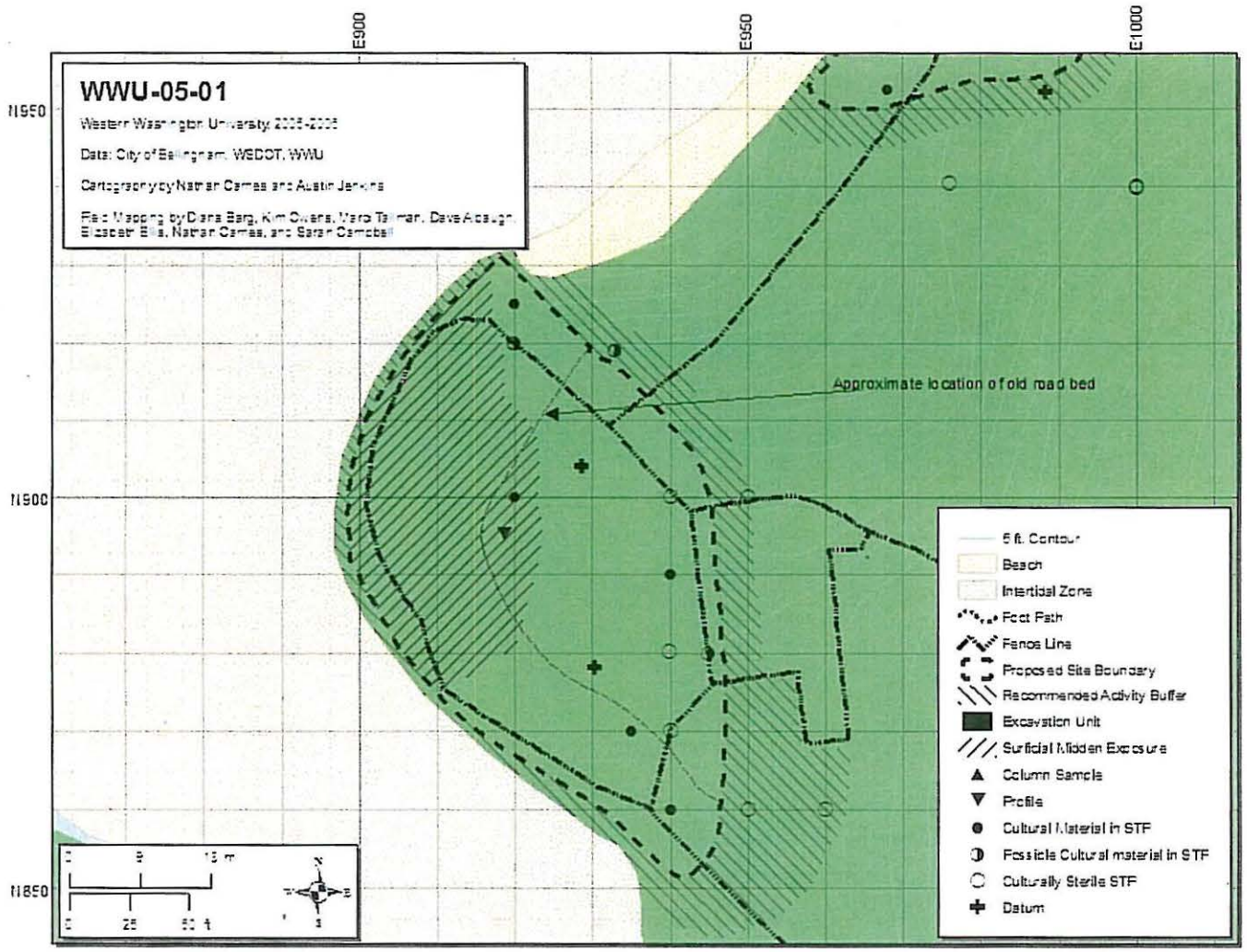


Figure 3: 45WH763 (WWU-05-01 on map) site map showing location of shovel tests, radiocarbon sample location and surface recorded artifacts.

Figure 4: Overview of 45WH763.

Analysis and Results

Midden is exposed across much of the lower portion of the headland, approximately 60 m north-south, and 25 m east west. Based on subsurface testing, we have defined a much larger site area, 85 m north- south and 65 m east-west, that encompasses finds of lithic artifacts without shell midden. However, the relationship between these areas is still poorly understood.

The shell-bearing midden deposit is at least 50 cm thick in some areas as indicated in a tree tip-up at the edge of the headland. Cultural materials noted in the area include both definite precontact and definite historic materials, as well as some that could potentially be either. Presumed precontact materials include FMR, charcoal, lithics, worked antler, a flaked cobble, and various invertebrate remains including little-neck clam (*Protothaca staminea)*, butter clam (*Saxidomus giganteus)*, horse clam (*Tresus capax)*, purple whelk (*Thais* spp.), *Mytilus edilus*, *Clinocardium nuttallii*, and *Balanus* spp. Artifacts noted on the surface and recovered after mapping include a worked antler fragment, a cobble chopper, and a dacite core. A bullet casing also was found.

The bullet casing was identified as a 22-caliber rim-fired copper cartridge. The head stamp, a "U", identifies it as being manufactured by the Union Metallic Cartridge Company (UMC) (IMACS 1992). UMC was incorporated in 1867, and later merged with Remington Arms Company to Form Remington UMC in 1912, according to the Remington Company homepage (accessed May 25, 2010). Presumably the U headstamp was not used after the merger, although other sources place this merger at an earlier date; as early as1902 according to IMACS (1992) or 1910 (Gillio et al. 1980).

The uphill boundary of the site is still not well-defined, partly because the shovel tests were spaced 10 m apart, but also because of ambiguous contents. Definite flakes were found in several STP's 25 to 40 m away from surface-visible midden, while evidence for prehistoric cultural deposits in the intervening area was ambiguous. A number of shovel tests yielded charcoal and burned sandstone, but there is a strong possibility that these are historic in origin, and they were not treated as evidence of prehistoric site deposits. Pelvis and tibia fragments from an historic sheep burial were recovered in one shovel test. Sparse, scattered shell was observed on the surface; in some cases it was clearly recent. Therefore, the sparse shell fragments encountered in a few shovel tests was not considered positive evidence of cultural deposits.

The single bulk sample collected from the bank was screened by ¼" and 1/8" size fractions, and sorted by material type and shell taxa (Figure 5). Invertebrate taxa identified *Protothaca staminea*, *Saxidomus giganteus*, *Mytilus edulis*, *Thais* sp., *Clinocardium nuttallii*, *Balanus* spp. and Olympia oyster (*Ostrea lurida*). Body fragments of *Clinocardium nuttallii, Protothaca staminea, Mytilus edulis*, and *Balanus* spp. from the ¼" screen fraction bulk midden sample were sent to Beta Analytic (Beta Analytic Sample # 211704) for radiocarbon dating. The sample yielded a 2-sigma calibrated age of 2600-2320 BP (Table 2).

Figure 5: Bank exposure of 45WH763 after collection of bulk column sample.

Table 2: Radiocarbon dates obtained.

Site	Sample Number	Material Dated	Measured Radiocarbon Age (BP)	13C/12C	Conventional Radiocarbon Age (BP)	Local Reservoir Correction (BP)	Calibrated Radiocarbon Age
45WH54	Beta-211703	*Mytilus, Protothaca, Clinocardium,* unidentifiable body fragments	1030 +/- 40	-0.5 o/oo	1430 +/- 40	1040 +/- 50	1280 – 1420 AD 670 – 530 BP
45WH55	Beta-215323	*Mytilus, Balanus*	2880 +/- 50	-1.7 o/oo	3260 +/- 50	2870 +/- 60	800 -500 BC 2750 – 2450 BP
45WH758	Beta-211705	*Saxidomus, Protothaca*	1090 +/- 40	-3.0 o/oo	1450 +/- 50	1060 +/- 60	1240 – 1420 AD 710 – 530 BP
	GX-32437	*Protothaca*		-0.9	1740 +/- 50	1271 +/- 74	542 – 877 AD 1407 – 1072 BP
	Beta-227507	*Balanus cariosus*	1350 +/- 40	+0.3 o/oo	1760 +/- 40	1370 +/- 50	940 – 1150 AD 1010 – 800 BP
45WH763	Beta-211704	*Protothaca, Clinocardium, Balanus, Mytilus*	2730 +/- 40	-0.9 o/oo	3130 +/- 40	2740 +/- 50	710 – 370 BC 2660 - 2320 BP

WWU-05-02

Site WWU-05-02, also known as Inspiration Point, is a historic scenic overlook built by Cyrus Gates in the early 1900s. It is situated along the west shoulder of SR-11 (Chuckanut Drive) parallel to the road in a turnout just north of milepost 18 on the northeastern shore of Chuckanut Bay (Figure 6). The overlook sits approximately 180 feet in elevation above Chuckanut Bay. When it was built, the hillside between the site and Chuckanut Bay was mostly clear-cut by logging activities, and it commanded views southwest to Samish Bay, Chuckanut Bay, and the San Juan Islands (Figure 6). The views are now largely obscured by trees (Figure 7).

Figure 6: Historic viewpoint known as Inspiration Point in the 1910s (From Gordon Tweit Woodstock Collection).

Figure 7: WWU-05-02, historic viewpoint, summer 2005.

The site consists of a rectangular platform, built atop a steep Chuckanut Sandstone outcrop, with an associated rock wall and other features. Cultural materials associated with the structure include a deteriorated water fountain, benches, and a concrete plaque monument. The rectangular viewpoint is constructed with a concrete floor and a mortared rock wall constructed of granite, basalt, and local Chuckanut sandstone and measures 17.3 ft wide by 10.2 ft deep. It is supported by a 13'6" concrete foundation on the west side of the road. Concrete benches are set within the walls and there are remnants of a pipe from a water fountain. The associated rock wall runs parallel to SR-11 for 151 ft north-south and 35 ft east-west. The overall complex including the wall and platform is 183 ft long and 37 ft wide. The viewpoint structure and the rock wall are heavily damaged due to erosion. Two shovel test probes showed no buried cultural horizons or artifacts. We chose not to submit a site form for the overlook. The Parks Department is currently considering plans to rebuild the platform.

45WH758 (WWU-05-03)

Site 45WH758 is a precontact shell midden in the intertidal zone in the northeast corner of Chuckanut Bay at the outlet of the locally-named Woodstock Creek that flows through the Woodstock Farm property. It is exposed in a cutbank along the subtidal channel of Chuckanut Creek, which flows roughly parallel to the shore at this point (Figure 8). It is only accessible at low tide. The shell layer is exposed for over 35 m in the cut bank that is the seaward edge of a gently sloping lobate platform lying just below the high tide level (absolute elevation has not yet been determined). It varies in thickness from 10 to 20 cm in these exposures (Figure 9). Shovel tests indicate that it extends at least 6 m shoreward within the platform, and increases in thickness shoreward to at least 55 cm. The channel of Woodstock Creek flows through the platform, slightly to the east of center. The upper surface of the platform is composed of fine-grained sediment; it is submerged regularly and is devoid of vegetation (Figure 10). It was unclear from the initial examination of the bank exposure whether the deposit was cultural or not. Fire Modified Rock (FMR) was observed on the surface and in apparent association with the shell, suggesting a cultural origin, but woody debris and articulated shells in growth position in some areas suggested natural processes. One of the goals of the 2006 season was to determine whether the deposit was anthropogenic in origin, and if so, whether it was a primary or secondary deposit.

Field observations and laboratory analysis to date support the interpretation that the deposit is cultural given the diversity of shell taxa, presence of lithic artifacts, and abundant FMR. Also, we believe that it is a primary deposit, rather than a secondary deposit, and that it was originally terrestrial. Further analysis and fieldwork conducted in consultation with geologists will be aimed at determining the mechanism by which the landform became submerged.

Figure 8: Looking south at the cutbank of the subtidal channel of Chuckanut Creek; the deposits of 45WH758 are exposed most of this length. Red line indicates where midden is exposed.

Figure 9: Exposed midden in cutbank, 45WH758.

Figure 10: View west of exposed midden in cutbank and surface devoid of vegetation, 45WH758.

Field Methods

Fieldwork conducted at 45WH758 included pedestrian survey of the platform surface and the adjacent hillslope, mapping and collection of surface artifacts, column sampling, and shovel testing. It was not possible to shoot with the total station from the 45WH55 datum to any location on the subtidal platform. A piece of rebar was placed into the subtidal platform to serve as a temporary mapping datum, and bearings were later taken to the rebar from two points on the mudflat to the west that could be shot in with the total station. The site datum is estimated to be at E1023 N1033.

During the summer of 2005, five column samples (either 20x20 cm or 25x25 cm) were collected along the bank exposure (Figure 11). As we were inspecting the bank to choose sampling locations, a Cascade type projectile point was found on the sloping surface of the bank below the shell layer just west of the Woodstock Creek channel. It was not *in situ*. We placed Column Sample 2 at this location along the bank, and Column Sample 1 was placed east of Woodstock Creek roughly halfway between the outlet of the creek and the eastern end of the shell deposit.

Column samples 3 through 5 were placed to the west of Column Sample 2 approximately 3 to 4 m apart.

Shovel Test Pit (STP) A was placed 6 m inland from Column Sample 2 at about the same distance from the Woodstock Creek channel to determine whether the shell deposit extended inward. No similar dense shell layer was encountered, so STP B was placed only 3 m back from the bank, and to the west. This STP encountered dense shell and was thought to be within the bounds of the midden. STP C was placed 9 meters west and south of STP B. This area was chosen due to the large amount of FMR on the surface. Two additional column samples (6 and 7) were taken by Barg and Owens in the fall of 2005 to increase the horizontal extent of the bank sampling to aid in determining geologic origin of the deposit.

A total of 15 bulk samples were collected from the seven column samples and 16 from the shovel tests. Samples were wet-screened in Chuckanut Creek through ¼ inch and ⅛ inch mesh; material less than ⅛ inch was not collected. The material was later re-screened, washed, and dried in the laboratory before analysis. Table A - 2 summarizes the material (¼ inch or larger) collected from the STPs and column samples based on initial field observations and laboratory analysis of selected samples.

Analysis and Results

Analysis of the site to date has focused on understanding the formation of the shell deposit. After fieldwork, we felt relatively certain that the deposit was at least partially anthropogenic, based on the number of lithic artifacts and FMR observed on the surface, but we wanted to confirm this with content analysis of the shell sample layers, for which we could control association. If the layer was indeed anthropogenic, it could have been deposited in several different ways. First, it could be redeposited midden material from a source at higher elevation. Second, it could be a primary cultural deposit created by people dumping material directly into the intertidal zone. Third, it could be a primary deposit that was originally formed above the high tide line, and which then was submerged through a change in relative sea level. The results discussed here are based on work done by undergraduate students Diana Barg and Kim Owens throughout the academic years 2005-2007, and presented on several occasions as the project progressed (Barg and Owens 2006 a and b; Campbell et al. 2006; Campbell et al. 2007).

Thirteen invertebrate taxa have been identified in the 30 ¼" samples that have been sorted (3 remain to be sorted). These include *Saxidomus giganteus, Protothaca staminea, Macoma* spp., *Mya arenaria, Clinocardium nuttallii, Balanus cariosus, Balanus* spp., *Mytilus* spp., *Ostrea lurida, Tresus capax*, *Thais* spp., Limpet (*Acmea* spp.), *Dendraster*, and terrestrial gastropods. Only three of the 31 1/8" samples have been sorted at this point, but these added sea urchin (*Strongylocentrotus* spp.) to the list of taxa present in the deposit. The STP B samples are dominated by *Saxidomus giganteus, Protothaca staminea, and Macoma nasuta.* It is notable that the species run the full range from rocky to muddy substrates and brackish to regular marine water. Representation of diverse habitats is common in shell midden deposits and uncommon in natural deposits, further supporting the cultural nature of 45WH758.

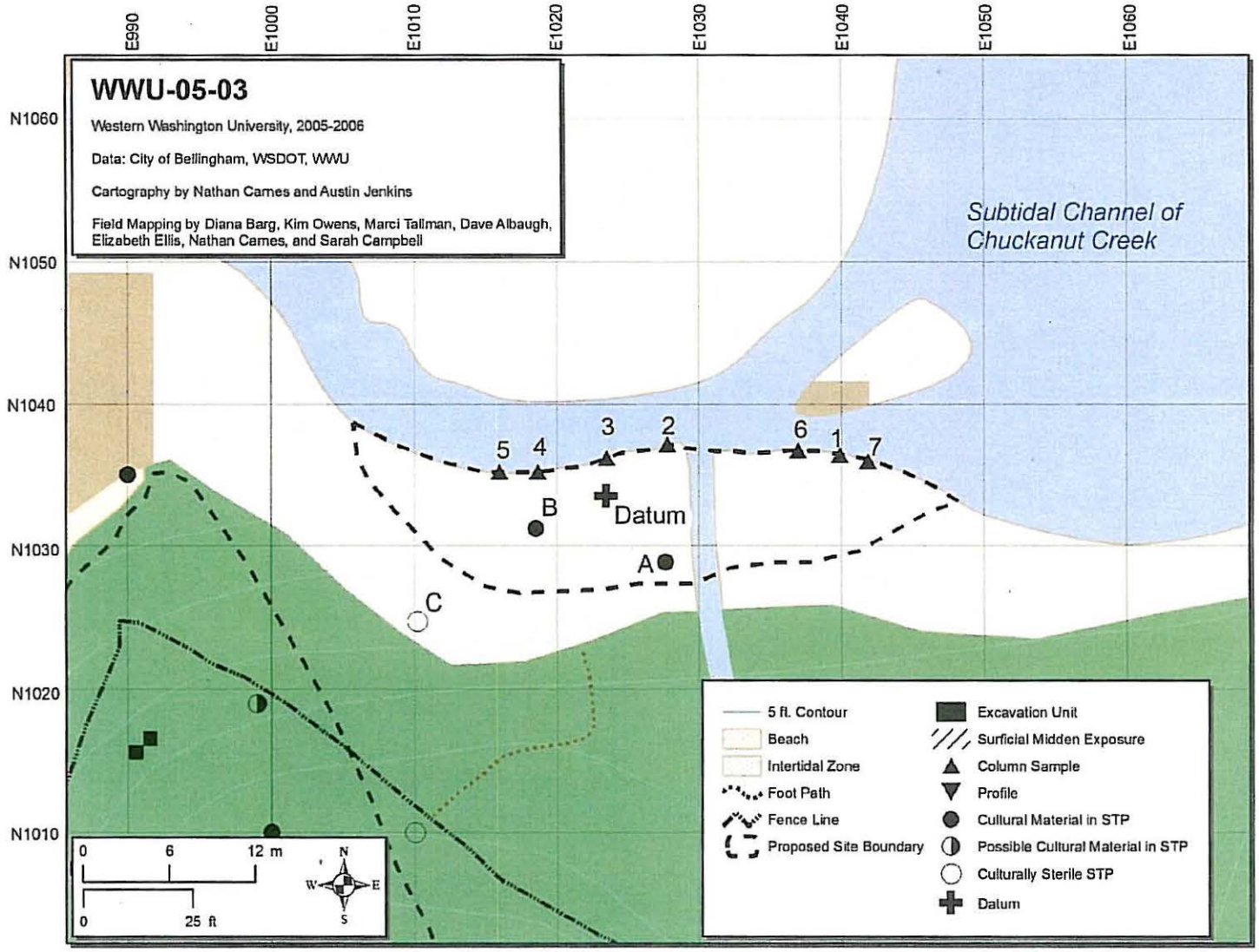


Figure 11: 45WH758 (formerly WWU-05-03) site map showing location of shovel tests and column samples.

During collection of the first five column samples, several lithic artifacts were found on the surface. These included a projectile point, a bifacially flaked cobble, and three flakes. Another bifacially-flaked cobble was found on the surface during shovel testing. Although not in direct association with the shell deposit, the occurrence of this many lithic artifacts on the surface supports the interpretation that there is a buried cultural deposit. Only four lithic artifacts, all unmodified flakes, were found in excavated samples so that their vertical position and association with other contents is known. Although this is a small number of lithic artifacts, they were recovered from a very small overall volume; so their presence does support a cultural origin of the deposit.

Quantification of sample constituents from STP B revealed that the peak amounts of FMR, shell and charcoal did not occur in the same levels, making this association somewhat ambiguous. Bone, another common midden constituent, was almost entirely absent from the samples and represented only by six calcined pieces.

The presence of *Mya arenaria*, which was visible in the bank profile in some locations, was one of the ambiguous aspects of the deposit. This bivalve was introduced to the Pacific Northwest around 1900 AD (Flora and Fairbanks 1982; Kozloff 1976) and was found throughout the samples. These apparently grew in place after the shell deposit formed as indicated by articulated specimens in growth position observed in the bank and the numerous juvenile specimens (< 2 cm) observed in the samples (Figure 12). Therefore the presence of *Mya arenaria* in the samples is not a significant indicator of the age of the deposit.

To determine if this shell deposit is geologically primary or secondary the morphology of the deposit was examined. As this site straddles Woodstock Creek it is possible that it accumulated as a delta. To test this hypothesis, the horizontal variation in clast size and angularity was

Figure 12: *Mya arenaria* in growth position in the cut bank, 45WH758.

determined. One hundred clasts from each column were randomly selected, measured by the middle dimension, and classified by angularity. For the samples that were collected in levels, a sample of 100 was chosen from all levels of the total volume of the sample. For example, 25 rocks would have been chosen per level for a 40 cm sample broken into four 10 cm levels. Observations recorded included the middle dimension of the clast (greatest width where l>w>th) to the nearest millimeter and its roundness or angularity. The clasts do not decrease in size laterally along the cut bank, which is the distributional pattern that would be expected for a homopycnal deltaic deposit from Woodstock Creek. The largest clasts would be expected at the outlet of the creek and the deposit would be well-sorted (Boggs 2000), but this is not the case. The smallest clasts are found near the outlet of Woodstock Creek and the deposit is poorly-sorted. We found the distribution overall was not consistent with a homopycnal deltaic deposit from Chuckanut Creek.

Another observation that bears on whether the deposit was transported from another location is the presence of stacked shells. These are similar to stacked shells observed in the deep profile at 45WH55, which is undoubtedly an anthropogenic midden. This suggests that the deposit, if transported, was moved as a single unit.

Determining the age of the deposit has been an interesting challenge, complicated by the question of whether it is primary or not. The projectile point (Figure 13) found on the surface of the cut bank is very similar to one recovered from the Old Cordilleran component at Glenrose Cannery (Matson 1996: Figure 4e), and we initially thought that the deposit might be relatively old. However, no further evidence has been recovered that supports an earlier date.

Figure 13: Projectile point from 45WH758.

Three shell samples were submitted for radiocarbon dating (Table 2). First we submitted a shell sample from Column 3 that yielded an age of Cal 1240 – 1420 AD (2 sigma). This date was

later than we had expected, and we wondered if exposure of the column sample in the bank had resulted in slumping or contamination. Therefore, we next chose a sample from a shovel test probe. The sample from STP B level 60-70 cm yielded an age of Cal 610 – 780 AD (2 sigma). For both of these samples, we had selected *Saxidomus giganteus* and *Protothaca staminea* body fragments to make sure that no *Mya arenaria* were included. After more consideration, we realized that if there were "intrusive" post-depositional bivalves like *Mya arenaria*, there may also be recent individuals of other non-introduced species. A third sample, consisting solely of *Balanus cariosus*, was chosen from the same sample as the earlier date to test its validity. This sample, from shovel test probe B level 60-70 cm, yielded an age of Cal 940-1150 AD (2 sigma). *Balanus cariosus* is generally found on rocky substrates in high energy environments, and thus it is highly unlikely these specimens would have been introduced growing in the mudflat.

In summary, the diversity of invertebrate taxa as well as lithic artifacts, burnt bone, charcoal and FMR in the deposit are consistent with expectations for a cultural shell midden. The distribution of clasts in the deposit is not consistent with a delta (Boggs 2000). The presence of woody debris, terrestrial gastropods, and the intact nature of the deposit seem to indicate that the deposit is primary and was formerly terrestrial. The radiocarbon estimates suggest it may have been deposited over several hundred years, between approximately 600 and 1450 AD. Further research needs to be conducted to determine the process by which the shell midden was incorporated in the intertidal zone. Because Barg and Owens made an extensive search of the small watershed above the site and were unable find any traces of midden that could have been the source, and because of the stacked shells, we believe that the shell-rich layer was not redeposited by erosion from above. If it changed position vertically, it did so *en masse*.

How then do we account for the presence of this midden deposit within the intertidal zone of Chuckanut Bay? The deposit could have subsided from its original terrestrial elevation due to movement of the ground or liquefaction (Sanders 2005; Waters 1992). There are known seismic disturbances in the Puget Sound region, including both megathrusts and other earthquakes, that occurred after the deposition of the shell deposit (Sanders 2005; Waters 1992). Although none of the events is directly documented in the Chuckanut Bay area, they represent possible causes of subsidence. An alternative is sea level rise. Sea level rose approximately 50 cm over the last 2,000 years in Northern Puget Sound (Beale 1990) which could account for gradual inundation of a terrestrial deposit. The infilling of Chuckanut Bay may also add to this effect. On the other hand, most midden deposits do not occur in a narrow elevational range just above high tide; they are more likely to be on terraces and surfaces at least somewhat elevated above high tide.

SURVEY AND SITE RECORDATION OUTSIDE OF WOODSTOCK FARM

In addition to working on Woodstock Farm, we attempted to relocate and update records for other archaeological sites in the northern part of Chuckanut Bay. The state site forms indicated a total of five sites other than 45WH55 in the area. We were able to relocate four of these sites, and re-recorded three of those. A brief description of the field methods and results is given below for each site. Updated site forms for 45WH54, 45WH77, and 45WH78 that include additional work in 2007 will be included in the report for the 2007 field season.

45WH50

Site 45WH50 is a precontact shell midden at the head of the bay, which is also the location of a reported historic burial. It lies on a low terrace about 4 to 5 m above the median high tide line. It was first recorded by Garland F. Grabert of Western Washington State College, now Western Washington University, in 1974. Grabert noted that the landscape had been significantly altered by houses and gardens and that further inland the terrace was wooded with secondary growth. Because of poor visibility, the site extent was uncertain, but he estimated the size as 30 m x 10 m. The deposits are described as thin layers of broken and decayed shell and FMR 10 to 30 cm in depth, overlying a sandy alluvium with gravel. A broken greenstone adze was also collected. Grabert reported that one landowner, Ted Allen, found a historic Caucasian burial with filled teeth, associated shoe remnants and several square nails from a coffin. These remains are reported to be one of five individuals from a shipwreck in the late 1890s or early 1900s.

During a reconnaissance of the site periphery from public roads, we observed enough shell in the roadside to confirm the site's general location. Because the site is apparently located on several private lots, we decided that it would not be practical to have students re-record it as a learning exercise and conducted no further investigation. Judging from the age of the houses, there does not appear to have been much development or alteration of the terrain since the site was recorded in 1974.

45WH76

The site form for 45WH76 indicates that it is a surface scatter of cobble choppers and core tools on a high terrace. It lies in the vicinity of the railroad tunnel on the northwestern side of the bay. The area is described as having heavy brush and secondary growth following logging. The original form filled out by K. Jacques and A. Pflanzer of Western Washington State College in 1977 is incomplete and somewhat ambiguous; for example, in one place it says the site is west of the tunnel, while in another it says it is directly above, and east of the tunnel entrance.

The form indicates that the site is partially on private property and partially in the railroad ROW. We attempted to relocate the site by walking on the ROW, but were unable to gain access without crossing private property, for which we did not have permission.

Although we were unable to confirm the location of the site, we did examine cultural materials stored at Western Washington University that were collected during the 1977 survey. The assemblage includes four flaked cobbles, one of coarse-grained quartzite and three of metamorphic material. There is also a soil sample that had been collected below the leaf litter where one of the flaked cobbles (Artifact #3) was recorded. We removed a 29 g subsample from this sample to retain with the collection, examining the remainder for artifacts. We screened the material through 1/16" mesh in case there were small use-flakes associated with the cobble tools. We found numerous predominantly sub-angular pebbles and a few pieces of charcoal, but no flakes. Given that the area had been logged in the past, there is no reason to believe that the charcoal was associated with the lithic assemblage and we discarded all of the material.

45WH77

Site 45WH77 is a historic petroglyph chiseled into an outcrop of Chuckanut sandstone, situated in a small cove along the northernmost shoreline of Chuckanut Bay (Figure 14) and first recorded in 1977 by K. Jacques and A. Pflanzer of Western Washington State College. The site comprises a single petroglyph, which is an interconnected lizard and peace sign approximately 105 cm long and 36 cm wide. Fieldwork in 2005 confirmed the location of the petroglyph, recorded additional details on the design, tested for associated subsurface deposits, and collected oral history (Figure 15).

The lizard and peace sign appear to have been created as a single design because the tail crosses over and under the peace sign (Figure 16). Due to weathering, most likely by wave activity, the bottom portion of the peace sign image has been obscured, which may also account for the absence of an autograph referred to in the earlier site form. Where the grooves are less weathered, they are "V"-shaped and narrow (0.6 to 0.9 cm wide and 0.6 to 0.8 cm deep) suggesting they were made with a chisel. The 1977 site form indicated 1967 as the date of origin, but provided no specific basis. We obtained an interview with a long-time resident who confirmed this date, and indicated that the inscribers were art students from Western Washington State College.

No other cultural material was visible on the surface in the immediate vicinity, except for possible evidence of burning on a sandstone boulder. Two shovel tests were excavated to determine whether there were any associated buried cultural deposits, one at the base of the petroglyph, and one next to the boulder with evidence of burning. Brown and green glass fragments and shell were found in the upper 15 cm, below which were poorly-sorted sediments. There is no basis for making a direct connection between these artifacts and the petroglyph.

Figure 14: View across Chuckanut Bay at low tide from the Chuckanut Village parking lot; site area outlined in white.

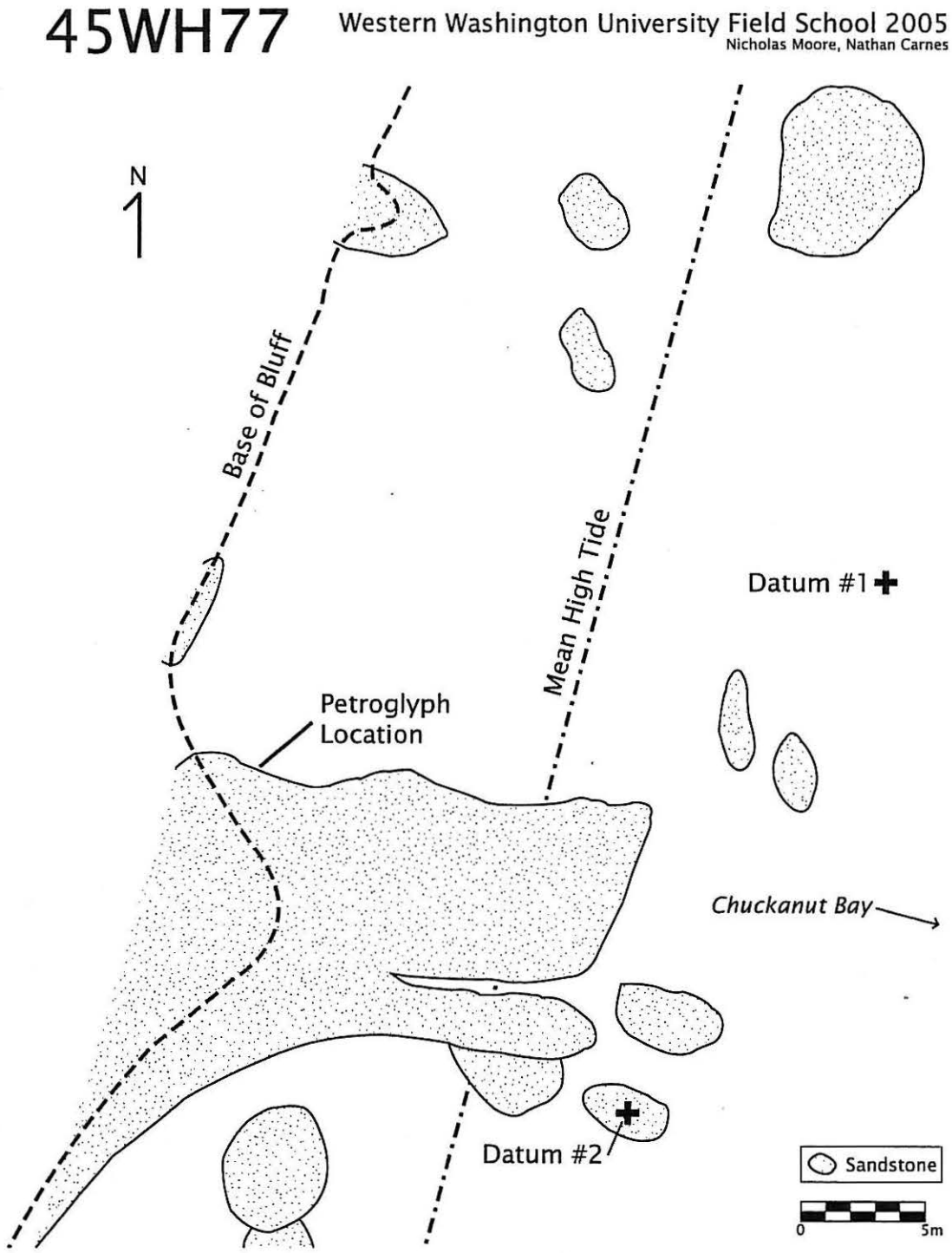


Figure 15: 45WH77 Site Map.

Figure 16: Close-up of historic petroglyph.

45WH78

Site 45WH78 was originally recorded by K. Jacques and A. Pflanzer of Western Washington State College. It was included as part of 45WH54 by Allan Richardson in 1984. It is a precontact petroglyph on a small boulder, originally situated along the northeastern-most shoreline of Chuckanut Bay (Figure 17). In response to a report that the boulder had been drug along the beach, the petroglyph was removed in 2004 by Tim Wahl of the Bellingham Parks and Recreation Department and Dr. Sarah Campbell of Western Washington University, in consultation with Stephanie Kramer from the Washington Department of Archaeology and Historic Preservation. It is currently located on Bellingham City Parks' Woodstock Farm property.

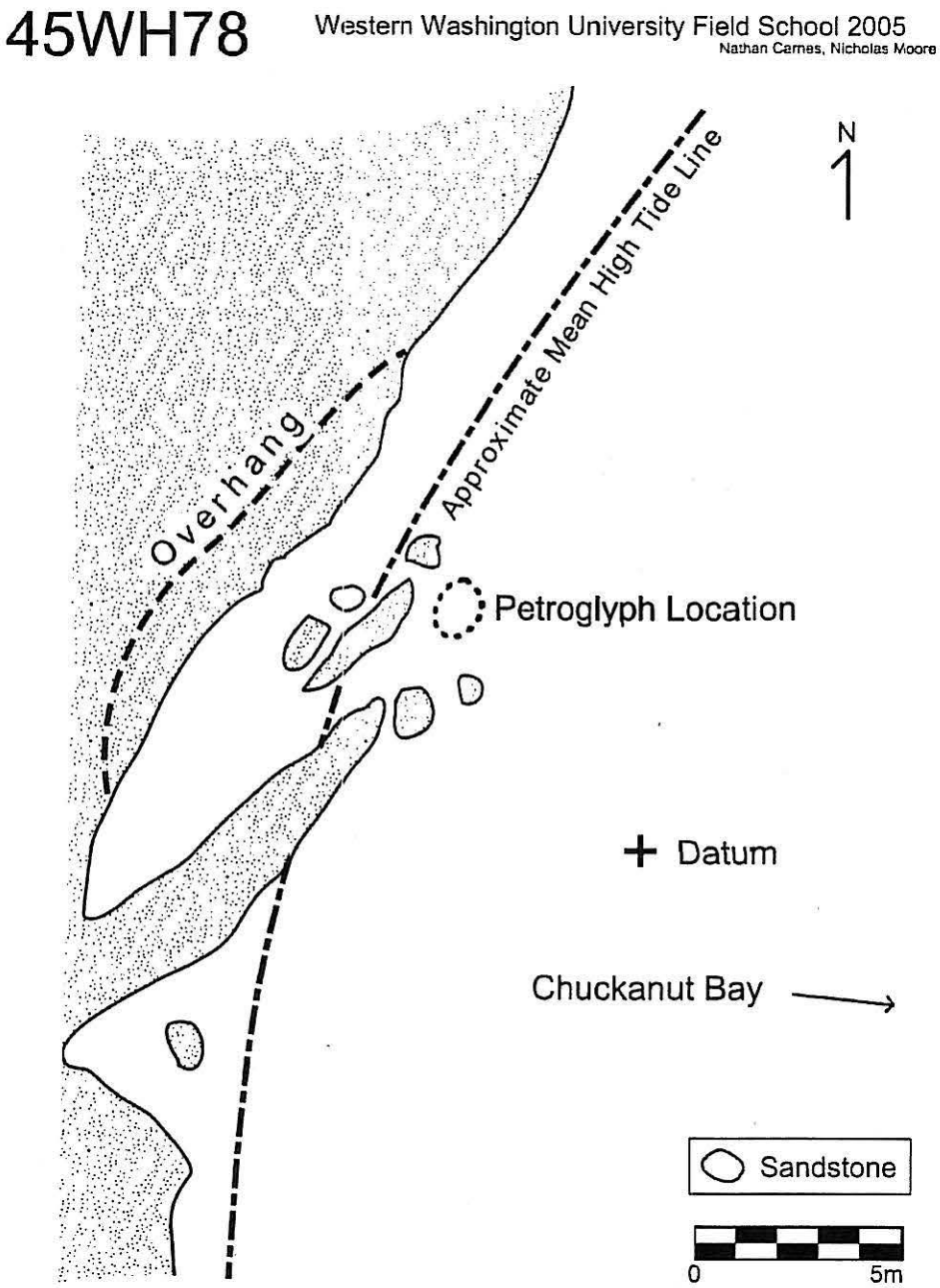


Figure 17: 45WH78 site map.

The site comprises a single ovoid petroglyph pecked into a piece of Chuckanut sandstone approximately 80 cm long, 40 cm wide, and 30 cm in height. This petroglyph is possibly associated with shell midden site 45WH54 which begins 15 m north along the beach. The site, as recorded, is the location of the petroglyph before its removal. It is not clear how far the petroglyph may have been moved, although from the site location information in the 1977 site form, it appears to have been close to its original location. Surface visible cultural material is limited to the petroglyph and shovel testing did not indicate a buried cultural horizon. A single shovel test probe was excavated 2 m north of the former location of the boulder. It revealed 30 cm of beach deposits overlying bedrock. Both clear and green glass, a bottle cap, and part of a plate were found in the upper 17 cm.

The ovoid petroglyph from 45WH78 is pecked into a boulder of Chuckanut sandstone 0.8 m x 0.3 m that is weathered on all sides. The petroglyph resembles a "D" turned on its side, or a collapsed oval, containing within it a smaller image of the same shape, centered around a raised surface (Figure 18). Ovoid-within-ovoid forms were traditionally used by Northwest Coast Peoples to depict an eye (Holm 1965). The outer ovoid measures 22 cm in length with a height of 15 cm and the grooves range from 0.8 - 0.95 cm wide and 0.15- 0.20 cm deep. The inner ovoid measures 17 cm in length and 9.5 cm in height, with the grooves ranging from 1.0 - 0.80 cm wide and 0.15 - 0.25 cm deep. The petroglyph was formed by pecking as indicated by the "U" shape of the shallow, wide grooves.

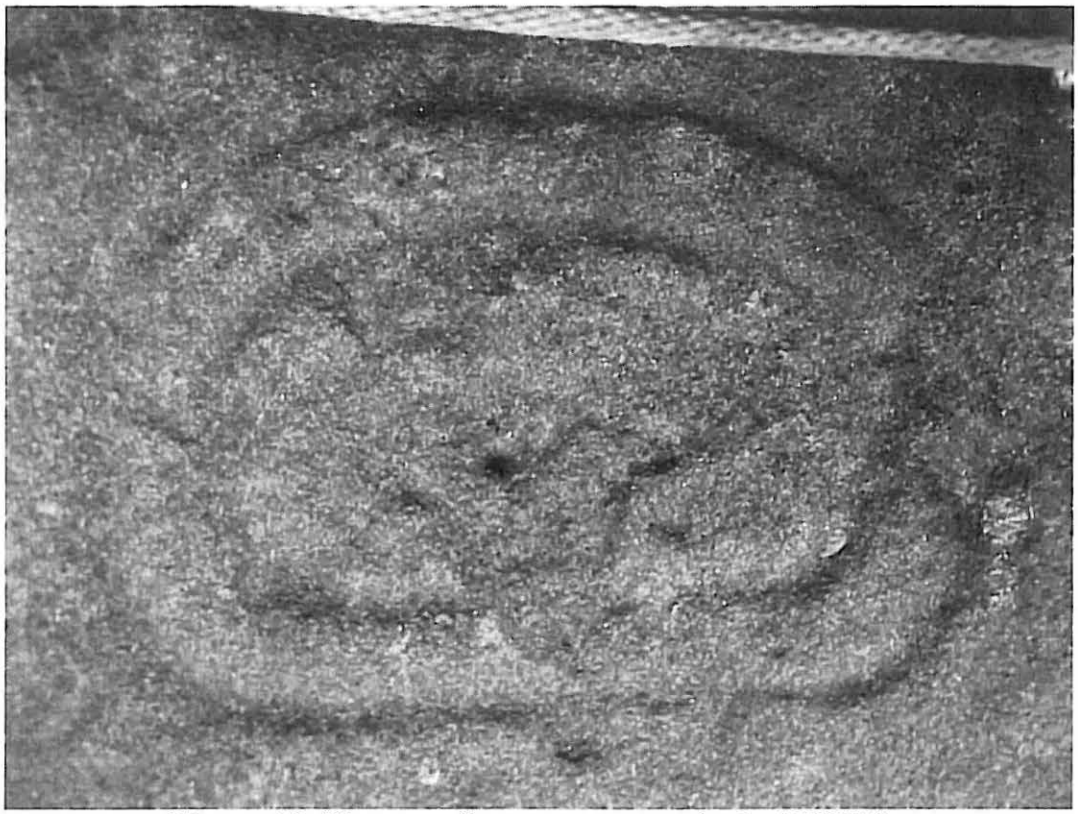


Figure 18: Close up of precontact petroglyph, 45WH78.

45WH54

Site 45WH54is a precontact shell midden originally recorded by Garland Grabert in the 1970's. Allan Richardson of Whatcom Community College rerecorded it in 1984 after conducting test excavations. Shell midden is found in four discontinuous areas along approximately 200 m of shoreline according to Richardson. He also included the petroglyph which is also recorded as 45WH78 in this site. Limited test excavation was conducted in Area 1, the northeastern most area, by the Whatcom Community College field school in May 1984. The excavation uncovered a number of artifacts, FMR, shell taxa and two features. The maximum depth of the midden was approximately 25 cmbs.

A partly completed site form dated 1985 was found in the archives at Western Washington University; it provides UTM coordinates Easting 536900 m E and Northing 5394170 m N, but does not describe the extent of the site or cultural materials.

The portion of the site recorded by the 2005 field school corresponds with Richardson's Area 4 at the southwestern end of the site. This section of the midden is approximately 30 m long by 3 m wide and 40 cm in depth, and situated on a narrow terrace above a bank on the north shore of Chuckanut Bay (Figure 19). It may extend as much as 300 m to the east based on an exposure in a trail near the berm at the head of the bay. According to landowners, the area of the site was logged and used as a public campground at the turn of the century.

Field Methods

Systematic investigation of site 45WH54 was limited by landowner permission to Lot 28 and Lot B Seas Pines LLA AS REC 370213 154537 0000 (the Tullis property). Surface visible shell midden was also observed in a trail. It is certain that the shell midden extends onto neighboring lots to the east. A limited walkthrough of an adjacent lot, accompanied by the property owners, was conducted and some surface shell and FCR was observed. Shovel Test Pits were used to determine artifact deposition and subsurface extent of the shell midden on the Tullis property. Samples of intact midden were taken from an exposed profile for dating, but no other cultural materials were collected (Figure 20).

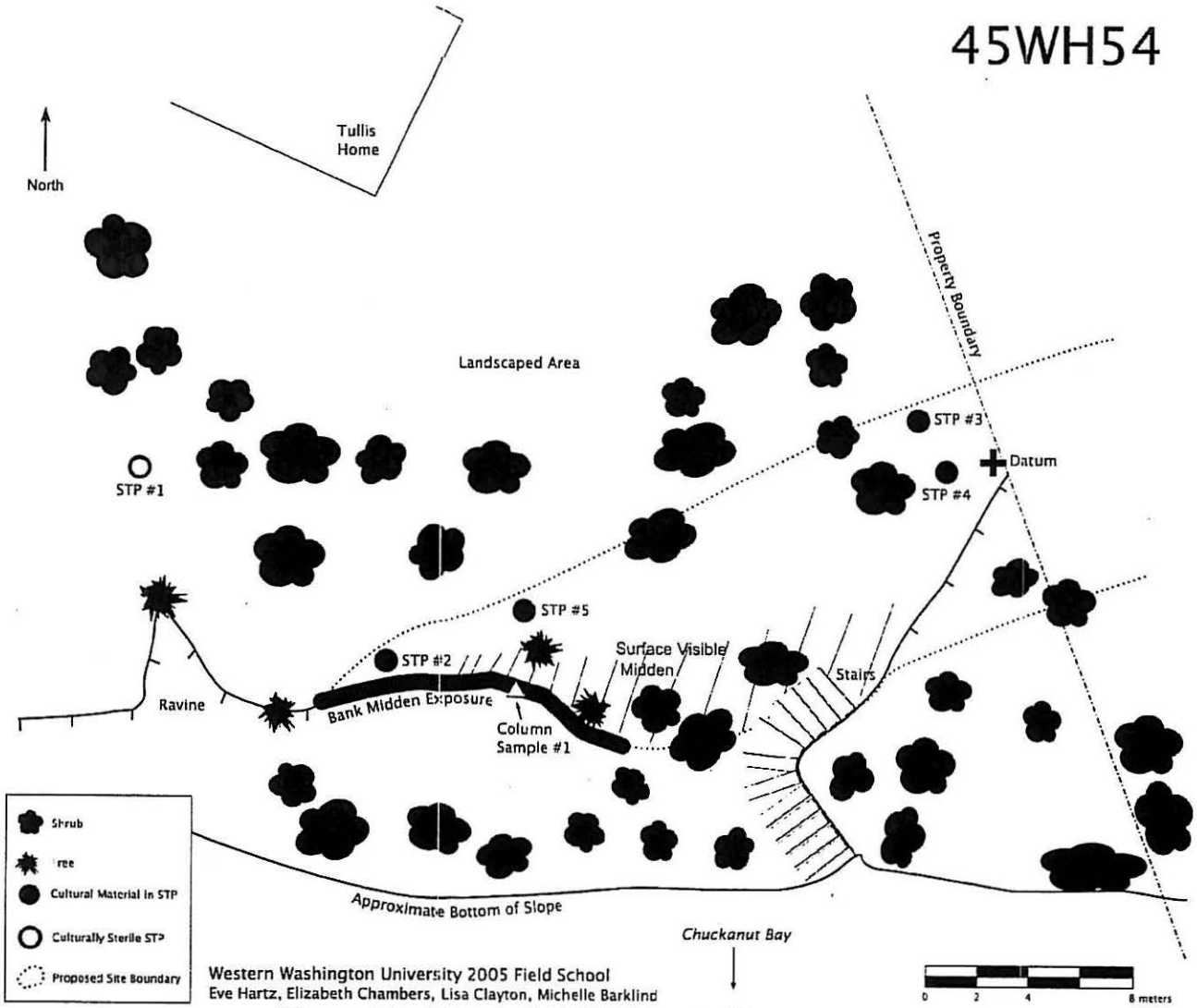


Figure 19: Extent of 45WH54 on Tullis property.

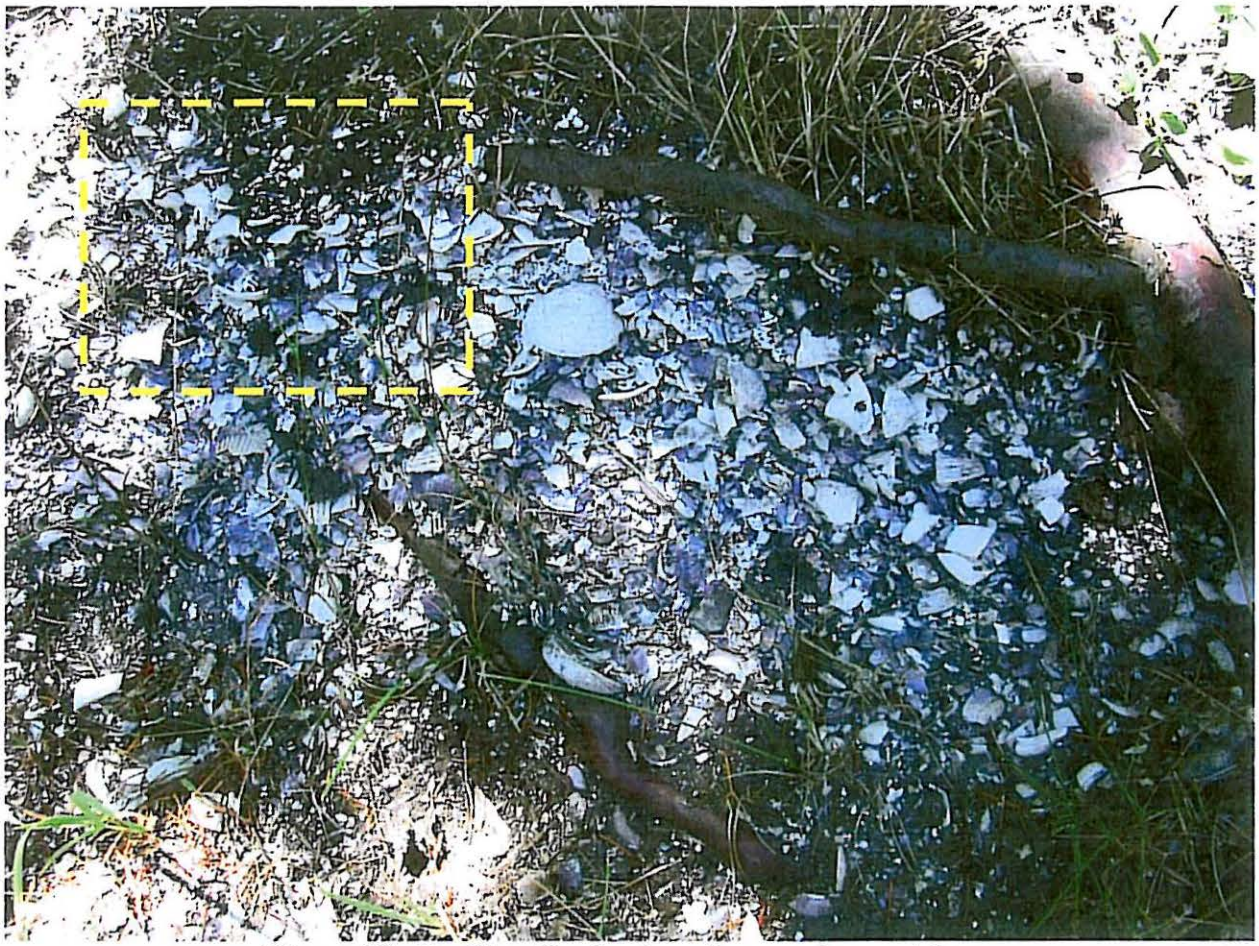


Figure 20: Profile of bank where the sample was taken.

Analysis and Results

Material from the column sample was screened through ¼" and 1/8" mesh, washed, and sorted by material type and taxa. The site comprises whole and crushed shell, FMR, burnt wood, and artifacts. Surface cultural deposits included FMR, a single cobble chopper, and numerous shell fragments of *Mytilus edulis*, *Clinocardium nuttallii*, *Protothaca staminea*, *Ostrea lurida*, *Balanus spp.*, *Thais sp.*, and possible *Saxidomus giganteus* or *Tresus capax*. A sample of *Mytilus edulis*, *Protothaca staminea*, *Clinocardium nuttallii* and unidentifiable body fragments were sent to Beta Analytic (Beta – 211703) for radiocarbon dating, yielding a date of Cal 670 to 530 BP (2 sigma). Today the shell midden is heavily eroded and slumping into Chuckanut Bay. Organic rich midden soils range from a silt loam to a sandy silt. No diagnostic artifacts were found, but two flakes of basalt and a cobble chopper of were recorded and reburied in shovel test #2 at 60cm in a plastic ziploc bag with labeled pink flagging tape. Interestingly, a relatively new-looking white binder tab with WH-50 written on one side and WH-76 written on the other was found in the first 10cm of STP #1. It is uncertain whether it was present due to an accident or whether it was purposefully buried by a previous survey team.

TEST EXCAVATIONS AT 45WH55, WOODSTOCK FARM

GOALS AND METHODS

Site 45WH55 is a precontact shell midden originally recorded in 1974 by Gaston and Swanson of Western Washington University. The original site form indicates the site as visible in the beach cut bank and approximately 50 x 25 m in size. It is situated on a bluff on the eastern side of Chuckanut Bay; bordered by a ravine on the east and south sides and the Bay on the west (Figure 21 and Figure 22). Shell midden can be seen eroding into Chuckanut Bay along the western perimeter of the site. Our investigation indicates the dimensions are 80 x 60 m with depths up to 2 m at the water's edge.

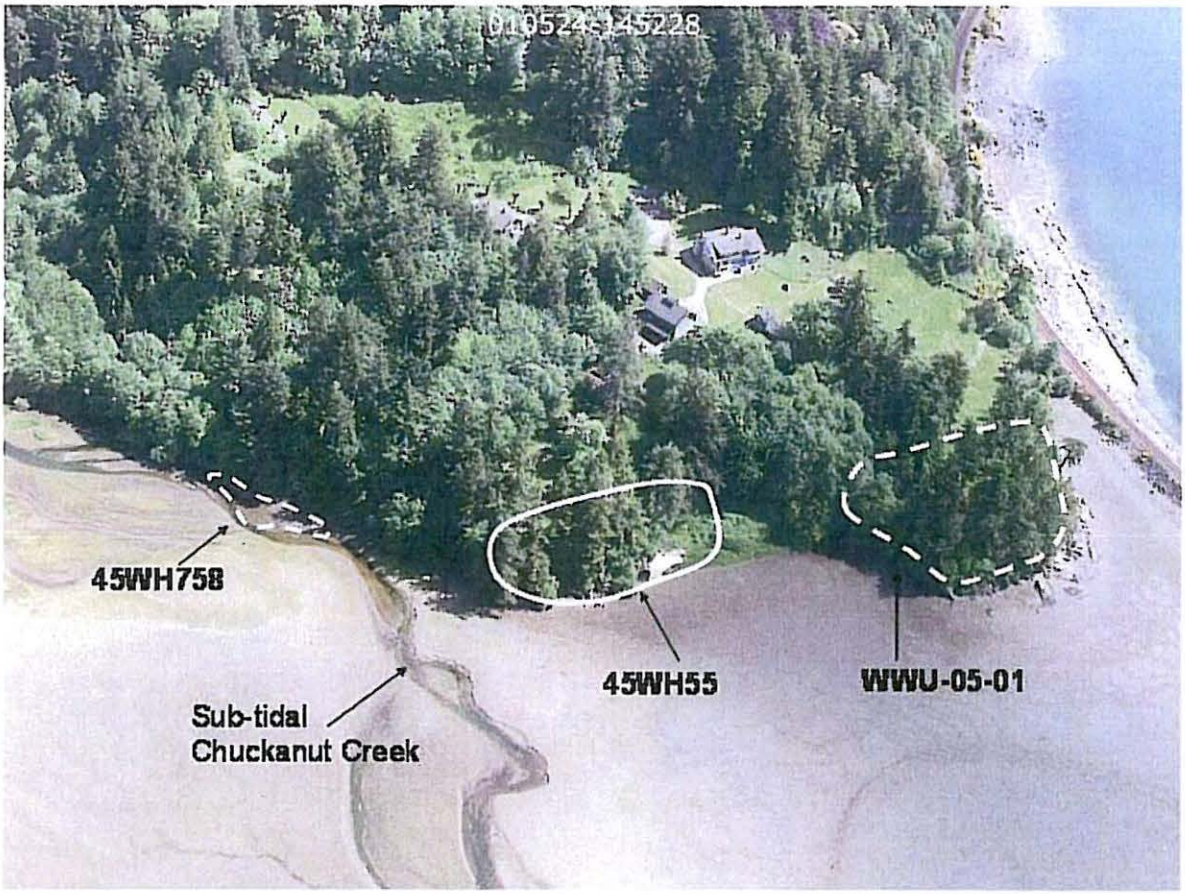


Figure 21: Aerial view of site 45WH55 and surrounding bay, which includes 45WH758 and 45WH763 (shown on photo as WWU-05-01).

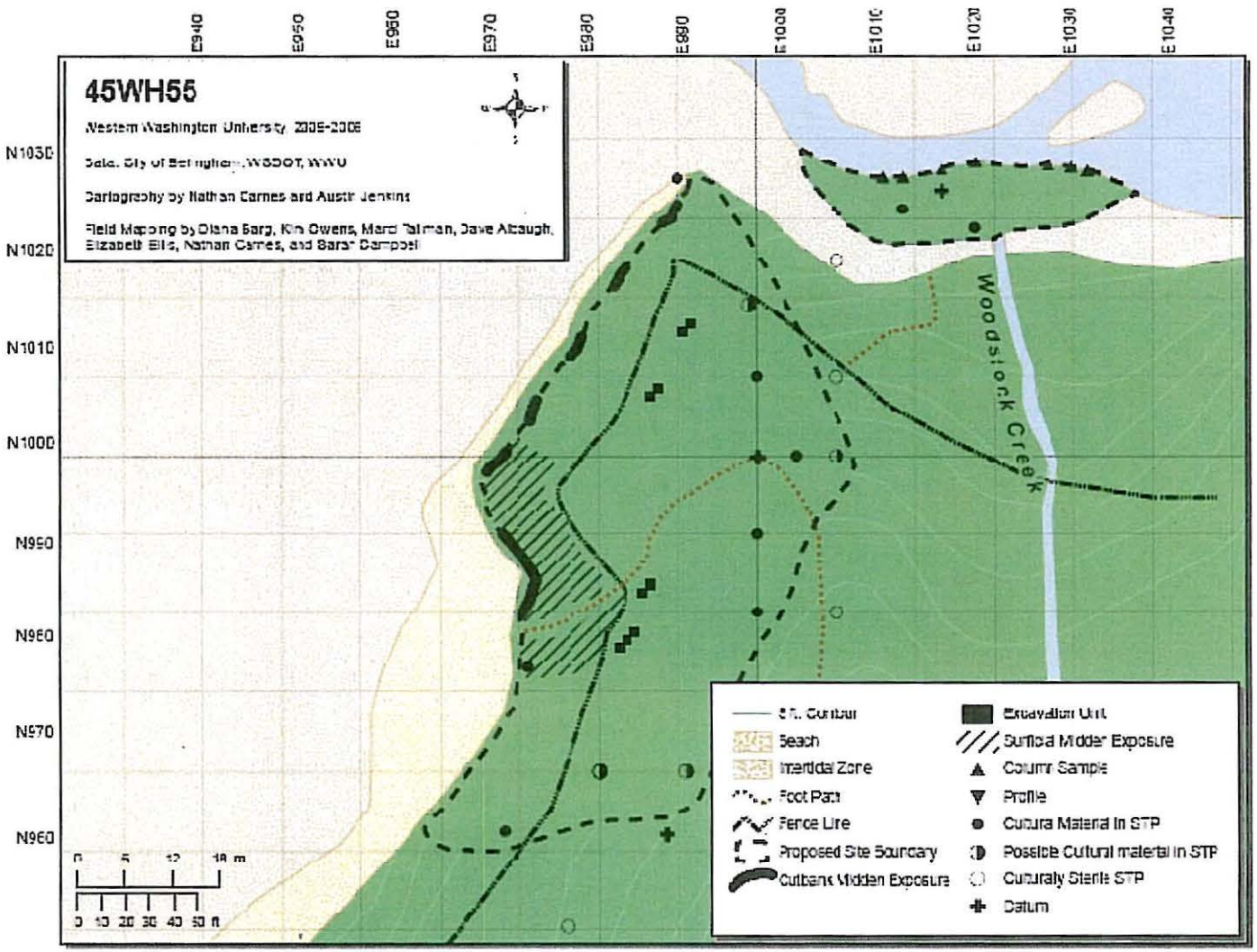


Figure 22: 45WH55 site map.

Seven 1 x 1 m test units were excavated to a depth of between 50 and 75 cm below ground surface. Another two were opened but abandoned when it became apparent that they were in an extensively disturbed area. Twelve features were recovered as well as cultural strata containing whole and crushed shell, FMR, burnt wood, bone and lithic artifacts, and large quantities of FMR. Surface cultural deposits included FMR, a single cobble chopper, and numerous shell fragments of *Mytilus edulis, Clinocardium nuttallii, Protothaca staminea, Ostrea lurida, Balanus sp., Thais sp., Saxidomus giganteus* and *Tresus capax*, as well as unidentifiable shell fragments. A variety of historic items were also recorded at the site including metal, bullet shells, nails, machinery parts, glass syringes, bottle glass, flat glass, wire, and peach seeds. In addition, 15 STPs were used to determine horizontal and vertical boundaries of the site. Samples of intact midden were taken from the profile in the beach cutbank and from each feature for dating. All cultural materials were recorded and collected.

SURFACE AND SUBSURFACE DATA COLLECTION METHODS

No systematic surface collection was conducted at 45WH55, but several artifacts were observed on the surface and collected after recording point provenience. Four types of subsurface data collection were conducted: STPs, excavation units, feature sampling, and a bank profile excavation.

Each 1 x 1 m unit was excavated in arbitrary 10 cm sublevels within natural layers. On occasion arbitrary 5 cm sublevels were used. A 10 x 10 cm bulk soil sample was collected from each natural layer as well as a ¼" screen shell sample and 1/8" screen bulk sample, both of which were taken at random during excavation within the layers. Within each 1 x 1 m square, prehistoric artifacts larger than 2 cm were mapped in horizontal and vertical axes to the nearest centimeter. Non-recent historic artifacts were collected and given point provenience only when found in contact with prehistoric layers. Recent historic material (Styrofoam, etc) was examined and discarded in the field. Whole *Protothaca staminea* valves were collected and mapped for possible use in determining seasonality. Samples of feature fill and occasional miscellaneous samples of anomalous material were also collected. FMR was both counted and weighed by natural layer and feature, but not collected.

EXCAVATION SUMMARY AND STRATIGRAPHY

A total of nine 1 x 1 m units were opened at 45WH55. Two of these were terminated at a shallow depth when it became apparent that they were located in a disturbed area. Of the other seven units, three were excavated to sterile, and the other four were terminated due to time. Table 3 summarizes the samples that were collected by unit. The counts of modified bone and modified lithics shown are counts of individual artifacts, as these were catalogued separately. The counts for unmodified bone are counts of separate samples, most of which are aggregate lots.

Table 3: Samples and artifacts collected by unit.

	Samples			Modified Lithics	Modified Bone	Unmodified Bone	Whole Protothaca	Historic Artifacts
	Shell	Bulk	Other					
E981 N975	4	3	3	20	24	59	10	3
E982 N976	3	2	4	30	11	40	5	14
E983 N977	3	3	3	28	7	27	4	4
E985 N982*	0	0	0	0	0	0	0	0
E986 N983*	0	0	0	1	0	0	0	2
E986 N1007	5	4	4	35	25	30	1	23
E987 N1008	3	3	8	58	22	82	23	32
E990 N1015	7	6	14	28	4	24	10	89
E991 N1016	5	4	5	6	3	15	4	26
Total	30	25	41	206	96	277		

*Units aborted due to disturbance.

E991 N1016 and E990 N1015

These two units were placed diagonally adjacent to each other in the northern area of the site. The layers were correlated between the units using the profile drawings along the E991 line and N1016 line (Figure 23 and Figure 24). Layer 1 was a silty loam or fine sandy silt that was compact in places. It ranged from 5 to 25 cm in thickness and was thicker to the north. Historic artifacts and some FMR were found throughout this layer. Layer 2 contained shell, ash lenses, and precontact artifacts in a silty loam matrix. It is up to 30 cm thick, thinning to the east. Layer 3 is a lighter-colored silty loam (10YR4/2, 4/4, and 6/2 are the recorded colors) with patches of charcoal. In E990 N1015 it ranges in thickness from 20 to 25 cm. Excavation in E991 N1016 was terminated due to time after excavating less than 5 cm into layer 3. Layer 4, a compact clay loam with sparse FMR, ash, or shell was encountered only in the southern section of unit E991 N1016 and only excavated for 5 cm.

E991 N1016 was excavated down to 53 cm below the surface. Historic artifacts including nails, bricks, glass, and metal were found in the sod layer and in Layer 1, which extended to approximately 23 cm below the surface. Layer 1 was very dark brown (10YR 2/2) to black (10YR 2/1) silty loam, and contained few FMR. Below this was Layer 2, a silty loam, with patches of ash and fine shell. Soil colors ranged from very dark grayish brown (10YR 3/2), dark

brown (10YR 3/3) to Black (10YR 2/1). Areas of ashy fine shell found in the center and NE and NW corners of the unit were excavated as Layer 2 sublevel 3.

Feature 5, a refuse pile (Table 4), apparently originated at the base of Layer 2 in E991 N1016. This relatively dense concentration of ash, FMR, bone, and shell was oblong in shape (90 cm x 20 cm) and 7 cm thick. The very dark brown (10YR2/2) matrix color contrasted with the layer matrix of very dark grayish brown clay (10YR3/2) silt loam. Immediately below it was an area of oxidized soil and organic staining approximately 40 cm by 35 cm. The contents included deer and fish bone, whole *Saxidomus giganteus* shell, burnt crushed shell, and several modified artifacts, including a bone tool, a cobble chopper, a flake and a possible hammerstone.

Table 4: Features recorded at 45WH55.

Unit	Feature	Feature Type	Length	Width	Depth	Content
E982 N976	1	Abandoned	1 m	70 cm	5 cm	Shell, Bone, Lithics Subsequently treated as stratum
E990 N1015	2	Pit Hearth and Activity Area	70 cm	30 cm	51 cm	Bone, Lithic, Charcoal, Shell, FMR, Ash, Burnt Soil
E987 N1008	3*	Area of shell with wood ash				Subsequently treated as stratum
E987 N1008	4	Pit				
E991 N1016	5	Refuse Pile and burnt soil	93 cm	35 cm	7 cm	Shell, Bone, FMR, Ash, Cobble Chopper, Lithic, Bone Tool, hammerstone
E990 N1015	6	Surface Hearth and Activity Area	60 cm	36 cm	5.5 cm	Shell, Ash, Charcoal, FMR, Burnt Soil
E987 N1008	7*	Crushed shell lens				Crushed Shell Subsequently treated as stratum
E987 N1008	8*	Crushed shell lens				Crushed Shell; Combined with Feature 3 Subsequently treated as stratum
E981 N975	9	FMR concentration	55 cm	35 cm	N/A	FMR Designated but not excavated at base of unit
E983 N977	10	Basin	80 cm	20 cm	10 cm	Ash, Charcoal, Lithics, Shell
E986 N1007	11	Pit	49 cm	12 cm	26.5 cm	Shell, Ash, FMR, Cobble Chopper
E982 N976	12	Lens	44 cm	34 cm	5 cm	FMR, Shell

* Decided to treat as stratum, dimensions not taken.

One possible interpretation of Feature 5 is that it represents remains from boiling that were emptied from a box or basket. This is supported by its thinness, the number of whole shells, and the lack of charcoal. The underlying oxidized soil could be indicative of the surface hearth where the rocks were heated.

Feature 5 was excavated across most of the northern part of the unit and was terminated when hardpan beige clay with little to no shell was reached. This deposit, designated Layer 3, was exposed primarily in the southeast corner of the unit. The lowest stratum encountered, Layer 4, is a very dark brown hard packed clay loam (10YR 2/2). It was excavated only in the southwest corner, between 48 and 52 cmbd. A small amount of FMR was recovered, and small amounts of ash and shell were noted in the eastern part of the layer.

In E990 N1015 the sod layer was excavated conformably with the slope and contained historic artifacts, possible lithic debitage, burnt bone, charcoal and FMR. Layer 1, generally around 15 cm thick, consisted of ash and a fine sandy silt (10YR 2/2) compact soil. Artifacts include historic material, bone, two pieces of which were sawn, a burnt bone scatter and a tertiary flake. Layer 2 consisted of mixed clay, crushed and whole shell, and charcoal. The upper portion of this layer contained crushed shell of a gray color (10YR 6/1); the lower portion was crushed gray shell (10YR 5/1) but also included charcoal. The marine taxa included *Tresus capax, Protothaca staminea, Saxidomus giganteus, Clinocardium nuttallii, Balanus* spp. and crab (*Cancer* spp.*)*; artifacts included bone, flakes, and sandstone but no identifiable historic material. Layer 3 was a silty loam ranging in color from a grayish brown (10YR 5/2) to a light yellowish brown (10YR 6/4). This layer contained FMR, shell, lithic artifacts and ochre. A hard silt ranging in color from brown (10YR 5/3) to yellowish brown (10YR 5/4) made up Layer 4 of this unit. Fire Modified Rock, charcoal and shell were found in the surface of this layer.

Layer 2 was difficult to follow, with substantial vertical and horizontal variation and root disturbance, hence the inconsistent definition in Figure 24. The lower portion of this stratum seemed to represent multiple depositional events associated with the excavation and abandonment / infilling of Feature 6 and possibly Feature 2. Underlying Layer 2 in E990 N1015 were Features 2 and 6, which may be associated in an activity area.
Feature 6, which appears to be half of a circular hearth was encountered at 54 cmbd, has a length of 75 cm and is 10 cm thick. It occurs at or near the bottom of Layer 2 and extends into Layer 3, but its upper boundary was diffuse. The fill comprised a black to very dark grayish brown (10YR2/1 to 3/2) matrix (contrasting with lighter stratum matrix) with ash, charcoal, burned whole and crushed *Clinocardium nuttallii*, *Protothaca staminea*, *Saxidomus giganteus*, *Thais* sp., and *Tresus capax.* Three pieces of FMR weighing 1.75 lbs were also recovered. Oxidation of sediments underneath and surrounding the feature was observed during the excavation.

Feature 2 is a roughly circular pit approximately 40 cm in diameter and 30 cm deep that extends down from a more irregular oval stained area in Layer 3. The pit fill is comprised of finely crushed burned shell, whole *Protothaca* and *Saxidomus* shell, charcoal, and ash. A total of 19 pieces (1.95 lbs) of FMR were reported inside the feature boundary, while 89 pieces (9 lbs) were found directly outside the pit hearth.

The area between Features 2 and Feature 6 at 52-58 cmbd contained four flakes, a hammerstone, a piece of slate, *Ostrea* shell, and red pigment, possible red ochre. Although not treated as a feature, it is likely part of the same activity area.

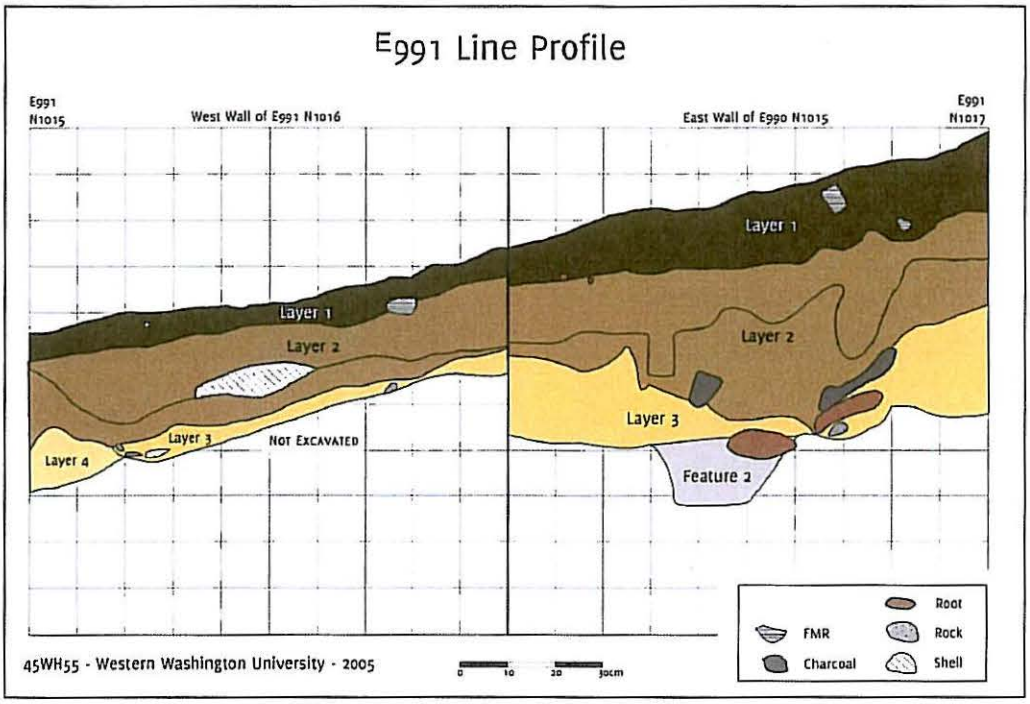


Figure 23: E991 line profile; looking east.

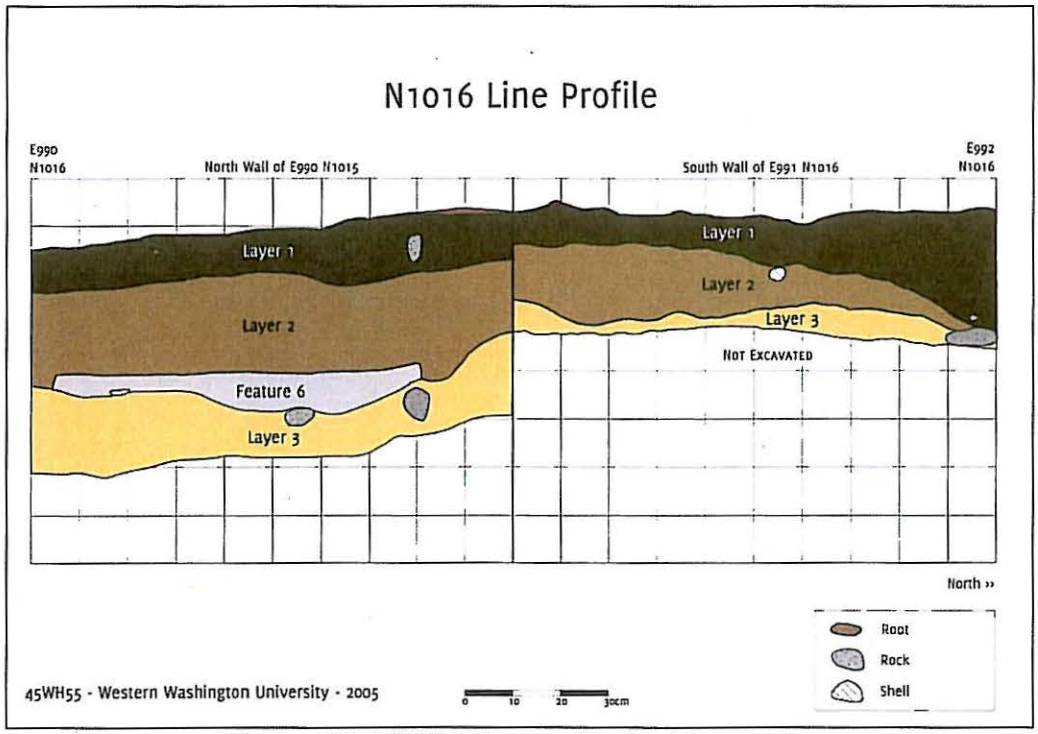


Figure 24: N1016 line profile; looking north.

E987 N1008 and E986 N1007

These two 1 x 1 m units were placed diagonally adjacent to each other. A striking difference in the stratigraphic sequence was apparent as excavation progressed, with sterile sediments encountered relatively high in E986 N1007 and steeply sloping complex stratification in E987 N1008 (Figures 25, 26, and 27). It became apparent that the units were on either side of the rim of a relatively large pit, possibly a housepit, filled with a series of cultural deposits. In the discussion below, the layers are correlated across the two units. The sod layer, and Layers 1, 2, and 6 occur in both, while Layers 3-5 are unique to unit E986 N1008.

The sod level in both units was darkish gray (10YR 3/1 – 5/2) silty loam and fine in texture. A few shells, glass fragments, FMR and ceramic fragments were found in this layer. Layer 1 in both units was a mixture of very dark grayish brown (10YR 3/2) silt loam with some crushed shell, yellowish brown (10YR 5/4) silt loam with little shell, and a dark grey (10YR 4/1) silt loam with crushed shell. It contained FMR, bone, and historic artifacts. Crushed shell was exposed diffusely in several areas and a pit, with bones above it and filled with historic material, was uncovered in the northeast corner of E986 N1007. Under the historic material in the pit a quartz crystal microblade was found. A crushed burnt shell concentration was uncovered in the southwest corner and an FMR concentration in the northwest corner of the same unit. The crushed shell concentration was retroactively designated Feature 3. Below Layer 1, the units differed dramatically (Figure 25).

In E986 N1007, Layer 2 ranged from a yellowish brown (10YR 5/4) silt loam with sparse shell to a dark grayish brown (10YR 4/2) silty loam with small shell fragments. The artifacts recovered from this level include bone fragments, lithic material and a quartz crystal microblade. Flat glass, presumably intrusive, was also recovered in the screen from this layer. Layer 2 extended into E986 N1008 only marginally in the SW corner and along the western edge.

Layer 6, immediately underlying Layer 2 in E986 N1007, appears to be the native subsoil. It consists of brown (10YR 5/3) silty loam with very little shell, light yellowish brown (10YR 6/4) silty loam, very pale brown (10YR 7/4) and yellow (10YR 7/6) silty loam with no shell. Artifacts recovered in this level include bone and lithic fragments, possible ochre, and glass. After ca. 30 cm below surface only one piece of bone and small amounts of shell were found. Feature 11, a deep, narrow pit with extensive root disturbance was uncovered in Layer 5 along the west wall. It appears to be rodent disturbance.

In the SW corner of E987 N1008, the surface of Layer 6 formed a steep slope, on which alternating charcoal and ashy lenses were conformably deposited (Figures 27 and 28). These deposits, designated Layer 3, represent at least two fill events where ash and charcoal were dumped into the SW corner of a pit that had been excavated into Layer 6. The depression was subsequently filled with material designated Layers 5 and 4.

Layer 5 is found exclusively in this unit and consists of a silty loam varying widely in color from dark gray (10 YR 4/1), to grayish brown (10YR 5/2). It contains many bone and lithic artifacts as well as crushed and whole shell, and FMR. The north and east wall profiles show extensive areas of very thin, alternating layers of crushed shell, ash and charcoal. These appear to be *in*

situ fires, or dumps from fires that occurred as fill onto the interior surface of the large pit. A concentration of burnt shell and wood in the southeast corner was designated as Feature 4. Several small crushed shell concentrations in the western area of the unit were designated Features 7 and 8 but were subsequently treated as strata.

Layer 4, a yellowish brown (10YR 5/4) silt loam with sparse shell, and some lithic and bone artifacts also is found exclusively in this unit. A root burn or krotovina disturbance cross-cuts the unit from the northwest to the southeast. Several small crushed shell concentrations are present.

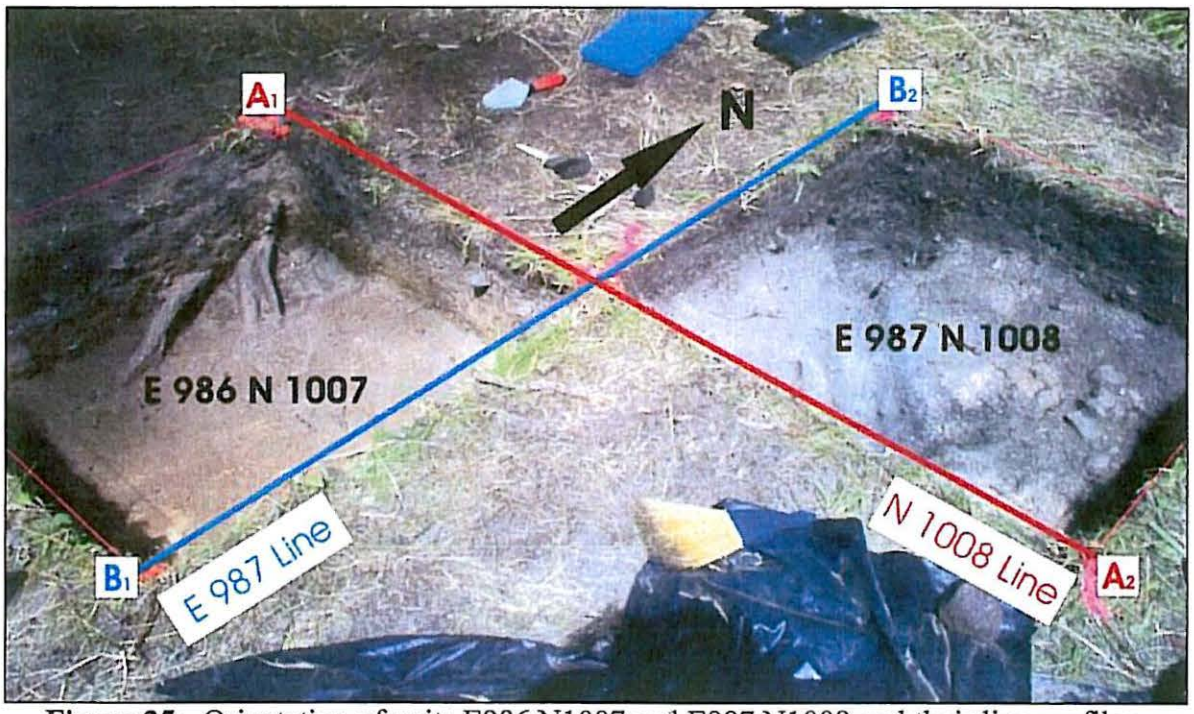


Figure 25: Orientation of units E986 N1007 and E987 N1008 and their line profiles.

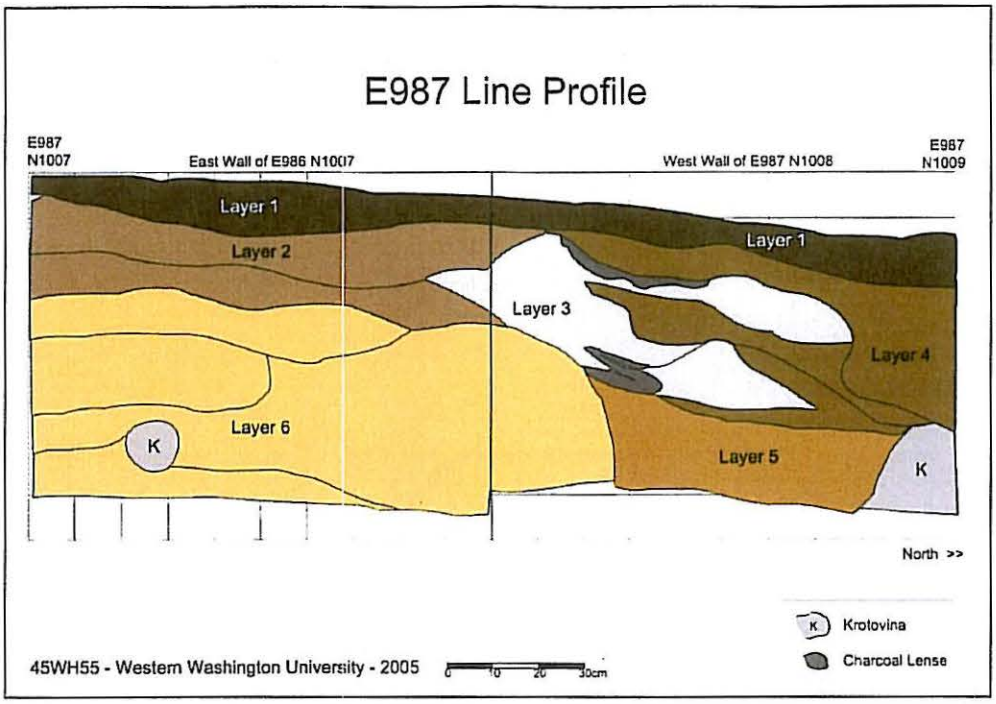


Figure 26: E987 line profile; looking west

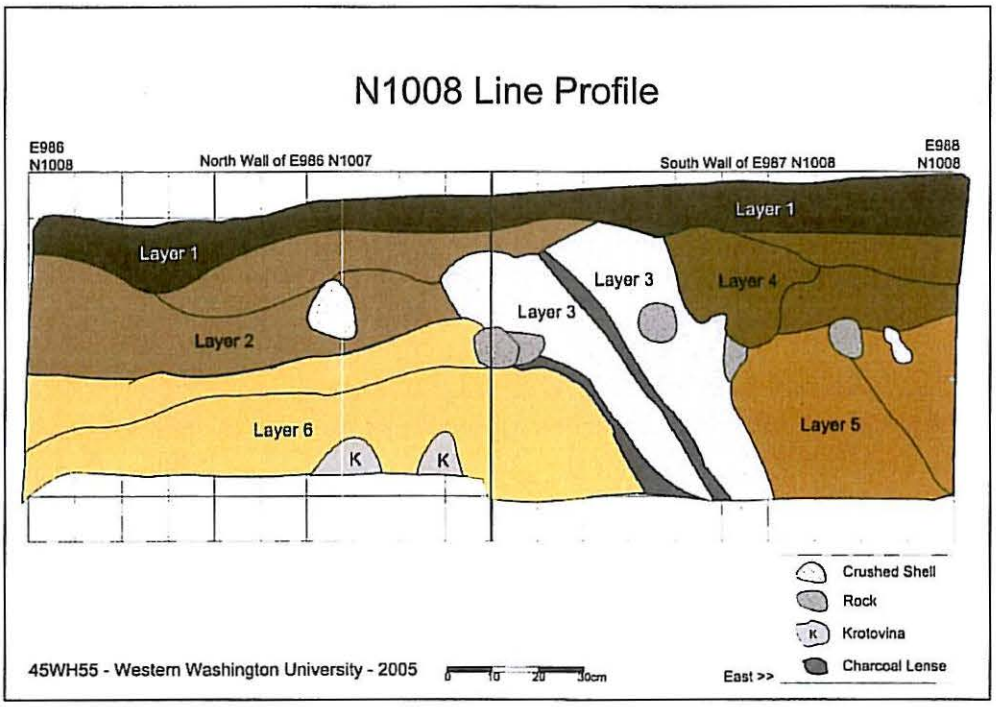


Figure 27: N1008 line profile; looking north

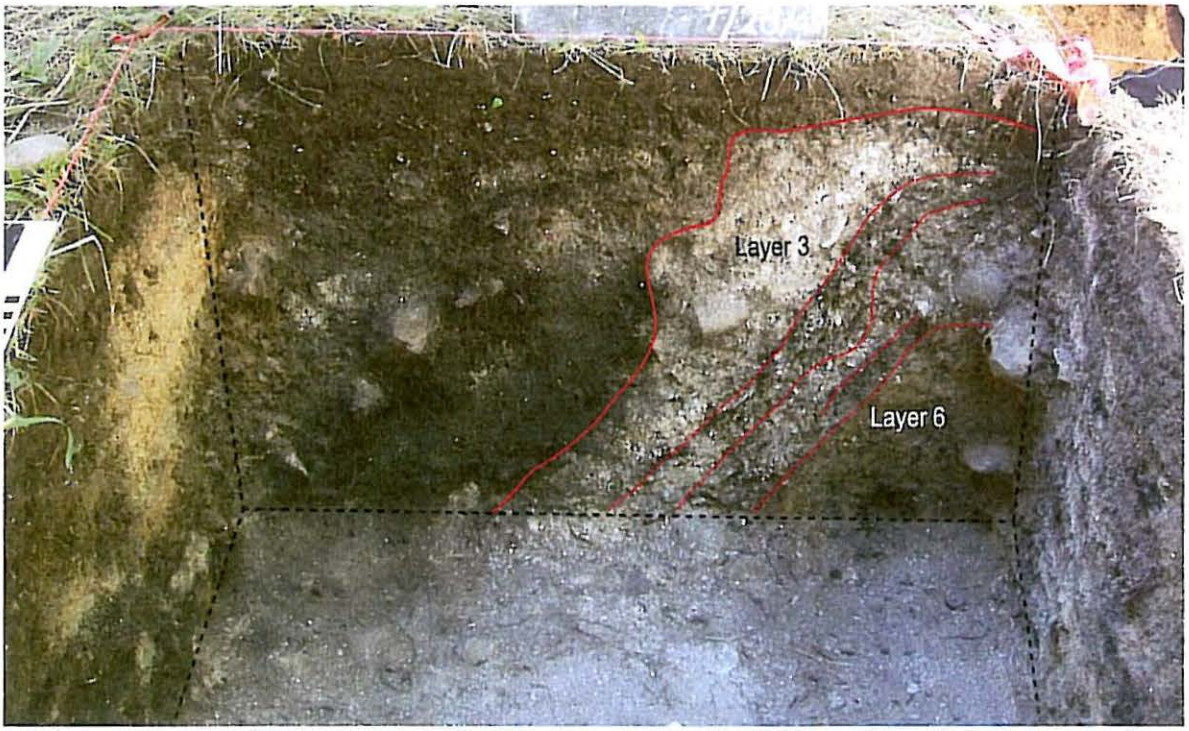


Figure 28: Sloping strata over Nati Silt Loam, E987 N1008 south wall; looking south.

E986 N983 and E985 N982

These two 1 x 1 m units were laid out diagonally adjacent near the center of the site, but both were terminated after brief excavation revealed evidence of extensive disturbance, probably due to excavation and earthmoving associated with historic drainage and road construction.

In E986 N983 the slightly sloping surface sod level ranged from 5 to 10 cm thick and contained no artifacts. Level 1, which consisted of grayish brown clay, started at 16–20 cmbd. A few small flakes, a piece of glass and some FMR were found in this level, which was terminated at 21–23 cmbd because the material appeared to be disturbed. This is the only area excavated in which clay was found under the sod. The mottled appearance of the clay suggested that it was backfill, and the location coincided with a probable drainage line indicated by a pipe at the base of the slope. In E985 N982, a unifacially flaked cobble and a piece of slate were found on the surface of layer 1, immediately under the sod.

In both units shovel tests at least 50 cm in depth were excavated in the center of the unit from the base of the excavation to determine whether intact cultural deposits might lie below the clayey materials at the surface. Both shovel tests revealed mottled yellow orange clay throughout and no evidence of midden.

E983 N977, E982 N976, and E981 N975

These three 1 x 1 m units were placed adjacent to each other diagonally near the southern end of the site (Figure 29). The sequence of deposition is very similar across these three units, and

although levels were defined independently in each unit, they were readily correlated in post-field analysis.

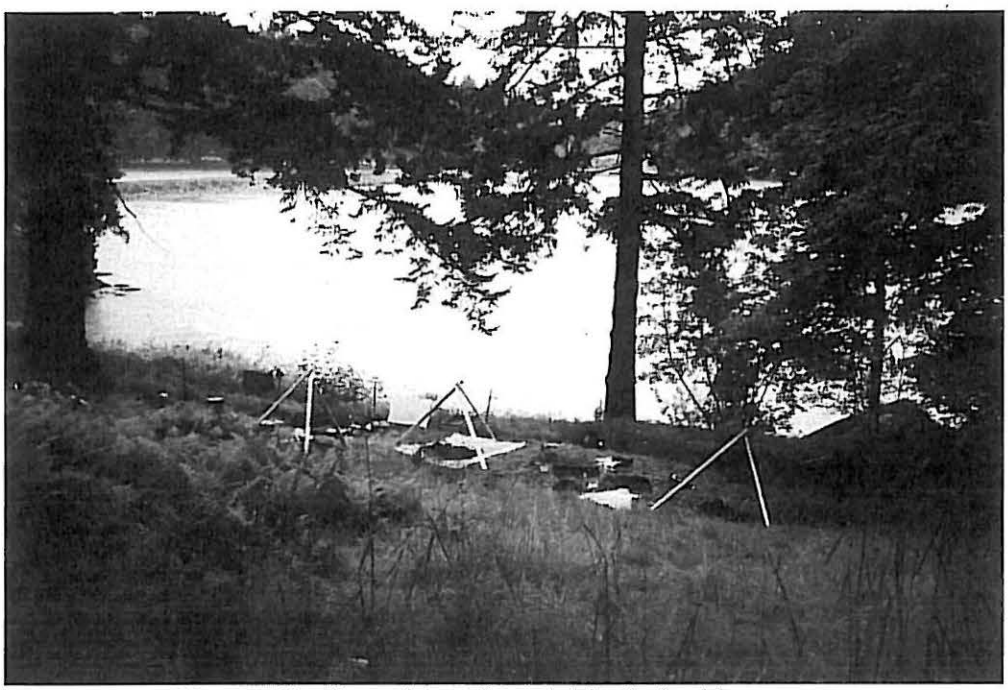


Figure 29: Overview of south block; looking west.

An uppermost layer of sod and dark grayish brown (10YR5/2) matrix extended across all three units, ranging in thickness from 5 to 20 cm. It contained sparse but varied historic artifacts as well as shell, FMR, and a few lithic artifacts. This was underlain by stratified midden deposits characterized by very dark gray (10YR3/1) silty loam with shell lenses ranging up to 1 m in length and up to 20 cm in thickness, some of which were found immediately below the sod. Generally angular FMR was abundant and formed a thick, often interlocked level across all three units in Layer 2 and the upper portions of Layer 3, but varied in concentration (Figure 30). It did not look like an intentional pavement as much as it appeared to be rocks discarded and walked upon.

At the base of the midden, where it was reached, the sediment changed to a dark yellowish brown, compact silty clay loam which is probably generally sterile, although some shell, FMR, and artifacts were recovered in its uppermost 5 cm. The stratified cultural deposits in this area are interpreted as a palimpsest of secondary refuse deposits forming a large sheet midden which apparently extends beyond these units, as the boundaries were not encountered. Discrete deposits occur within it, such as the rock and bone concentration in E981 N975. Roots were extensive throughout these excavation units and disturbed the integrity to some extent.

Figure 30: Abundant FMR located in the three southern units.

In Unit E983 N977, the sod and Layer 1 were between 7 and 37 cmbds. The sediment was a silty loam, very dark gray (10YR 3/1) to black (10YR2/1). Historic artifacts, shell and FMR were recovered. Layer 2 sediments were a fine to medium-grained silt loam, ranging from very dark grayish brown (10YR 3/2) to dark gray (10YR3/2) and very dark gray (10YR3/1 and 4/1). Abundant FMR was found in the southwest corner, while whole *Protothaca* and *Saxidomus* shells were found in the northeast corner with crushed shell between them. Lithic artifacts including flakes and a cobble chopper were recovered. Feature 10 is a partial exposure (60 cm wide) of an ash-filled basin in the southeast corner near the bottom of the Layer 2. The vertical boundary between Layers 2 and 3 was diffuse. Layer 3 consisted of matrix colors ranging from dark yellowish brown to yellowish brown (10YR4/4, 5/4, 5/6). Very little shell, bone, or FMR was recovered from this unit, and it was terminated between 53 and 67 cmbd.

In Unit E982 N976 the sod and Layer 1 extended between 9 and 36 cmbd (Figure 31). The silty loam matrix ranged in color from very dark brown (10YR2/2) to very dark gray (10YR3/1) and incorporated patches of crushed shell and other areas that felt greasy. Historic artifacts were recovered as well as fish, bird, and mammal bone, and shell and lithic artifacts. An irregularly

shaped crushed shell lens noted in the east half of the unit at 23-27 cmbd was designated Feature 1, but was abandoned when it became apparent that it was the uppermost part of a unit-wide stratum that was being revealed. It was then treated as part of Layer 2, which ranged in elevation from 28 to 67 cmbd. The sediment was a fine to medium silty loam with crushed to large compact shell, FMR, fish and mammal bone, and lithic artifacts. Colors ranged from very dark gray (10YR3/1) to dark gray (10YR3/2). The upper portion of Layer 2 had much denser shell, while the density of FMR was high throughout although decreasing somewhat with depth. Large roots were encountered throughout. Feature 12 was designated in the southeast corner, starting around 34 cmbd and extending to 39 cmbd. The same yellowish brown matrix (Layer 4) that underlies the other units was encountered in portions of the unit but it was not excavated separately.

In Unit E981 N975 the sod and Layer 1 extended between 16 and 48 cmbd and yielded historic artifacts, shell, FMR and charcoal (Figure 31). The sediment matrix was similar in color and texture to that described for the units above. Layer 2 ranged from 37 to 51 cmbd. Matrix colors ranged from 10YR 3/1 to 5/1 (very dark gray to gray). FMR were fewer than in the adjacent unit, but relatively large. Shell, bone, and lithic artifacts were recovered. Layer 3 was excavated between 42 and 69 cmbd, and was a dark grayish brown (2.5Y4/2) in color. Some very fine crushed shell was observed and FMR increased. It contained a concentration of bone, flakes and FMR in the center that was not featured. The highest FMR densities were found in this level, as well as many large fragments of mammal bone. Dense shell was found in the southern half of the unit, including whole *Protothaca* valves, some of which were stacked. Due to time constraints, excavation was terminated without encountering sterile sediments. An FMR concentration in the SW corner at 61 cmbd was designated Feature 9 but was not fully excavated.

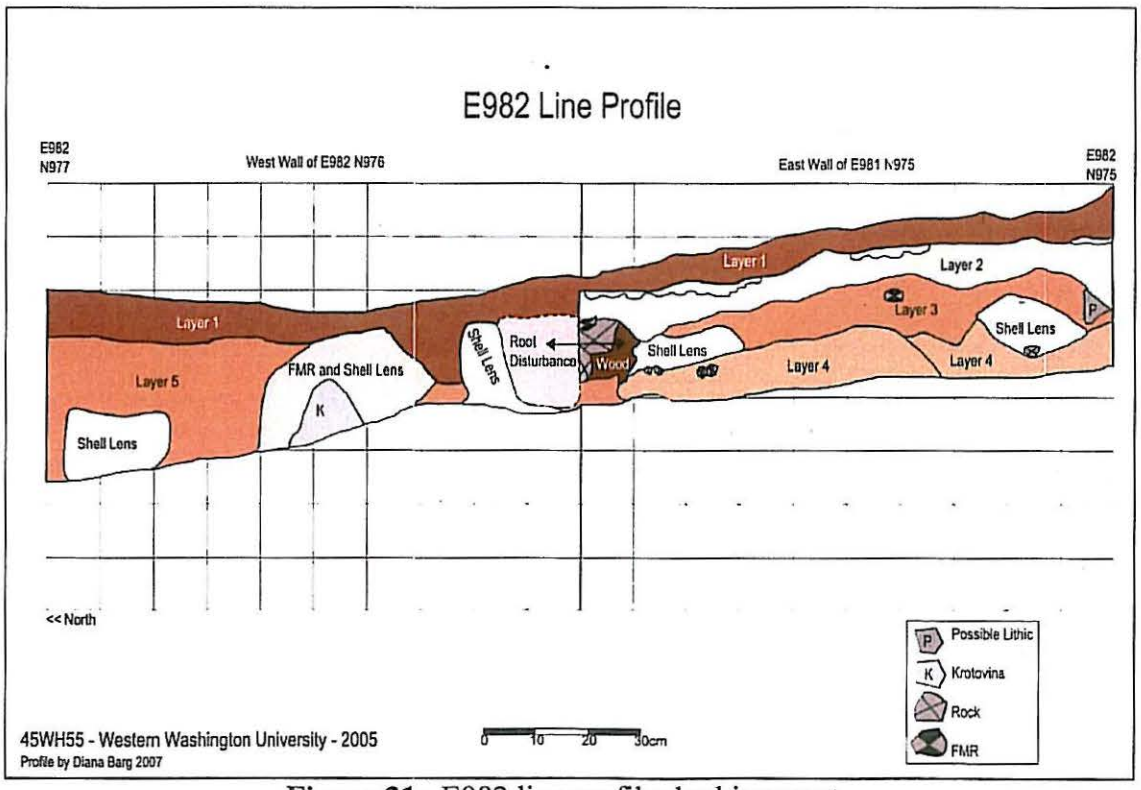


Figure 31: E982 line profile; looking west.

MATERIALS RECOVERED AND PRELIMINARY ANALYSIS

Artifact cataloguing has been completed but only preliminary analyses of artifact types and materials have been made.

Lithic Artifacts

The lithic assemblage (Table 5) is dominated by flaked items of various material types, although there are also a small number of artifacts showing evidence of grinding or battering use-wear (indicated as "pecked" in the table). Material type designations are preliminary and will require further research and examination.

Table 5: Summary of lithic artifacts from excavated units by material type and method of manufacture (items from collection and donation not included).

Material Type	Quartzite	CVR	CCS	Quartz Crystal	Platy Metased	Other	Total
Flaked	11	116	14	8	50	18	217
Pecked	3	0	0	0	0	1	4
Ground	0	4	0	0	2	3	9
Total	14	120	14	8	52	22	230

Quartzite artifacts include hammerstones, edged cobbles, and large primary and secondary flakes that likely resulted from manufacture or rejuvenation of edged quartzite cobbles on site. In E981N975 Level 4, a large secondary quartzite flake was found with three smaller flakes that refit although whether this was due to intentional retouch is unclear. Cobbles do not occur on the beach today, but a source of quartzite and other cobbles is only a short distance. About ¼ mile at the most up Chuckanut Creek, the south bank is a steep face cut into glacial drift, exposing numerous cobbles, quartzite and other usable toolstone.

The crystalline volcanic rocks designation (CVR) includes some glassy material with phenocrysts that appears to be dacite; three of the projectile points and a number of small thinning flakes are made of this material. The only clearly identifiable core is CVR.

The cryptocrystalline siliceous material (CCS) category includes several interior flakes and two projectile points; several of the objects are split pebbles of agate or jasper that may have been tested, but did not necessarily result in usable flakes. The impression given is that people brought curated CCS artifacts with them and did some maintenance, and that they checked out the possible local beach sources for CCS pebbles but met with little success. The quartz crystal assemblage

The quartz crystal assemblage clearly represents a curated, portable assemblage. Quartz crystals seem to be obtained near the source because the crystal faces still present on some objects do not show signs of the attrition that would result from geologic transport (this is based on observations at other sites in the region such as 45WH1 and 45SK46, not specifically in the 45WH55 assemblage). Quartz crystals occur at several locations in the Cascades. The eight

quartz crystal fragments from 45WH55 include one complete microblade, three microblade fragments, and five flake fragments or shatter. Although no cores or core fragments were found, the flake fragments or shatter could indicate that transported cores were worked at the site. The distal margin of the complete microblade (Cat. #760) may have been retouched to form an oblique angle. A reddish residue across the tip on the dorsal face ends in an abrupt line perpendicular to the length (Figure 33). It appears that the residue adhered to the tip when it was fastened into a haft and that the residue accumulated above the haft or binding.

The platy/metasediment material is dominated by a material that is likely local shale, available from bedrock exposures further south along Chuckanut Bay. Artifacts of this material are generally thin, flat pieces flaked at the edges. Flaked artifacts of materials grouped under "Other" include an anvil, hammerstones, edged cobbles, and utilized spalls of coarse-grained igneous material.

Analysis of 63 chipped stone artifacts from E983N977 and E987N1008 by undergraduate Ryan Shull showed that two-thirds of the objects were crystalline volcanic rock (CVR), coarse-grained lithics were the second most common, followed by 4 examples each of quartz crystal and CCS. Quartzite was also present (N=2). Tertiary flakes were the most common object type (N=38), but primary (N=1) and secondary flakes (N= 12), cores (N=3), microblades (N=1), and points (N=2) also occurred. The range of object types, especially for CVR , suggests some manufacturing on site, certainly at least tool rejuvenation. Hammerstones were also found in each of these two units. One cobble chopper is also part of the assemblage and expedient manufacture of such tools on site may account for some of the secondary flakes.

The six projectile points, point fragments, or preforms found encompass a wide range of styles (Figure 33). Several were recovered from contexts where they were not *in situ*. Three were recovered from the beach below the site, either on the surface or in a shovel test pit (Cat.#861, 863 and 864, Figure 33a-c). Two were found in E987N1008 (the unit with the housepit wall), Cat#726 (Figure 33d) and a medium size chert point with a triangular blade rounded shoulders and a thick, straight stem (Cat #736, not shown in Figure 33). A large triangular CVR biface (Cat #183, Figure 33e) may be a preform. Several thinning flakes that appear to match the material were found in the same unit; one of them appears to refit.

Ground stone is rare in the excavated assemblage, including three sandstone abraders (listed as "other" in table) and several items of CVR or metasediment with striations. However, three nephrite artifacts have been found on the beach (Figure 34). Catalogue #1149, an unusual object resembling the proximal bit of a chisel or adze blade, but worked on all surfaces, was found during controlled screening of the beach in front of the exposed profile. Artifact #1142 is a large nephrite adze blade with partially ground surfaces and what appears to be pitch from the haft remaining as a residue on the artifact. It was found by a local resident individual who donated it to the collection. A third item, Catalogue #1143, was also donated by a local resident. The grooves used to remove this piece are still evident on one side; they have not been ground over.

Bone Artifacts

Modified bones included 18 pieces identifiable as fragments of formal tool types such as awls and unipoints (Figure 35). An examination of 248 mammal bones from all units by undergraduates Andre Parquette and Alex DeViteo found no evidence of formal tool production in the form of systematic reduction by grooving and splitting or systematic splintering. Cut marks noted on a number of bones were more consistent with butchering and food preparation.

Figure 32: Microblades from 45WH55. Left = Cat #707, Right = Cat #760.

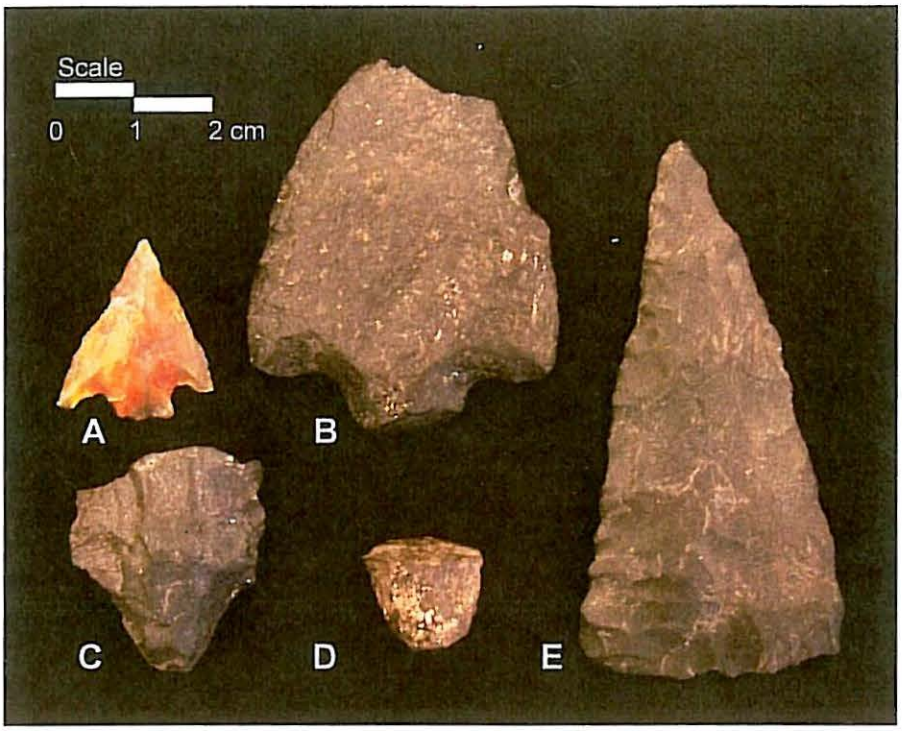


Figure 33: Projectile point styles from 45WH55. A=Cat#863, B=861, C=864, D=726, E=183.

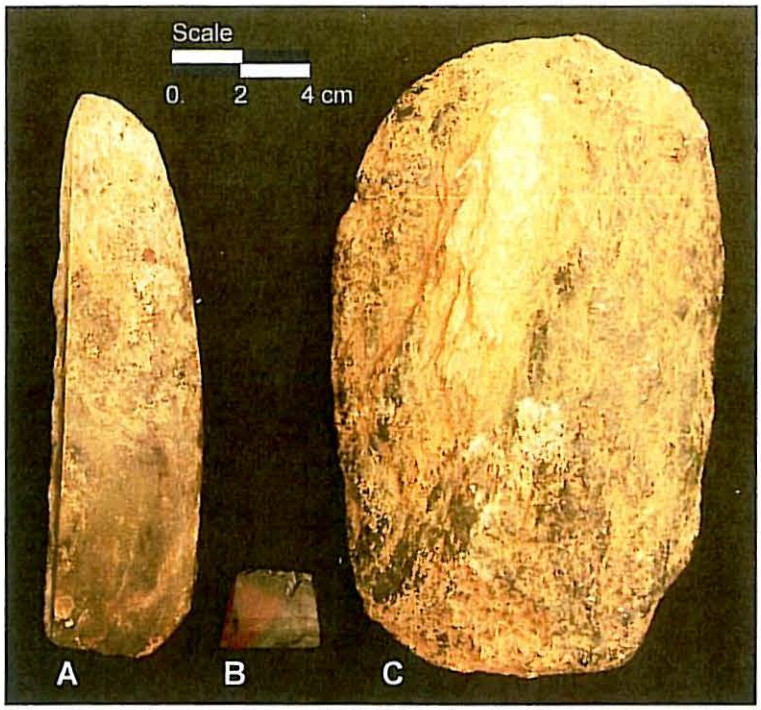


Figure 34: Ground stone from 45WH55. A=Cat#1143, B=1149, C=1142.

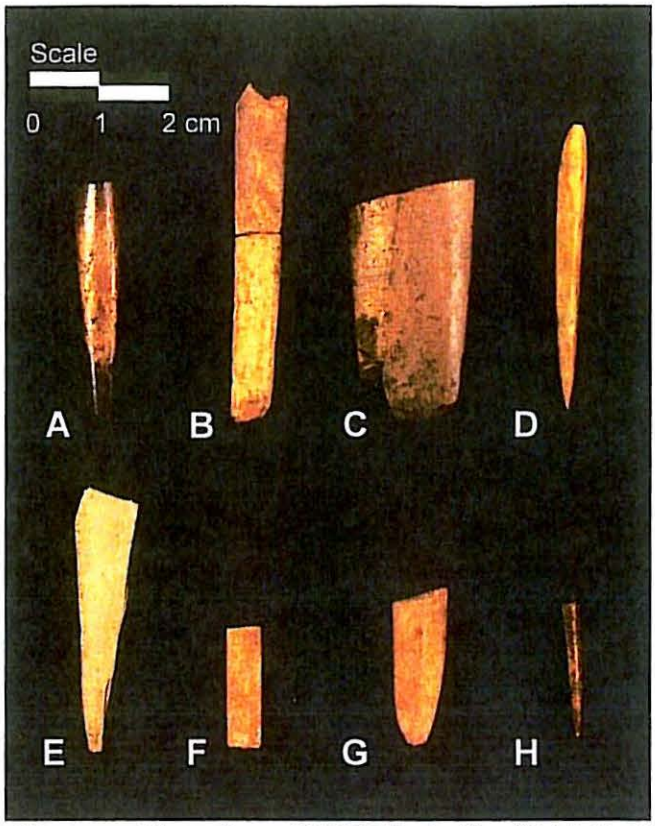


Figure 34: Modified bone artifacts from 45WH55. A=Cat #345, B=342 and 407, C=484, D=562, E=458, F=531, G=722, H=799.

Faunal Remains

Fifteen invertebrate taxa have been identified in the 14 ¼" samples that have been sorted. These include *Saxidomus giganteus, Protothaca staminea, Macoma* spp., *Clinocardium nuttalli, Tresus capax, Balanus cariosus, Balanus* spp., *Mytilus* spp., *Ostrea lurida, Thais* spp., limpet (cf. *Acmea* spp.), crab (*Cancer),* and urchin (*Strongylocentrotus). Mya arenaria* and *Crassostrea,* species introduced in the late 1800s, were also found in surface layers that also have historic Euroamerican artifacts. The nine 1/8" samples sorted at this point add no additional taxa.

Because people may have transported shells from other locations via canoe, we cannot assume that the mix of taxa represented is a direct indication of the local intertidal environment. However, taxa that prefer rockier, more exposed areas than currently exist in the vicinity, such as Thais, Mytilus, and Balanus cariosus are relatively abundant and ubiquitous in the samples, and it seems unlikely they were all brought in from elsewhere. Overall, the mix of taxa suggests very different conditions in the bay than the current fine sediments and low wave energy.

Mammal, fish, and bird bones were recovered *in situ*, as well as from the ¼ and 1/8th inch screen, resulting in a total NISP of 910 for mammals, 512 for fish and 62 for bird. Systematic faunal identification has not yet been undertaken. The greater abundance of mammal bones relative to fish is unusual for any shell midden in this area excavated using 1/8th inch screen. The mammal

bones are generally fragmented and the number of identifiable pieces is not large. Readily recognizable elements include deer distal radii, distal tibia, innominate, and foot bones, and an elk phalange. A mandible is tentatively identified as mountain beaver, *Aplodontia rufa.*

Marci Tallman, Ashley Hallock, and Charles Noard analyzed 672 bones from adjacent units E981N975, E982N976, and E983N977to see if frequencies of fish, mammal and bird bone varied across the fire-cracked rock feature. They tabulated 262 fish bones, 39 bird bones, and 371 mammal bones. Although the strata were relatively continuous across these three units, variation in bone frequencies suggests that there are discrete deposits within strata. Assemblages dominated by fish bone were found in all three units, but not in the same vertical position and the same is true for mammal bone.

Sediments

A total of 37 soil or bulk samples were collected from the excavation units and bank profile. Several sediment samples from E987 N1008 and E986 N1007 were analyzed to aid in determining the nature of the feature in that unit as discussed below. None of the other samples have been analyzed.

Barg and Holt (2006) used several approaches to determine whether the excavation of unit E987 N1008 had encountered the filled remains of a pithouse including examination of the profiles, grain size analysis, comparison of Munsell colors to the natural soil profile, and comparison to the cross section of a fully excavated Locarno Beach pithouse. The profiles of the units were examined to determine the order of deposition into the pit. Grain size distribution was determined for subsamples of six depositional layers using a Rotap machine and Malvern Mastersizer 2000 to separate phi size (-2 to 4). Field color designations and grain size were compared to the published descriptions of the Nati Silt Loam naturally occurring in the area. The slope of the possible pithouse wall at 45WH55 was measured and compared to that of a wall of a known pithouse of similar age.

Profiles across the 2 units show that parts of the sloping strata extend from Unit E987 N1008 into Unit E986 N1007. The underlying fine-grained yellowish brown soil also extends into both units, sloping steeply in E987 N1008 (Figure 26, Figure 27 and Figure 28). In Unit E987 N1008 the sloping strata lying above the Nati Silt Loam (Layer 3) suggest secondary dumping of cultural material over the edge of a pit. The expectation was that the grain size distribution for the Nati Silt Loam should be different than that of cultural fill deposits because of the addition of larger grained cultural material. Layer 3 of unit E986 N1007 differed in grain size distribution from the other layers of the two units, having a larger percentage of smaller grains (Figure 35). The variation in the two grain sizes within Unit E987 N1008 is indicative of dumping events from several different sources.

Another expectation was that the layer into which the pit was cut comprised native soil, while the strata inside the pit were influenced by cultural activity. If this was true, then not only textural but also color differences would be predicted. As shown in Table 6, the Level 3 colors recorded are almost the same as those for the Be horizon of the Nati Silt loam, differing only in having a

greater range of values. The Level 2 colors are similar in hue and value, but differ in chroma, being grayer than either B horizon, which may be due to the addition of shell and charcoal.

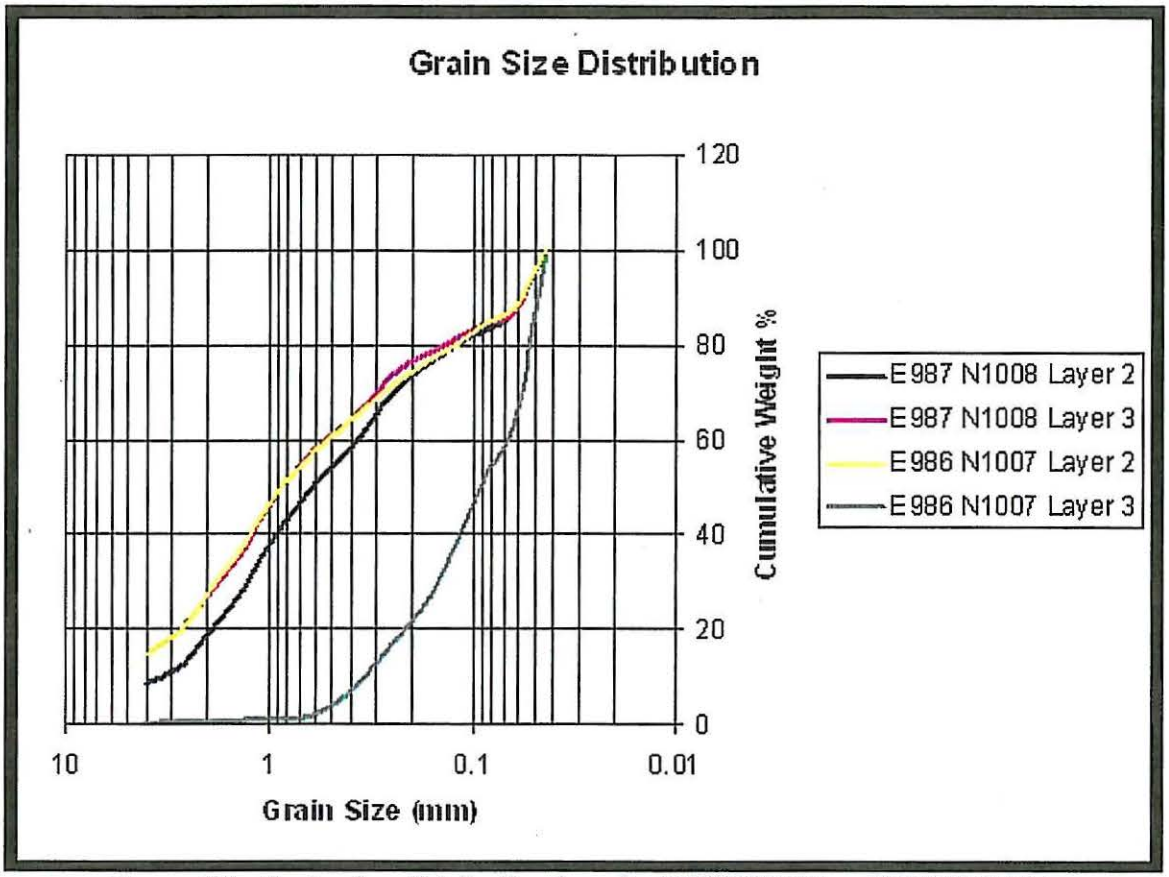


Figure 35: Grain size distribution in units E986 N1007 and E987 N1008.

The uppermost Level 1 and the sod layer are lower in both value and chroma than a natural A horizon would be expected to be. This is likely due to the addition of organic material. These comparisons suggest that the sediment underlying the sloping strata is the equivalent of the B horizon of the natural Nati Silt Loam found in the locality of 45WH55, while the overlying layers are either entirely anthropogenic or comprise organically enriched reworked native sediments.

The wall slope of a Locarno Beach phase pithouse at 45SJ169 on Decatur Island (Walker 2003:Figure 6.38) was used to compare the slope of the sloping strata in E987 N1008. The lower surface of the sloping strata in E987 N1008 has a slope of 45° (rising 35 cm in 33 cm). Measured on the steepest wall (SW), the Decatur Island pithouse wall rises 1.1 m in 37 cm (71°). Other areas of the Decatur Island pithouse wall are shallower (27° slope) and are similar to the slope of the sloping strata in E987 N1008, which suggests the feature is outlining the wall of a pit. Based on this comparison, the possible pithouse could extend up to about 9 m² out from the SW corner in a circular or sub-rectangular shape and be about 1.5 m below the surface.

Table 6: Comparison of Nati Silt loam colors (Goldin 1985) to excavated strata.

Nati Silt Loam		**Excavated Levels E987 N1008 and E986 N1007**	
Horizon	Color	Level	Color
A (0-32 cm)	Hue: 7.5 YR or 10 YR	Sod and Level 1	Hue: 10 YR
	Value: 4 to 6		Value: 2 to 3
	Chroma: 4 to 6		Chroma: 1 to 2
Bs (32 – 41cm)	Hue: 7.5 YR or 10 YR	Level 2	Hue: 10 YR
	Value: 5 to 6		Value: 5 to 6
	Chroma: 4 to 6		Chroma: 3 to 4
Bc (41 – 78cm)	Hue: 2.5 Y or 10 YR	Level 3	Hue: 10 YR
	Value: 6 to 7		Value: 5 to 7
	Chroma: 4 to 6		Chroma: 4 to 6

The slope, stratigraphy, and differences in grain size support the hypothesis that a pithouse filled in with anthropogenic dumped materials is present at the site. Based on the available information, our interpretation is that a pit was dug into the Nati Silt Loam, and that at some later point, shells and other material were dumped over the edge of the pit. A layer of charcoal in between shell layers shows that there was more than one dumping event. Additional discontinuous dumping events occurred over the shell layers and outside the pit (represented by Layers 2 and 3 in E987 N1008 and a portion of Layer 2 in E986 N1007).

SUMMARY OF 45WH55 INVESTIGATIONS

The radiocarbon date obtained indicates that at least portions of 45WH55 date over 2500 years BP. This, combined with the few diagnostic artifact types, suggests that much of the material in the upper terrace where excavations took place may represent a single component of a Locarno Beach phase occupation. A high degree of spatial integrity in the deposits is indicated by the discreteness of different activity areas. These vary in nature and contents, ranging from a bone processing feature to a large pavement of fire-cracked rock and a possible pit house, with distinct activity areas and features. Even within the fire-cracked rock pavement, substantial variation in the proportions of fish, bird, and mammal bones suggests different short-term depositional events. The association of a CVR biface with thinning flakes is another example of the degree of integrity.

Such good preservation of the spatial patterning suggests two things about post-occupation processes. First is that activities in the historic era did not extensively disturb the deposits, or disturbed them in readily delimited ways. The impact of historic activities on pre-existing deposits varied a great deal; in some areas prehistoric deposits were completely removed, and in others the uppermost layers are mixed, with both Euroamerican artifacts and stone tools. The latter areas seem to be rare, despite some evidence of leveling across the site, and in most areas of the site, intact prehistoric cultural deposits, including discrete features, were found below the sod layer. It is possible that the uppermost prehistoric deposits had been removed in these areas by leveling in the historic era, but there is no way to confirm that at this point. The second is that

the Locarno Beach occupation was not subject to cultural reworking and disturbance after 2500 BP, suggesting that the site was abandoned as a whole or that the locus of activities shifted substantially. Further exploration of this interpretation will require testing more areas of the site and additional radiocarbon dates.

Because the site retains a high degree of integrity and internal spatial patterning, it offers great potential for investigating activity areas, technology, subsistence and shelter within a Locarno Beach phase occupation and thus to a better understanding of Locarno Beach subsistence and settlement patterns. The Locarno Beach adaptation is assumed to be less logistically organized than later Marpole, but the numbers and types of settlements likely to make up the seasonal round have not been elucidated. Neither the "life span" nor the internal functional organization of Locarno Beach base camps is well known, and neither is the degree of functional task differentiation within and between camps. Are habitation sites with houses indicative of base camps occupied year round, or could they represent a more seasonally restricted occupation? If habitations with houses represent base camps used for a substantial part of the year, were they supported primarily by use of resources in the local catchment area? If so, did this lead to a limited duration for such occupations due to impact on the local resources?

Archaeological site 45WH55 appears to represent a base camp occupied for long enough to warrant construction of a pithouse structure and fabrication of opportunistic tools and maintenance of a curated tool kit. Most of the resources used could have been obtained locally; quartz crystal is a specific exception. Residents ate a varied diet of deer, elk, fish and shellfish that were procured locally. The shell taxa at the site suggest that the shoreline was rockier and more exposed, which is consistent with our understanding that the fine substrate currently filling Mud Bay is the result of rapid sediment influx in the last 100 years, and that the amount of wave energy was reduced by construction of the railroad causeway.

PROJECT CONCLUSIONS

The 2005 Western Washington Department of Anthropology field project investigated the nature of prehistoric land use in the northern part of Chuckanut Bay with the goal of characterizing the age and type of activities at as many locations as possible, with a focus on the poorly known site complex on the Woodstock Farm property. The investigations resulted in updated site information for four sites and the recording of two new sites, and more importantly provide the first chronological framework for prehistoric use of the area with six radiocarbon dates from four sites. Although 6 sites had previously been recorded in the area, no radiocarbon dates had been obtained, and the single artifact assemblage collected, by Richardson at 45WH54, provided little basis for interpretation.

Limited test excavations in 2005 at 45WH55, a precontact shell midden on the Woodstock Farm property, revealed food processing and discard areas, and a possible house structure, with an associated radiocarbon date of approximately 2600 years BP. Shovel testing established the boundaries of the site, which had not been previously determined, and also demonstrated that a second area with exposed shell midden was non-contiguous. This area, recorded in the field as WWU-05-01, is now designated 45WH763. It is close in age to 45WH55, based on a

radiocarbon date of approximately 2500 years BP from a column sample from a bank exposure.

A shell deposit in the intertidal zone near 45WH55 was also surveyed and recorded as 45WH758. Shovel testing and column samples indicate that it is a cultural deposit, probably originally deposited in a terrestrial context, but its repositioning in the intertidal zone is still poorly understood. Three radiocarbon dates for this deposit range between 600 and 1400 AD, and there appears to be no physical connection to 45WH55. Other project activities included re-recording sites 45WH54, 45WH77, and 45WH78 which are across the bay from Woodstock Farm.

Our interpretation of data collected from 45WH55 and 45WH763 is that a group established a residential site on the rocky headlands of what is now Woodstock Farm around 2500 years ago, at which time the shoreline of the bay was rockier and more exposed. They constructed a semi-subterranean pithouse structure as well as thermal features for preparing food for consumption and/or storage. Butchering, food preparation, and artifact manufacture were conducted in separate outdoor areas. Group size can't be estimated until we know whether both rocky headlands were used contemporaneously and whether there are other house structures. We do not yet have evidence defining the seasonal span of occupation or an estimate of its duration.

Continuity between these occupations and later occupation of this part of the bay cannot be demonstrated at this point. Dates collected from 45WH54 on the northern shore of the bay and from the midden deposit in the intertidal zone on the southern shore of Mud Bay range between 1200 years to 600 years ago. The large shell midden at the head of the bay, 45WH50 is yet undated, although its position on a low-lying area adjacent to the current beach berm suggest it is more recent than the other sites.

An intriguing result of our work at the complex of sites around Mud Bay is the indication of extensive erosion and slumping of site deposits around the northern end of the bay, that suggest major geomorphological changes, possibly due to tectonic movement. These include the deep deposits at the seaward margin of 45WH55 that could not have reached this depth stably without a substantial seaward extent originally, large slumps evident in the center and at the margin of 45WH55, the shell deposit in the intertidal zone, and the very narrow remnant of midden on a steep slope at 45WH54. Evidence of subsidence associated with a major earthquake has been documented in Southern Puget Sound, but the tectonic history of northwestern Washington is less well known. Regardless of the cause, the environmental changes that are suggested may have had an impact on the patterns of use of this area by people.

We plan to continue research in the northern Chuckanut Bay area, including both additional fieldwork and analysis of materials collected through test excavation at 45WH55 and samples collected during survey at 45WH4, 45WH758 and 45WH763. Our next goal is to further characterize the activity areas at 45WH55 which appears to be a relatively intact Locarno Beach residential occupation. Until recently, few house sites of this age had been excavated; recent work at Locarno Beach age sites throughout the Salish Sea now provides an excellent comparative framework for interpretation. In the long run, another goal is to trace the use of the Mud Bay area through time, contrasting the Locarno Beach components at 45WH55 and WWU-05-01 with the later occupations across and at the head of the bay.

Students working under supervision have already completed most of the basic sorting and processing of faunal samples and will also be involved in measuring and describing lithic and bone artifact types. Student research projects are usually small in scope and cannot be considered final, but frequently reveal interesting patterns and suggest directions for graduate student research.

Results of student research have been presented at two regional conferences. Posters presented at the 59th Annual Northwest Anthropological Conference 2006 included: Diana Barg and Kirsten Holt: "Possible Pithouse Feature at 45WH55"; Diana Barg and Kim Owens: "Origin of an Intertidal Shell Deposit in Chuckanut Bay"; and Elizabeth Chambers and Melanie Kerr: "Lithic Analysis of the Chipped Stone Assemblage from site 45WH55". Nicholas Moore and Lisa Clayton examined the fire-cracked rock feature, comparing the continuity and contents of deposits across the three adjacent units in a poster entitled "Feature Analysis of 45WH55".

At the 2007 NWAC in Pullman, Crystal Richards presented a poster describing the evidence for the historic contribution of shellfish to the deposits in a poster entitled "Examining Possible Euroamerican Shellfish Consumption at Woodstock Farm in Bellingham, Washington".

Undergraduates Kim Owens and Diana Barg worked with Sarah Campbell to pursue various analyses of 45WH758 in attempts to understand its origin. This research collaboration resulted in several presentations (NWAC 2006, 2007, Quaternary Research Center) and Owens received a grant of $480 from the RSP, Western Washington University, for a radiocarbon date for the intertidal midden deposit at Woodstock Farm.

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APPENDIX A: SHOVEL TEST DATA

Table A - 1: Shovel test probes from 45WH763

STP	Depth Below Surface	Sediment Description	Cultural Material
E920 N925	0-20 cmbs	10YR4/3 (brown) silt rounded gravel 5-10%	Charcoal, shell, possible FMR
	20-40 cmbs	10YR4/6 (dark yellowish brown) silty loam	Shell and FMR
	40-60 cmbs	7.5YR4/4/ (brown) silty loam	N/A
E920 N900	0-10 cmbs	10YR2/1 (black) silty loam gravel 15-30% angular sandstone	Shell
	10-33 cmbs	10YR6/3 (pale brown) sandy loam gravel 40-50%	Shell midden at 12-22 cm and charcoal
	33-40 cmbs	10YR4/4 (dark yellowish brown) sandy loam 40% gravels	Shell, charcoal
	40-50 cmbs	Sandstone bedrock	Little shell
E920 N920	0-25 cmbs	10YR3/4 dark yellowish brown fine grain silty loam	FMR, charcoal, shell, nail
	25-50 cmbs	10YR5/6 (yellowish brown) fine grain loam	FMR, charcoal, shell, nail
E935 N870	0-40 cmbs	10YR3/2 (very dark grayish brown) fine grain silty loam	FMR, charcoal
E933 N919	0-30 cmbs	10YR3/3 (dark brown) fine grain silty loam	FMR, charcoal, few small shell fragments, hit sandstone at 30 cm.
E940 N 860	0-13 cmbs	10YR4/3 (brown) silt 40% gravel	Charcoal and seeds
	13-40 cmbs	10YR4/6 (dark yellowish brown) silty loam 40% gravel	Charcoal, 2 lithic flakes, FMR, and historic metal, ceramic and seeds
	40 cmbs	10YR5/6 (yellowish brown) sandy silt loam	N/A
E940 N870	0-20 cmbs	10YR2/2 (very dark brown) silt loam	Charcoal and pine seed
	20-30 cmbs	10YR3/3 (dark brown) silt loam, high iron content	Charcoal
	30-50 cmbs	10YR4/6 (dark yellowish brown) loamy sandy clay	N/A
E940 N880	0-33 cmbs	10YR4/2 (dark grayish brown) silt loam and gravel	Decreasing charcoal with depth
E940 N890	0-15 cmbs	10YR4/3 (brown) silty loam	Shell and charcoal
	15-40 cmbs	10YR4/3 (brown) silty loam 10% small sub-angular	Shell, charcoal, FMR

		gravel	
	40-70 cmbs	2.5Y5/3 (light olive brown) 30% small sub-angular gravel	Shell, charcoal, FMR, and ash
E940 N900	0-22 cmbs	10YR4/3 (brown) silt	Glass, sheep bone, charcoal, FMR, shell
	22-51 cmbs	10YR5/3 (brown) silt	Glass, sheep bone, charcoal, FMR, shell
	51-60 cmbs	10YR4/6 (dark yellowish brown) sandy loam 10% small angular gravel	N/A
E945 N880	0-28 cmbs	10YR4/4 (dark yellowish brown) silt 40% gravel	One piece of shell, 1 quartzite flake
	28-47 cmbs	10YR4/6 (dark yellowish brown) oxidized sandy loam 10% gravel	Charcoal and ash
	47-55 cmbs	7.5YR3/2 (dark brown) silt loam 40% gravel	High concentration of charcoal, ash and oxidized soil
E950 N860	0-13 cmbs	10YR4/3 (brown) silt loam	Charcoal, FMR, and shell
	13-29 cmbs	7.5 YR4/3 (brown) silt loam	Charcoal and unburnt wood, 2 flakes
	29-60 cmbs	10YR4/4 (dark yellowish brown) loam	Charcoal
E950 N900	0-10 cmbs	10YR4/2 (dark grayish brown) fine grain silty loam	FMR, charcoal, fine shell
	10-30 cmbs	10YR4/2 (dark grayish brown) fine grain silty loam	Flake
E960 N860	0-30 cmbs	10YR3/3 (dark brown) silty loam 15% gravel	Charcoal
	30-50 cmbs	10YR6/2 (light brownish gray) silty loam	Charcoal
E980 N840	0-30 cmbs	10YR4/3 (brown) silty loam 15% gravel	Charcoal
	30-60 cmbs	10YR4/4 (dark yellowish brown) silty loam	Decrease in charcoal

Table A - 2: Shovel test probes and profiles from WWU-05-03

STP	Depth Below Surface	Stratigraphy	Cultural Material
STP A	0-10 cmbs	10YR4/1 (dark gray) sandy loam, lots of roots and pebble-cobble sized rocks	FMR, *Macoma* shell

	10-40 cmbs	10YR2/1 (black) loam, roots and bark, angular pebble sized rock	FMR, shell, charred bark
STP B	0-25 cmbs	2.5Y4/1 (dark gray) silty loam	One piece of shell, pinecone
	25-30 cmbs	10YR4/1 (dark gray) mixed with 10YR4/6 (dark yellowish brown) fine grain sand red layer	Midden shell, rock
	30-55 cmbs	10YR4/1 (dark gray) fine grained sand	FMR, Shell
	55-65 cmbs	2.5Y4/1 (dark gray) fine sand	Shell
	65-75 cmbs	Waterline	
STP C	0-5 cmbs	10YR4/1 (dark gray) fine grain sand	High Density of FMR, some charcoal and organics, and shell
	5-10 cmbs	10YR4/3 (brown) sandy loam	FMR, organics, shell
	10-20 cmbs	10YR5/4 (yellowish brown) mixed with 10YR5/6 (yellowish brown) fine grained sand	FMR, seaweed, bark, shell
	20-40 cmbs	2.5Y6/1 (gray) part 10YR5/6 (yellowish brown) clay	Many rocks, few shell fragments
Column 1	0-7 cmbs	Gley 1 4/N (dark grey) sandy loam	Shell, charcoal, and glass observed on surface, but not in profile
	7-13 cmbs	Gley 2.5/1 (greenish black) sandy loam	
	13-19 cmbs	10YR2/1 (black) loamy sand with dense well sorted gravels	
	19-27 cmbs	10YR4/6 (dark yellowish brown) loamy sand with dense well sorted gravels	Soil sample collected from 20-40 cmbs
	27-53 cmbs	10YR2/1 (black) loamy sand	
	53-80 cmbs	Gley 2 3/1 (dark bluish gray) clay	Cobble chopper collected at 80 cmbs
Column 2	0-14 cmbs	10YR3/1 (very dark gray) sandy loam	
	14-18 cmbs	10YR 3/2 (very dark grayish brown) iron oxide rich sandy loam	Soil samples collected from 0-20 cmbs, some shell

	18-35 cmbs	Dense finely crushed shell midden and large wood fragment	Soil sample collected from 25-35 cmbs
	35-40 cmbs	10YR4/1 (dark grey) sand	
	40-48 cmbs	Dense well sorted gravel lens	
	48-56 cmbs	5YR4/6 (yellowish red) iron rich gravel lens	
	56-64 cmbs	10YR3/1 (very dark grey) coarse grain sand	
	64-70 cmbs	10YR2/2 (very dark brown) coarse grain sand	
	70-110 cmbs	10YR4/1 (dark grey) clay	
Wall cleaning included FMR, worked quartzite, shell, and lots of burnt and unburnt wood throughout profile.			
Column 3	0-8 cmbs	2.5Y3/2 (very dark grayish brown) silt with clay and a few pebbles	FMR, shell Soil sample taken from 0-10 cmbs
	8-15 cmbs	Gley 1 3/N clay	Few shells
	15-20 cmbs	2.5Y3/2 (very dark grayish brown) loose sand and increase in pebbles	Soil sample taken from 10-20 cmbs
	20-30 cmbs	Dense shell and sand	Dense shell Soil sample taken from 20-30 cmbs
	30-32 cmbs	2.5Y4/2 (dark grayish brown) sand with pebbles	charcoal
Column 4	0-10 cmbs	2.5Y3/2 (very dark grayish brown) silt, light gravel	FMR, shell Soil sample taken from 0-11cmbs
	10-30 cmbs	Sandy loam	Shell more fragmented, wood, charcoal Soil sample taken from 11-30 cmbs
	30-50 cmbs	Sandy loam with gravels	Little shell
Column 5	0-11 cmbs	2.5Y4/3 (olive brown) silt	None
	11-16 cmbs	2.5Y3/1 (very dark gray) soil silt loam	Shell Soil sample taken from 0-16 cmbs, Charcoal Sample taken from 16-18 cmbs
	16-32 cmbs	5Y4/1 (dark grey) sandy loam charcoal at interface with lower stratigraphic layer	Dense shell, wood, and charcoal
	32-52 cmbs	5Y3/1 (very dark grey) sandy loam and gravel	Shell and wood Soil sample taken from 18-32 cmbs

Table A - 3: Shovel test probes from 45WH54

STP	Depth Below Surface	Stratigraphy	Cultural Material
1	0-20 cmbs	10YR 2/1 (black) organic rich fine soil	Two flakes, FMR, burnt wood
	20-30 cmbs	10YR3/2 (very dark grayish brown) sandy soil	FMR, Charcoal, Little Shell, large rocks
	30-60 cmbs	10YR5/4 (yellowish brown) fine grain sandy silt	Large rocks little shell (*Saxidomus, Tresus, Clinocardium, Balanus, Mytilus, Thais*) charcoal
	60-80 cmbs	10YR5/4 (yellowish brown) fine grain sandy silt	Single piece of Balanus, and possible FMR
2	0-13 cmbs	10YR3/2 (very dark grayish brown) sandy soil, rounded cobbles	Disturbed midden 45% shell *Clinocardium, Balanus, Mytilus, Saxidomus/Tresus*, possible FMR
	13-30 cmbs	10YR4/3 (reddish brown) fine grained and big rocks	Little shell (*balanus* and *Mytilus*), burned wood (root?), FMR, glass
3	0-11 cmbs	10YR2/2 (very dark brown) root mat and very fine silt	Charcoal, *Protothaca, Balanus, Mytilus, Tresus, Clinocardium*, and unidentified gastropod,
	11-20 cmbs	10YR3/3 (dark brown) very fine silt	*Clinocardium, Protothaca, Mytilus, Balanus*, and Thais
	20-50 cmbs	10YR6/3 (pale brown) very fine silt	Less than 5% shell *Protothaca, Saxidomus, Tresus, Clinocardium, Balanus*, Oyster
4	0-20 cmbs	10YR4/4 (dark yellowish brown) silt loam 15% gravel	Charcoal
	20-50 cmbs	10YR5/3 (brown) silt loam 5-10% gravel	Burnt bark at 30-50 cm
5	0-10 cmbs	10YR4/2 (dark grayish brown) loam	FMR and Charcoal
	10-50 cmbs	10YR5/3 (brown) loam	FMR and Charcoal
	50-60 cmbs	10YR5/3 (brown) loam	Charcoal, shell, (flake, chopper?)

APPENDIX B: RADIOCARBON DATE REPORTS

(unpaginated)

FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)
(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)

January 25, 2006

Dr. Sarah K. Campbell
Western Washington University
516 High Street
Arntzen Hall, 215
Bellingham, WA 98225
USA

RE: Radiocarbon Dating Results For Samples TULLIS 45-WH-54, WWU-05-01, WWU0503COL3

Dear Dr. Campbell:

Enclosed are the radiocarbon dating results for three samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

Dr. Sarah K. Campbell

Report Date: 1/25/2006

Western Washington University

Material Received: 12/12/2005

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 211703 SAMPLE : TULLIS 45-WH-54 ANALYSIS : Radiometric-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal AD 1280 to 1420 (Cal BP 670 to 530)	1030 +/- 40 BP	-0.5 o/oo	1430 +/- 40 BP
Beta - 211704 SAMPLE : WWU-05-01 ANALYSIS : Radiometric-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal BC 710 to 370 (Cal BP 2660 to 2320)	2730 +/- 40 BP	-0.9 o/oo	3130 +/- 40 BP
Beta - 211705 SAMPLE : WWU0503COL3 ANALYSIS : Radiometric-Standard delivery MATERIAL/PRETREATMENT : (shell): acid etch 2 SIGMA CALIBRATION : Cal AD 1240 to 1420 (Cal BP 710 to 530)	1090 +/- 40 BP	-3.0 o/oo	1450 +/- 50 BP

Dr. Sarah K. Campbell

Report Date: 3/17/2006

Western Washington University

Material Received: 3/9/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 215323	2880 +/- 50 BP	-1.7 o/oo	3260 +/- 50 BP

SAMPLE : WH55-E987-F8
ANALYSIS : Radiometric-Priority delivery
MATERIAL/PRETREATMENT : (shell): acid etch
2 SIGMA CALIBRATION : Cal BC 800 to 500 (Cal BP 2750 to 2450)

Dr. Sarah K. Campbell

Report Date: 3/12/2007

Western Washington University

Material Received: 2/12/2007

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 227507	1350 +/- 40 BP	+0.3 o/oo	1760 +/- 40 BP

SAMPLE : WWU0503 STPB
ANALYSIS : AMS-ADVANCE delivery
MATERIAL/PRETREATMENT : (shell): acid etch
2 SIGMA CALIBRATION : Cal AD 940 to 1150 (Cal BP 1010 to 800)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-0.5:Delta-R=390±25:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-211703**

Conventional radiocarbon age: **1430±40 BP**

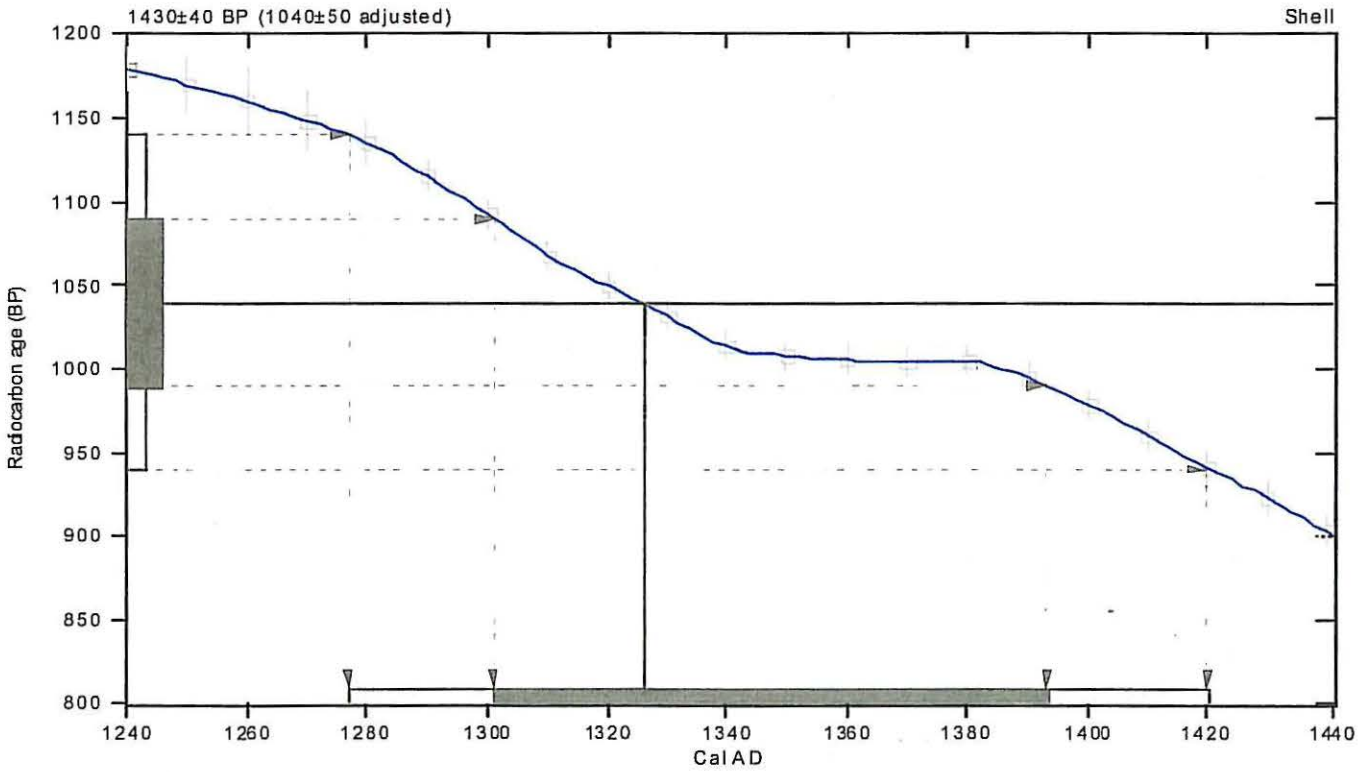
(1040±50 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 1280 to 1420 (Cal BP 670 to 530)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1330 (Cal BP 620)

1 Sigma calibrated result: Cal AD 1300 to 1390 (Cal BP 650 to 560)
(68% probability)



References:

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-0.9:Delta-R=390±25:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-211704**

Conventional radiocarbon age: **3130±40 BP**

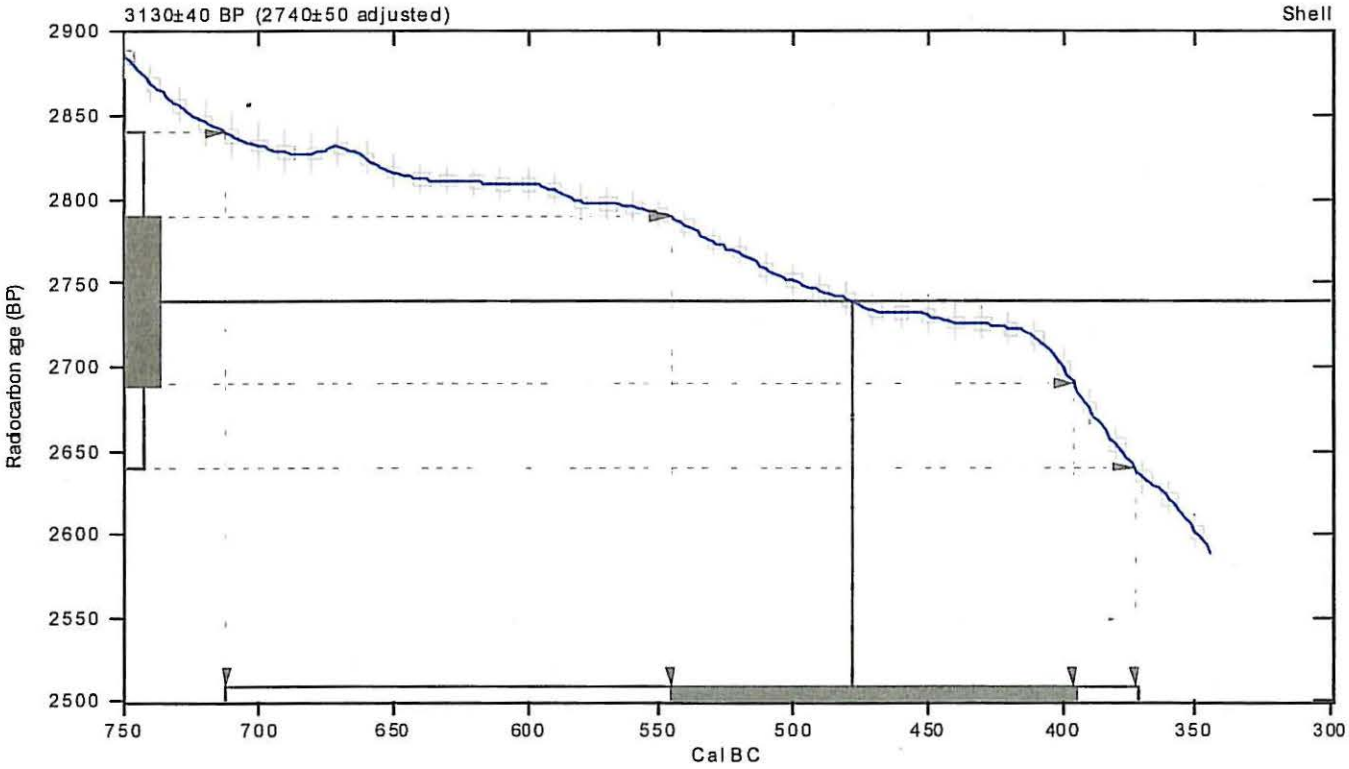
(2740±50 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal BC 710 to 370 (Cal BP 2660 to 2320)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 480 (Cal BP 2430)

1 Sigma calibrated result: Cal BC 550 to 400 (Cal BP 2500 to 2350)
(68% probability)



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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-3:Delta-R=390±25:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-211705**

Conventional radiocarbon age: **1450±50 BP**

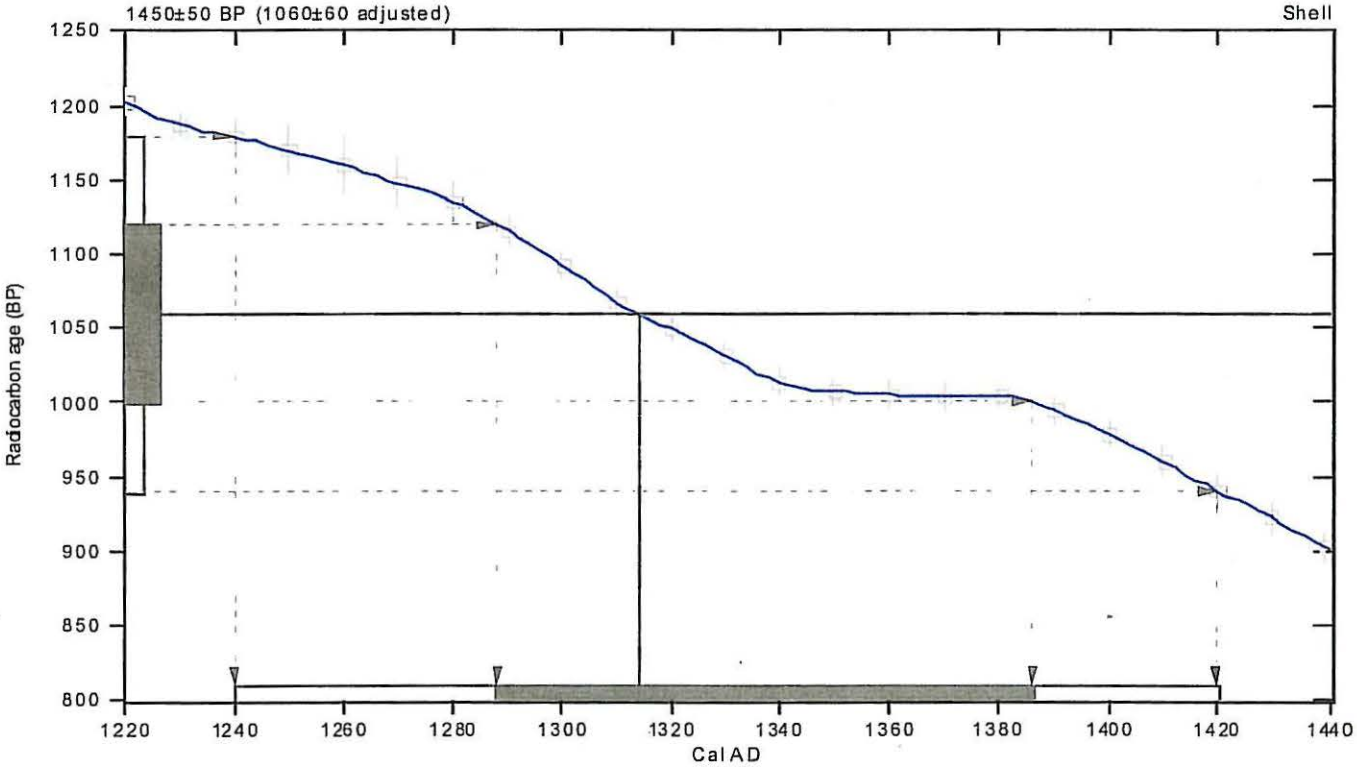
(1060±60 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 1240 to 1420 (Cal BP 710 to 530)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1310 (Cal BP 640)

1 Sigma calibrated result: Cal AD 1290 to 1390 (Cal BP 660 to 560)
(68% probability)



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FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)
(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)

March 17, 2006

Dr. Sarah K. Campbell
Western Washington University
516 High Street
Arntzen Hall, 315
Bellingham, WA 98225
USA

RE: Radiocarbon Dating Result For Sample WH55-E987-F8

Dear Dr. Campbell:

Enclosed is the radiocarbon dating result for one sample recently sent to us. It provided plenty of carbon for an accurate measurement and the analysis went normally. As usual, the method of analysis is listed on the report sheet and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. It was analyzed with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-1.7:Delta-R=390±25:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-215323**

Conventional radiocarbon age: **3260±50 BP**

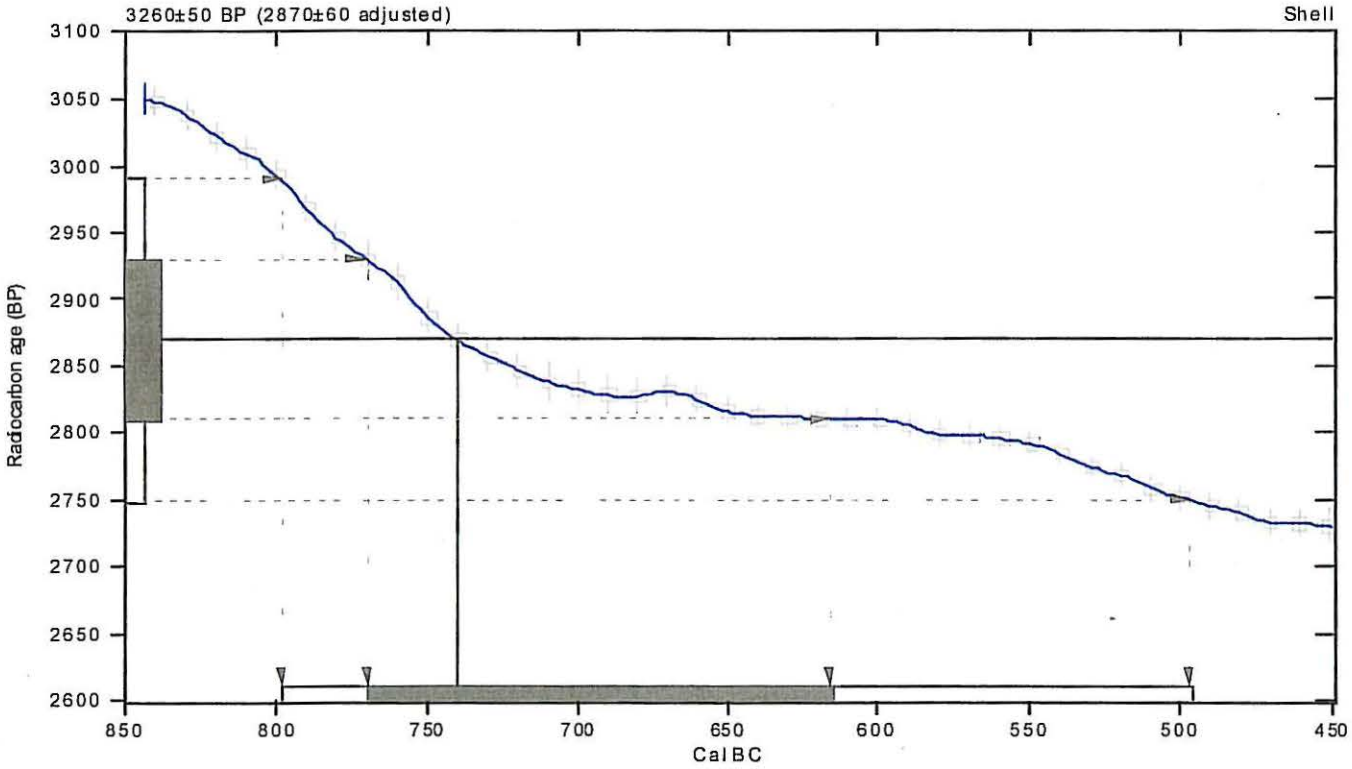
(2870±60 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal BC 800 to 500 (Cal BP 2750 to 2450)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 740 (Cal BP 2690)

1 Sigma calibrated result: Cal BC 770 to 620 (Cal BP 2720 to 2570)
(68% probability)



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FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)
(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)

March 12, 2007

Dr. Sarah K. Campbell
Western Washington University
516 High Street
Arntzen Hall, 315
Bellingham, WA 98225
USA

RE: Radiocarbon Dating Result For Sample WWU0503 STPB

Dear Dr. Campbell:

Enclosed is the radiocarbon dating result for one sample recently sent to us. It provided plenty of carbon for an accurate measurement and the analysis proceeded normally. As usual, the method of analysis is listed on the report sheet and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. It was analyzed with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-0.5:Delta-R=390±25:Glob res=-200 to 500:lab. mult=1)

Laboratory number: **Beta-211703**

Conventional radiocarbon age: **1430±40 BP**

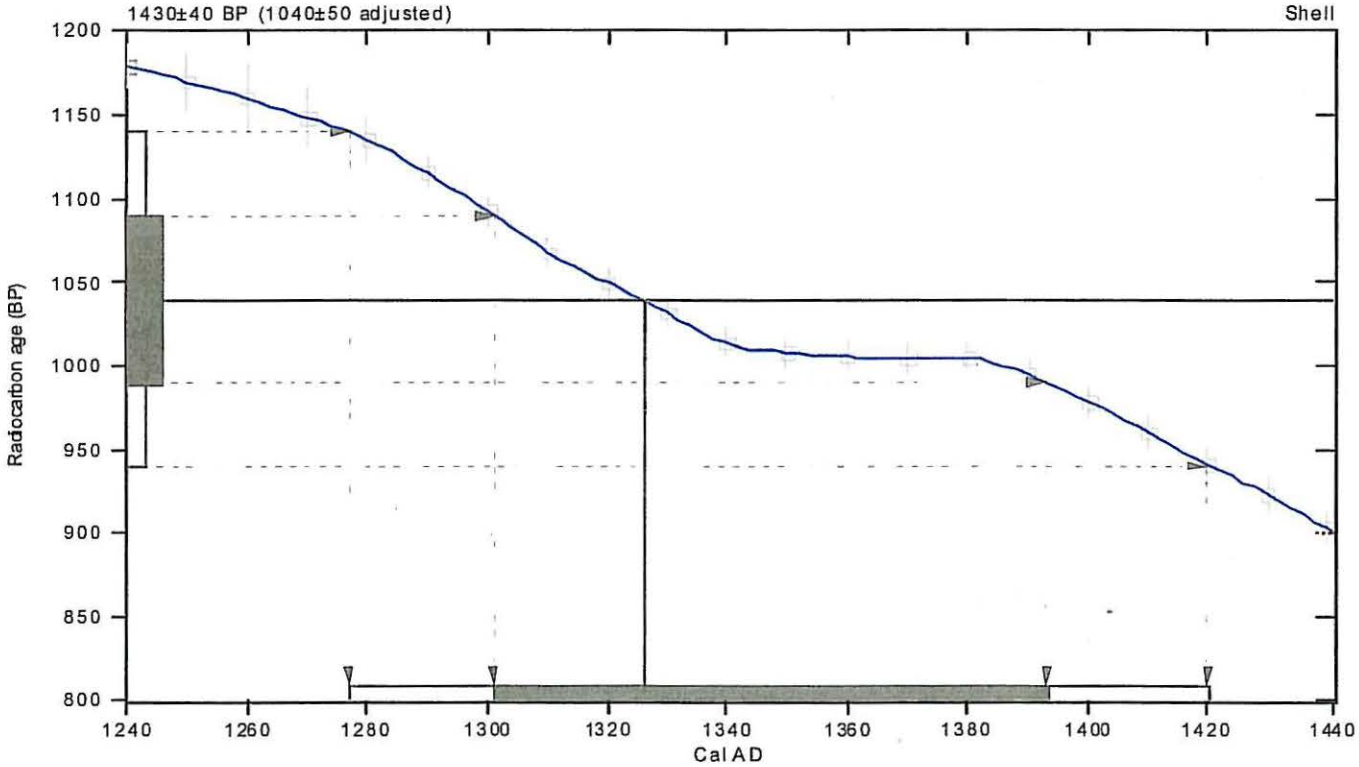
(1040±50 adjusted for local reservoir correction)

2 Sigma calibrated result: **Cal AD 1280 to 1420 (Cal BP 670 to 530)**
(95% probability)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1330 (Cal BP 620)

1 Sigma calibrated result: Cal AD 1300 to 1390 (Cal BP 650 to 560)
(68% probability)



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